



# **CLEAR-COM ENCORE**

**EF-70IM INTERFACE**

**I N S T R U C T I O N M A N U A L**

EF-701M Interface Instruction Manual  
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# CONTENTS

<b>OPERATION</b> . . . . .	<b>1-1</b>
Introduction . . . . .	1-1
Description . . . . .	1-2
Connecting a Party-Line Channel to a Matrix Frame Port . . . . .	1-2
Converting a Party-Line Channel to 4-Wire Audio . . . . .	1-3
Front Panel Controls . . . . .	1-8
Rear Panel Settings and Connectors . . . . .	1-10
Mode-Switch Settings . . . . .	1-10
3-Pin XLR Connector (Party Line I/O) . . . . .	1-11
DB-15 Connector . . . . .	1-12
RJ-45 Connector . . . . .	1-12

<b>INSTALLATION</b> . . . . .	<b>2-1</b>
Connecting the EF-701M Interface . . . . .	2-1
Connecting the EF-701M to a Matrix Port. . . . .	2-1
Connecting the EF-701M to a Modem . . . . .	2-2
Connecting the EF-701M to RTS-TW Equipment . . . . .	2-5
Other Connections. . . . .	2-5
Levels . . . . .	2-6
Nulling . . . . .	2-7
Adjusting the Null . . . . .	2-8
Troubleshooting Tips for Nulling. . . . .	2-9
Internal Adjustments . . . . .	2-10
Removing the cover of the EF-701M . . . . .	2-10
Transmission methods . . . . .	2-12
Direct Connection . . . . .	2-12
Fiber-Optic. . . . .	2-13
Other Methods. . . . .	2-15
 <b>MAINTENANCE</b> . . . . .	 <b>3-1</b>
Troubleshooting Tips . . . . .	3-1
Audio Troubleshooting Tips. . . . .	3-2

Data Troubleshooting Tips . . . . .	3-4
Nulling Troubleshooting Tips . . . . .	3-6
Block Diagram . . . . .	3-8
<b>GLOSSARY . . . . .</b>	<b>4-1</b>
<b>SPECIFICATIONS . . . . .</b>	<b>5-1</b>
EF-701M technical Specifications . . . . .	5-1
Clear-Com Format . . . . .	5-1
RTS format . . . . .	5-1
General Characteristics . . . . .	5-1
<b>LIMITED WARRANTY . . . . .</b>	<b>6-1</b>
Warranty Period . . . . .	6-i
Technical Support . . . . .	6-ii
Warranty Repairs and Returns . . . . .	6-iii
Non-Warranty Repairs and Returns . . . . .	6-iv
Extended Warranty . . . . .	6-v
Liability . . . . .	6-v



# IMPORTANT SAFETY INSTRUCTIONS

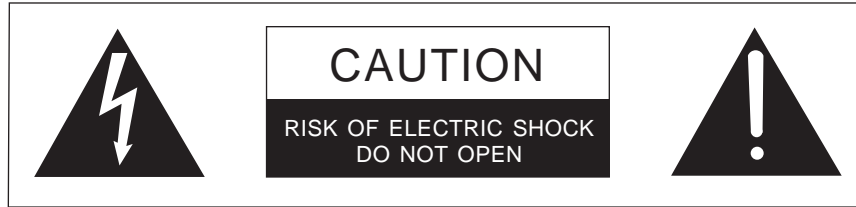
*Please read and follow these instructions before operating this product.*

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with dry cloth.
7. Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. Only use attachments/accessories specified by the manufacturer.
10. Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.

11. Unplug this apparatus during lightning storms or when unused for long periods of time.
12. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
13. **WARNING:** To reduce the risk of fire or electric shock, do not expose this product to rain or moisture.

**Please familiarize yourself with the safety symbols in Figure 1. When you see these symbols on this product, they warn you of the potential danger of electric shock if the station is used improperly. They also refer you to important operating and maintenance instructions in the manual.**





This symbol alerts you to the presence of uninsulated dangerous voltage within the product's enclosure that might be of sufficient magnitude to constitute a risk of electric shock. Do not open the product's case.



This symbol informs you that important operating and maintenance instructions are included in the literature accompanying this product.

*Figure 1: Safety Symbols*

## EMC AND SAFETY

The EF-701M Interface meets all relevant CE and FCC specifications set out below:

EN55103-1 Electromagnetic compatibility. Product family standard for audio, video, audio-visual, and entertainment lighting control apparatus for professional use. Part 1: Emissions.

EN55103-2 Electromagnetic compatibility. Product family standard for audio, video, audio-visual, and entertainment lighting control apparatus for professional use. Part 2: Immunity.

And thereby compliance with the requirement of Electromagnetic Compatibility Directive 2004/108/EC and Low Voltage Directive 2006/95/EC

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



# OPERATION

## INTRODUCTION

Congratulations on choosing this Clear-Com product. Clear-Com was established in 1968 and remains the market leader in providing intercoms for entertainment, broadcast and industrial applications. The ruggedness and high build-quality of Clear-Com products defines the industry standard. In fact, many of our original beltpacks and main stations are still in daily use around the world.

We recommend that you read through this manual completely to better understand the functions of the EF-701M. If you encounter a situation or have a question that this manual does not address, contact your dealer or call Clear-Com directly at the factory. Our applications support and service people are standing by to assist you. (Refer to Chapter 6: “Warranty” for contact information.) Thank you for selecting Clear-Com for your communications needs.

Thank you for choosing this Clear-Com Intercom Systems product.

The EF-701M 4-Wire and Matrix Direct Interface is a flexible and powerful tool for connecting 2-wire intercom systems or stations together over various 4-wire transmission media. The EF-701M Interface can also connect a 2-wire intercom system directly to a Clear-Com Matrix frame port.

## DESCRIPTION

### CONNECTING A PARTY-LINE CHANNEL TO A MATRIX FRAME PORT

An EF-701M Interface can connect a channel of standard or TW party line directly to a Clear-Com Eclipse Matrix frame port, allowing the party-line intercom to be located quite a long distance from the Matrix frame. At the same time, the EF-701M interfaces a DC-voltage call signal or 20-kHz call signal to the Matrix.

The EF-701M is recognized by the Matrix as a Clear-Com CCI-22 Interface. It provides the same function as the CCI-22 Interface with the following exceptions:

- the EF-701M supports only one channel.
- the EF-701M also supports the 20-kHz call signal protocol.
- the EF-701M is a stand-alone unit and does not require an interface frame.

*Note: The EF-701M must be powered from the party-line connection.*

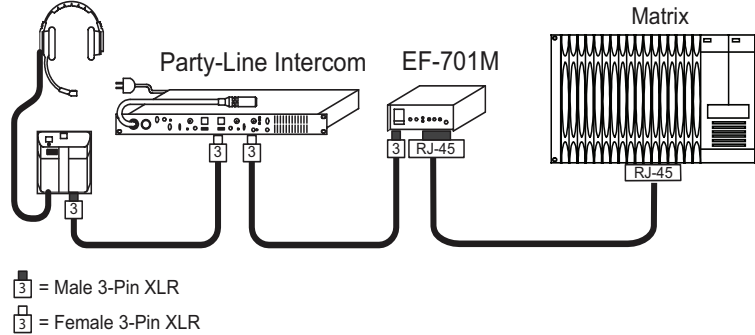


Figure 1-1: Connecting a party-line channel to a Matrix intercom

## CONVERTING A PARTY-LINE CHANNEL TO 4-WIRE AUDIO

The EF-701M Interface converts a channel of standard or TW party line to 4-wire audio and, at the same time, converts a DC-voltage call signal or 20-kHz call signal to RS-422 data. This 4-wire audio and RS-422 data can then be sent to a fiber-optic converter (modem); over copper, unshielded twisted-pair (UTP) cable such as Category 3, 5, or above; or it can simply be used as an excellent stand alone 2-wire to 4-wire converter. In most cases though, EF-701M units will be used in pairs, because once the signal is

converted to go over the chosen transmission medium, it must be reconverted to 2-wire mode to properly connect to the party-line system or station at the other end of the line. The EF-701M obtains its DC operating current from the local party-line connection on pin 2 of the XLR connector. This current is not conducted between EF-701M units, so each EF-701M must be powered by an intercom line as shown in Figure 1-2.

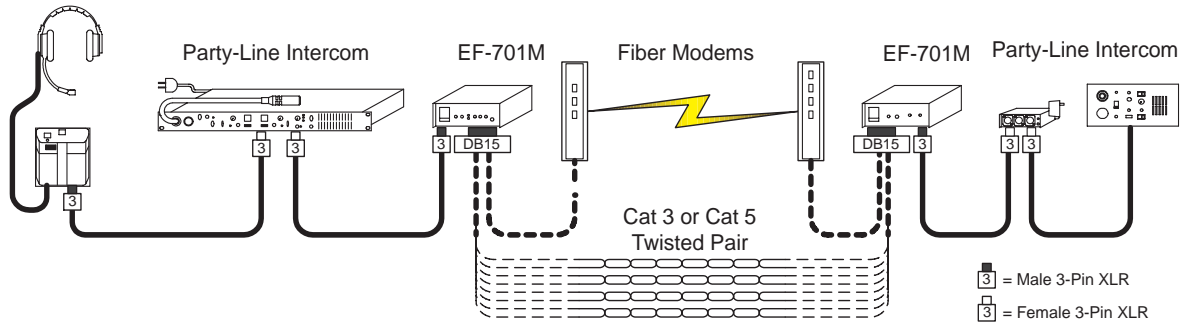


Figure 1-2: Each EF-701M unit must be powered by an intercom line

Call signaling can serve as more than simply a visual indicator. A call signal can activate relays and trigger functions in other connected Clear-Com equipment. The Clear-Com TW-47 Two-Way Radio Interface and KB-702 Speaker Station use this feature. Imagine a party-line (PL) system connected to a fiber-optic system over a 1-kilometer fiber as shown

in Figure 1-3. At the other end of the fiber there is another EF-701M unit and PL system with walkie-talkies interfaced through a TW-47 Interface. The EF-701M allows the people on the first PL system to communicate with the people on the walkie-talkies over a kilometer of fiber, with the call signal determining transmit or receive operation.

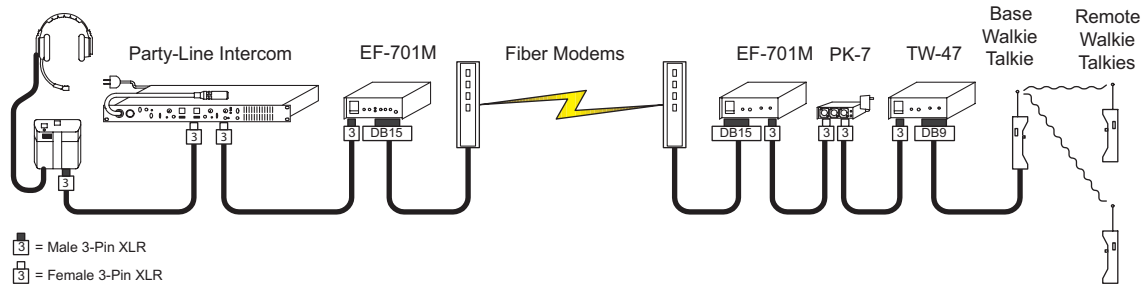


Figure 1-3: Interfacing two party-line systems over a kilometer of fiber

*Note: The terms modem, codec, and interface all refer to devices that convert one type of signal for transmission or reception to a different type of signal.*

Because of the EF-701M's low profile and compact size, it can function either as a stand-alone device, or it can be mounted on utility rack shelves. Up to three units will fit

horizontally in one-rack unit (1RU) of space and will offer sufficient vertical clearance to accommodate a variety of mounting methods. While the EF-701M may be used as a single-ended 4-wire-to-party-line interface with excellent results, it is uniquely equipped to work in point-to-point pairs. Much of the discussion in this manual addresses the issues of operation in this latter mode.

Due to the superior nulling capability of the EF-701M, more than a single pair of EF-701M units can be used to link various locations to a single channel.

As an example consider the following scenario: The three Channel A ports of an MS-702 main station are each connected to an EF-701M. (For an illustration, see Figure 1-4.)

Each of those three is in turn connected to a fiber-optic modem and sent through fiber to another fiber-optic modem, EF-701M unit, and party-line system at the three remote destinations. All four locations are now sharing the same channel, linked through fiber, with a total of six “nulls” on the channel. While the nature of 2-wire to 4-wire hybrids may limit the maximum number of external 2-wire party lines that can be combined, six EF-701M units on a common channel, properly nulled, should generally provide a stable system.

Because the EF-701M will be used with a wide variety of third-party systems and devices, it is not possible to address all the variables of setups and transmission methods. The key point is that the modem, multiplexer, or converter for the transmission medium (the



system that the EF-701M connects to via the DB-15) must accept line-level (-15 dBu to +4 dBu) 4-wire audio and, if call signal is desired, RS-422 data.

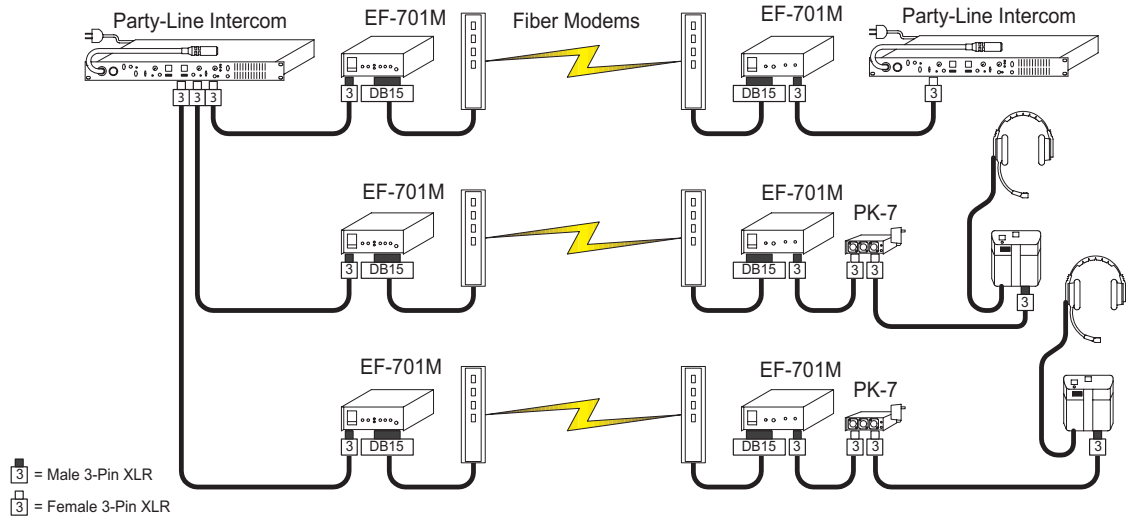


Figure 1-4: Six EF-701M units link various locations to a single channel

# FRONT PANEL CONTROLS

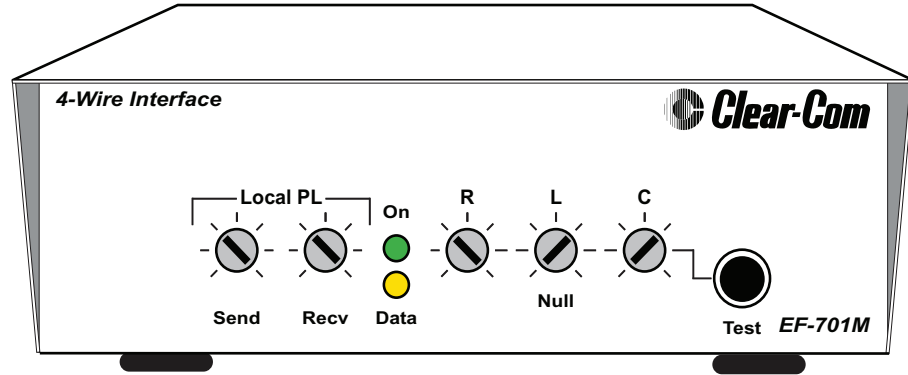


Figure 1-5: Front panel of an EF-701M unit

**Local Send** controls the audio signal level from the local 2-wire intercom (the system connected to this EF-701M) to the audio *out* of the 4-wire I/O.

**Local Receive** controls the audio signal level from the audio *in* of the 4-wire I/O to the local 2-wire intercom.

**Sidetone Null Adjustment** This set of three trimpots includes R=Resistance, L=Inductance, and C=Capacitance. These compensate for each component of the line impedance, providing the best null possible. To prevent damage to the level control and nulling trimpots, do not force them past their stop points.

**Power LED** This green LED will illuminate when the EF-701M is receiving power from pin 2 of the party-line XLR connection.

**Data LED** This amber LED has four modes. The first three relate to call signal data.

1. *ON*- Either a successful data link has been established with a remote EF-701M unit, or the Matrix Direct mode has been selected at the local EF-701M unit.
2. *OFF*- There is no data connection at the local EF-701M unit.
3. *RAPID BLINK*- There is data connection at the local EF-701M unit, but a “break” condition is present. Depending on the modems used, this can indicate a problem at the remote end.
4. *SLOW BLINK*- A test earbud or headphone has been plugged into the test tone jack at the local EF-701M and the nulling test tone is on.

Call signals will not transmit unless the LED is steadily illuminated. Audio is still transceived by a connected unit.

# REAR PANEL SETTINGS AND CONNECTORS

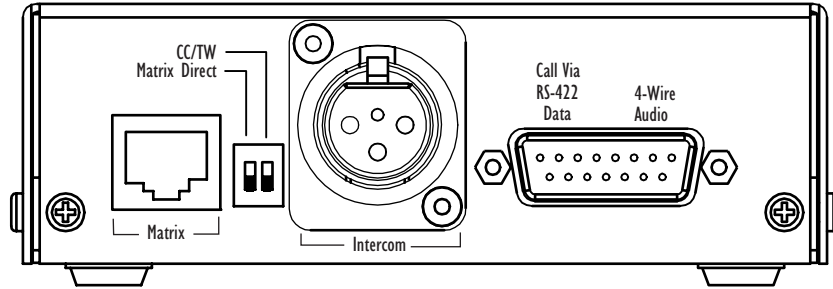


Figure 1-6: Rear panel of an EF-701M unit

## Mode-Switch Settings

The two switches on the rear panel of the EF-701M work independently of each other. Switch 1 adjusts the EF-701M's connector settings for use with either 4-wire fiber (the ON position) or a matrix intercom (the OFF position).

Switch 2 adjusts the EF-701M's connector intercom levels for use with either Clear-Com equipment (the OFF position) or RTS-TW equipment (the ON position). Table 1-1 summarizes the mode switch settings.

MODE SWITCH	OFF (DEFAULT)	ON
<b>MODE-SWITCH 1</b>	RJ-45 connects to 4-Wire/Fiber	RJ-45 connects to Matrix directly
<b>MODE-SWITCH 2</b>	DB-15 sends/receives C-C DC Call, C-C Intercom Level	DB-15 sends/receives 20-kHz Call, RTS-TW Intercom Level

Table 1-1: EF-701M's mode-switch settings

### 3-Pin XLR Connector (Party Line I/O)

The female 3-pin XLR jack on the EF-701M's back panel connects to the 2-wire party line. If a loop-through connection is needed, use a high quality "Y" cable like the Clear-Com SP-3.

*Note: Each (local) party-line channel must have one, but only one, termination.*

### **DB-15 Connector**

When mode-switch 1 is set to 4-wire mode (OFF), the DB-15 connects to additional interfaces or converters (or to another EF-701M). Two pins each are dedicated to audio *in*, audio *out*, data *in*, and data *out*.

Shorting pins 8 and 15 together, or setting mode-switch 2 to ON adjusts the unit to respond to 20-kHz call signal instead of DC voltage and adjusts audio levels for connection to RTS TW lines.

There are also connections for audio and data shields if present in the wiring.

### **RJ-45 Connector**

When mode-switch 1 is set to Matrix Direct mode (ON), the RJ-45 connects to the Matrix frame.

# 2 INSTALLATION

## CONNECTING THE EF-701M INTERFACE

### CONNECTING THE EF-701M TO A MATRIX PORT

To connect the EF-701M directly to a Clear-Com Matrix frame port:

1. On the EF-701M's back panel, set mode-switch 1 to the ON position.  
The Data LED will remain ON, except when the unit is being nulled.
2. Connect a CAT-3, CAT-5, or above cable from the RJ-45 Matrix connector on the back panel of the EF-701M to a port (RJ-45) on the Matrix frame.  
The EF-701M is powered from the 2-wire intercom line. When the EF-701M is receiving power, the Matrix will recognize it as a CCI-22 Two-Wire Interface.
3. Program the Matrix port. Refer to the *Eclipse Configuration System (ECS) Manual* for instructions.

Note that when the EF-701M is set to Matrix Direct mode (mode-switch 1 ON), the internal baud rate jumpers have no effect. The transmission rate is automatically set to the 19.2 kilobaud rate required for Matrix communication.

If you set mode-switch 2 on the EF-701M's rear panel to the ON position, the 20-kHz call signal is selected and audio levels are adjusted for connection to RTS-TW lines. If you set mode-switch 2 to the OFF position, the DC voltage call signal is selected and line levels are optimized for Clear-Com.

Shorting pins 8 and 15 of the DB-15 connector on the EF-701M's back panel will also select the 20-kHz call signal and adjust audio levels for connecting to RTS-TW lines. When you short pins 8 and 15, set mode-switch 2 to the OFF position.

## **CONNECTING THE EF-701M TO A MODEM**

The first step in connecting the EF-701M to a fiber-optic modem is to wire the DB-15 jack to the appropriate connector(s) for that modem.

The modem's connectors may be terminal blocks, XLR jacks, or co-axial connectors. Four-pair twisted cable or shielded-pair cable may be required. Check the operations manual for the modem. For unshielded, twisted-pair cable (UTP), Category 3, 5, or higher is acceptable if used within the distance limitations specified by the modem's manufacturer for this application.



The four pairs of cable used for full operation include one each for audio in and audio out and one each for RS-422 data in and data out.

Take care to wire the DB-15 or RJ-45 pins correctly. For added reference Figure 2-1 shows the pinout configuration. A stick-on label with the pinout assignments has been included for the user's convenience. Attach this in a convenient location.

After wiring the DB-15 to the appropriate connectors, follow these steps to connect the EF-701M to a modem:

1. Connect the local party-line channel to the EF-701M's rear-panel 3-pin XLR connector.
2. Check to see that the EF-701M is receiving power by checking the green Power LED (the "on" light). If there is a powered EF-701M properly connected at the other end of the transmission line, the amber Data LED should also illuminate within a second or two. This confirms a proper data "handshake" between the two units.
3. Send a call signal and check that it is received at the distant intercom system.
4. Adjust nulls, and then check audio levels as required.
5. Repeat as necessary for each EF-701M in the system.

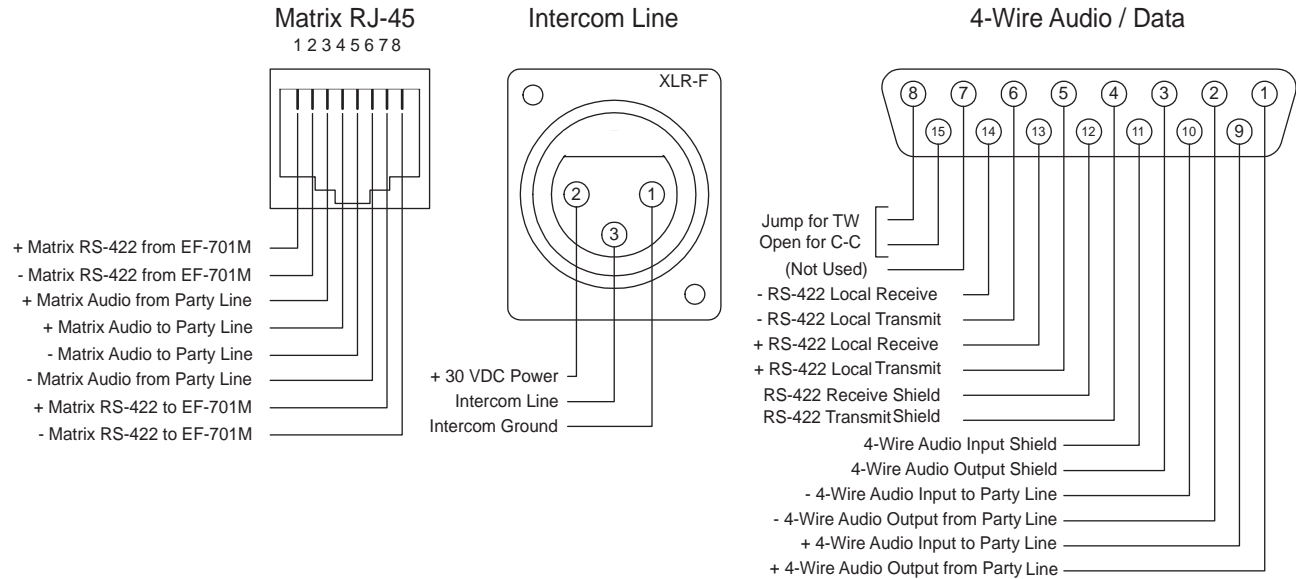


Figure 2-1: Connector Pinout Configurations

## CONNECTING THE EF-701M TO RTS-TW EQUIPMENT

To use the EF-701M with RTS-TW equipment you can either set the mode switch to the “RTS” setting as discussed in the previous chapter, or you can wire the DB-15 connector specifically for that purpose.

When used with all but the very early RTS-TW equipment, whichever audio channel is wired to pin 3 of the EF-701M’s XLR connector will connect through the DB-15. (Older units do not offer power on both channels; therefore a pin/channel reversal would result in no power supplied to the EF-701M). The audio channel carried on pin 2 of a TW line (Clear-Com or RTS) will not be connected through the EF-701M; however, it will not be negatively affected.

## OTHER CONNECTIONS

An EF-701M may be used in a wide variety of interface situations. Even if the call signal translation is not required, it is an excellent 4-wire to party-line interface for use with many types of intercom and audio equipment in the following situations:

- Any 4-wire audio source and destination to party line or wireless intercom
- PL system direct to PL system. Requires two EF-701M units (could be different types of PL on each end)
- PL system to PC sound card

## LEVELS

EF-701M front-panel controls affect the following “listen levels”: the sidetone and volume at the users’ stations or beltpacks; the *receive* level of the local EF-701M; and the *send* level of the remote EF-701M.

Adjust the PL send and receive levels as appropriate for the external PL system and listening conditions. The controls will typically be between 10 o’clock and 2 o’clock, roughly in the 0 dBu range at the 4-wire interface. If different intercom brands are used on opposite ends of a pair of EF-701M units (RTS and Clear-Com for example), the controls may need to be adjusted outside of the normal range. Otherwise, more extreme settings could indicate a problem elsewhere in the system.

Level settings will differ slightly if the EF-701M is used with RTS-TW intercoms, as the nominal audio levels for that system are slightly higher than Clear-Com or compatible systems (about 4-8 dB). RTS and Clear-Com may be freely mixed on a channel, including call signaling, though the maximum number of EF-701M units able to share a channel may be reduced. RTS levels and call signals are selected by jumpering together pins 8 and 15 of the DB-15 connector or by setting mode-switch 2 to ON.

## NULLING

“Sidetone” is the sound of the operator’s own voice in his or her headset or speaker. With interfaces, it is necessary to “null” (minimize) the sidetone when external party lines are connected over the secondary transmission media. Ideally, there should be no portion of the talk signal in the listen signal. Every EF-701M sharing a channel in a system should be nulled consecutively. Null is also referred to as “hybrid null.”

Null is affected by the local party-line system connected to the EF-701M, not the secondary interface. The null circuit is effective on line lengths from 2 feet to 4,000 feet (from 1.64 m to 1220 m) with impedances in the range of 120–350 Ohms and can reduce local audio in the received signal by more than 30 dB over the frequency range of 200 Hz– 8 kHz.

The EF-701M includes built-in nulling circuitry with a test-tone generator and is shipped from the factory with an accessory earphone. Plug the earphone into the 1/8 in. (3.5 mm) jack on the front panel. This will automatically activate the test tone (and the amber data LED will blink slowly). The earphone monitors the output of the nulling circuit. The test tone will be sent to any active stations and other EF-701M units on the channel, so remove headsets, adjust volumes, and turn off speakers as appropriate.

## Adjusting the Null

Normally, the following adjustment is made once during installation. (If the configuration of the local party-line system changes substantially, it may be necessary to re-null the system for optimum performance.)

1. Connect all the local party-line devices for that channel together and to the EF-701M.
2. Plug into the front-panel earphone jack labeled “test.” You will now hear a steady 200-Hz tone through the earphone.
3. Adjust the “R” control until the tone is at its minimum.
4. Adjust the “L” control until the tone is at its minimum.
5. Adjust the “C” control until the tone is at its minimum.
6. Because these controls interact with each other, you will need to repeat steps 3, 4, and 5 several times before fully minimizing the test tone.
7. Continue these adjustments until the test tone is virtually inaudible.  
If a complete or almost complete null cannot be obtained, is likely that there is a problem with either the wiring of the external party line or with one of the other devices attached to the external party line. The next section provides troubleshooting tips.
8. Unplug the earphone when the nulling operation is complete.

## Troubleshooting Tips for Nulling

- If the “R” control is turned fully counterclockwise, the line has multiple terminations or a resistive load.
- If the “R” control is fully clockwise, then the line is unterminated.
- The “L” control compensates for the low frequency inductive and capacitive elements of the external party line. If the “L” control is fully turned in either direction, it is likely that there is a problem in the external party line. With a Clear-Com party line connected, the “L” should be slightly to either side of the mid-pot position.
- The “C” control compensates for cable capacitance and is line-length dependent. If fully counterclockwise, this indicates a very short line (<10 feet or < 3 m). This is a valid setting for a short line.
- If “C” is fully clockwise, this indicates an excessively long line (>4000 feet or >1200 m).
- Remember, you are adjusting the null to/from the local party-line system. Only the transmit *send* level at the local EF-701M will affect the listen *receive* level at the remote EF-701M.

# INTERNAL ADJUSTMENTS

The only user-adjustable internal setting is selection of the baud rate for the RS-422 data.

The factory-set baud rate for the RS-422 data is 19.2 kilobits per second (19.2 kbps). For certain transmission schemes, the baud rate is internally selectable for 2400, 4800, or 9600 bits per second. Additional fixed settings are: 8 data bits; 1 stop bit; no parity.

*Note: Accessing the baud rate jumpers inside the EF-701M requires removal of the cover.*

## Removing the cover of the EF-701M

Three tools are required for this procedure: a #2 Phillips screwdriver, a 3/16 in. nut driver, and a flat-bladed screwdriver with a blade width of approximately .075 in. (1.9 mm).

To remove the cover of the EF-701M unit:

1. Disconnect all cables.
2. Remove the four sheet metal screws on the back and sides.
3. The XLR jack has a special locking tab to secure it to the housing. The jack must be released before the cover can be removed. Use a very narrow-tipped screwdriver. Insert it into the slot inside the XLR jack and twist the release lock counterclockwise for approximately 1/4 turn.
4. Remove the two 3/16 in. hex-head jack screws on the DB-15.
5. Slide the cover backwards until the DB-15 and XLR jacks are clear.



6. Lift off the cover.

7. Make the necessary adjustments of jumpers P3 and P4 (shown in the following table).

To set a jumper to the closed position, plug it onto both pins. To set a jumper to the open position, plug it onto only one of the pins.

BAUD 1	BAUD 2	RATE
Open	Open	19.2 kBaud
Closed	Open	9.6 kBaud
Open	Closed	4.8 kBaud
Closed	Closed	2.4 kBaud

Table 2-1: P3 and P4 jumper settings

8. For reassembly, reverse steps 1 through 6.

*Note: The potentiometer (R13) is used to factory tune the 20-kHz call-signal detection circuitry. It should be adjusted only by qualified personnel.*

# TRANSMISSION METHODS

## DIRECT CONNECTION

There are many instances where twisted-pair cable is available for audio connections. This wiring is typically found in unused telephone cable in or between buildings. Figure 2-2 illustrates twisted-pair wiring connections.

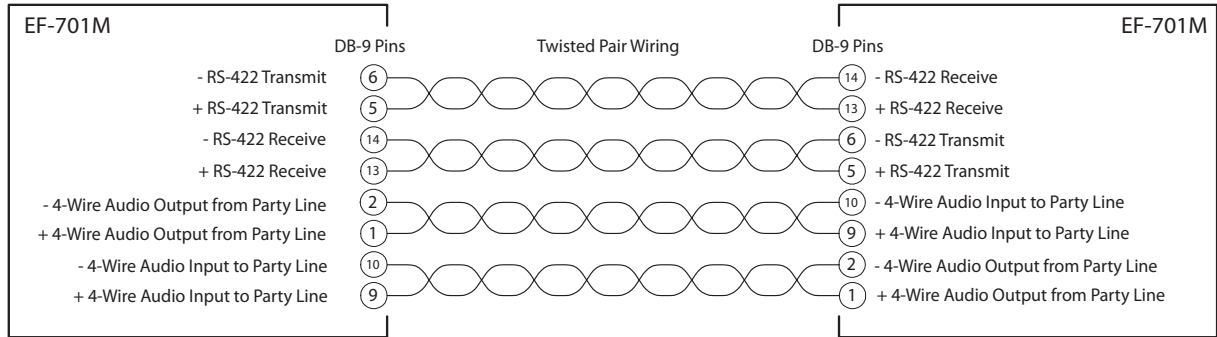


Figure 2-2: Twisted Pair Wiring

Simply connect the 4-wire audio and 4-wire data between EF-701M units utilizing this cable. This will form a direct connection between the DB-15 connectors on a pair of EF-701M units. The PL systems at each end of the cable will require their own power and termination for their local channel.

Up to 5000 ft. (1.52 km) of CAT 3 or better cable, and possibly more, may be used to connect between EF-701M units in this manner.

## FIBER-OPTIC

Fiber optic transmission offers a number of advantages over copper:

- There is no susceptibility to electromagnetic interference.
- Fiber-optic cable is much lighter and more space efficient than copper, even for a single channel.
- Transmission distance, in many cases, can be substantially longer.
- It is more difficult to eavesdrop on a fiber transmission.

*Warning: Always use extreme caution with fiber-optic equipment. Never look directly into the light port or into a connected cable with a unit powered up. Even if you don't see visible light, you could be exposing your eyes to invisible light from an infrared laser. This can cause damage to your vision. Always observe all manufacturer's recommendations and warnings.*

There are two basic modes of fiber-optic transmission. In a multimode fiber, the light travels through the fiber via multiple paths. In a single-mode fiber, the light travels in a single path. Depending on the equipment, single or multiple channels of audio, video, data, or a mix thereof can be multiplexed and carried in either one or both directions. Figure 2-3 illustrates wiring connections to a popular type of multimode fiber-optic modem over shielded-pair cable.

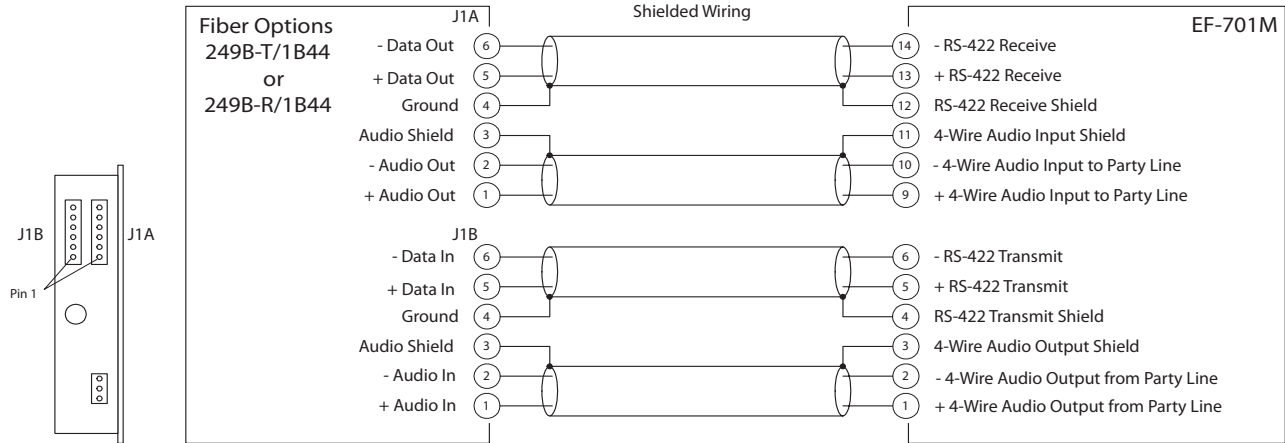


Figure 2-3: Shielded Wiring

Just as with analog cable, the longer the fiber-optic cable, the more signal degradation occurs. Cable splices and connectors also contribute to overall path loss. Performance is dependent on the modem, the cable, and the selected wavelength. Single-mode fibers can carry signals over much longer lengths, though the equipment is more costly, in part due to the use of lasers rather than LEDs as the light source.

For dedicated use, Clear-Com has found that the FiberOptions 249B series (multimode, single channel) works well for most single channel applications. Range is up to 2.5 km (1.55 miles) with negligible signal loss at 1 km (0.62 mile) or less.

## **OTHER METHODS**

Any device that can accept 4-wire audio and RS-422 data and convert them in either direction could be considered ideal for use with EF-701M units. There are a number of choices for fiber-optic “modems” that meet this criteria. Selection is much more limited among computer networking devices and audio codecs typically used with ISDN.



# 3 MAINTENANCE

## TROUBLESHOOTING TIPS

Listed below are symptoms, causes, and solutions for some of the more common problems that may occur.

## Audio Troubleshooting Tips

Symptom	Cause	Solution
Squealing feedback, levels too high, distortion, call signal stays on.	The local PL channel is not terminated.	Check termination switches on PL equipment and set appropriately. (One termination per channel).
Levels seem low even after adjustment.	The local PL channel has multiple terminations.	Check termination switches on PL equipment and set appropriately.
Echoes, hollow sound, resonance.	Improper nulls and/or delays introduced by digital signal processing, A-to-D and D-to-A conversion and other network-related processing.	Adjust the unit(s) for the best possible null. This will help to minimize the effects. Adjust the sidetone nulls on the party-line stations and beltacks.



<b>Symptom</b>	<b>Cause</b>	<b>Solution</b>
Levels don't match from one end to the other.	1. Additional level adjustments may be available on the modems. 2. Clear-Com/RTS jumper is set incorrectly.	1. Always begin a setup with these set to their nominal levels. 2. Reset jumper.
Excessive noise or poor frequency response.	Various causes related to modems and the network rather than to the party-line equipment.	Know the performance parameters of the transmission system.
Level adjustment controls seem to work backwards.	DB-15 is not wired correctly.	Check and correct wiring.

## Data Troubleshooting Tips

Symptom	Cause	Solution
Data LED is off even though units are connected at each end.	<ol style="list-style-type: none"><li>1. Problem in the wiring from the DB-15 to the modem or problem with the transmission medium.</li><li>2. Baud rate or other modem requirements not compatible with EF-701M.</li><li>3. The EF-701M units are set to different baud rates.</li><li>4. One EF-701M is set to Matrix Direct Mode when connected to another EF-701M.</li></ol>	<ol style="list-style-type: none"><li>1. Adjust wiring.</li><li>2. Adjust EF-701M units to match.</li><li>3. Adjust EF-701M units to match.</li></ol>
Data LED blinks rapidly.	EF-701M is receiving a "break" signal from the RS-422. Typically a power loss on the modem at the far end causes this.	Check modem power connections.

<b>Symptom</b>	<b>Cause</b>	<b>Solution</b>
Call signal is locked on at one end.	<ol style="list-style-type: none"><li>1. Local PL problem.</li><li>2. DB-15 is wired incorrectly at other end. This will happen if an RTS-TW channel is connected at one EF-701M and a Clear-Com is connected at the other, but the DB-15 on the RTS end has not been wired properly.</li></ol>	<ol style="list-style-type: none"><li>1. Check PL.</li><li>2. Check wiring.</li></ol>

## Nulling Troubleshooting Tips

Symptom	Cause	Solution
No audio; green LED is off.	EF-701M is not receiving power.	EF-701M units at <i>both</i> ends of the connection must receive power from a local PL system.

<b>Symptom</b>	<b>Cause</b>	<b>Solution</b>
<p>Unsatisfactory null.</p>	<ol style="list-style-type: none"> <li>1. Unstable PL system due to excessive cabling, a high number of stations, transformers connected across the intercom channel, or other PL equipment issues such as termination.</li> <li>2. Too many EF-701M units on channel.</li> </ol>	<ol style="list-style-type: none"> <li>1. Verify operational status of PL equipment.</li> <li>2. Remove EF-701M units from the network. If nulls on the remaining units improve, the problem was too many EF-701M units. This should not occur until approximately seven or more units are sharing a channel. However, as systems vary in size and complexity, a user could experience difficulty nulling as few as two EF-701M units, each connected to a very large system.</li> </ol>

## Block Diagram

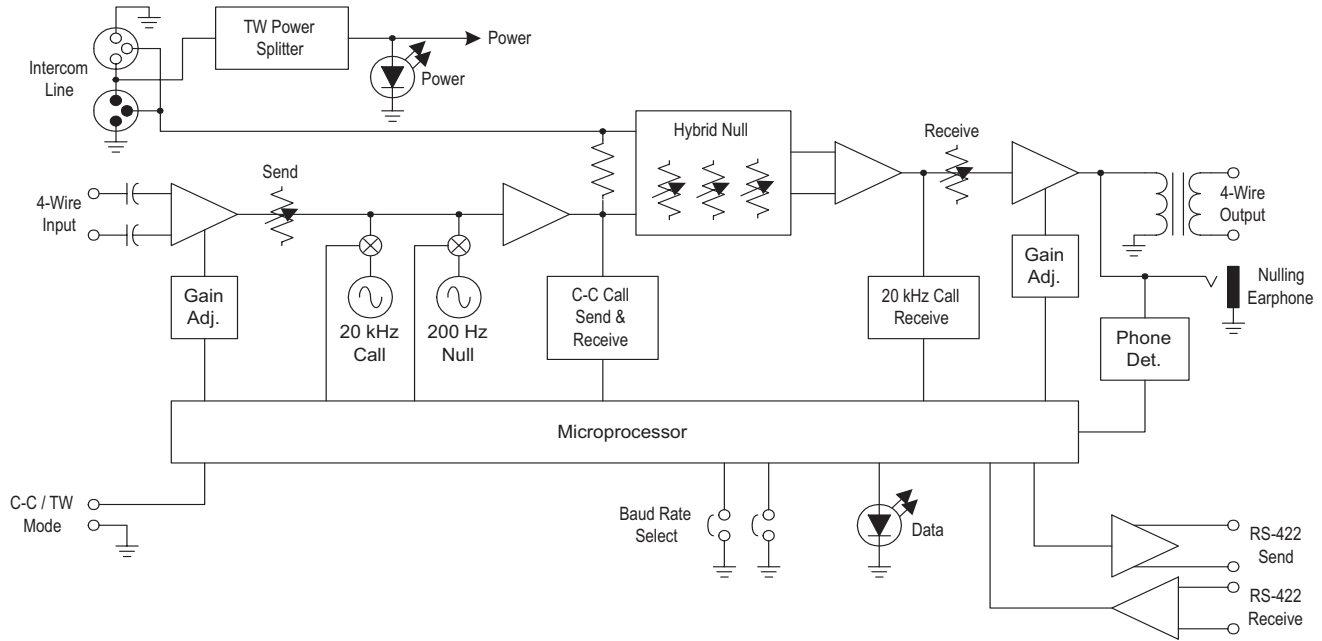


Figure 3-2: EF-701M Block Diagram

# 4 GLOSSARY

*The glossary gives definitions of technical terms found throughout this manual.*

**Category 3, 5, 5e, or 6 cable:** EIA/TIA 568 category specification relating to the performance of network cabling. All are adequate for EF-701M wiring.

**CODEC:** A device that enCODEs and DECODEs data.

**Drop(s):** A point or points in the party-line system where a beltpack or station is present. For purposes of this discussion, a drop is any point on a common channel where an EF-701M or other 4-wire to 2-wire interface is present.

**Four-wire audio:** A single shielded-pair or twisted-pair cable carries audio in one direction only.

**Hybrid:** A circuit that converts between 4-wire audio and 2-wire audio and contains a nulling circuit.

**Interface:** The place at which independent systems meet and act on or communicate with each other. An interface might be a hardware connector used to link to other devices, or it might be a convention used to allow communication between two software systems. An interface often converts transmission signals so that they are compatible.

The EF-701M Interface connects 2-wire intercom systems or stations together over various 4-wire transmission media. In doing so, it converts a channel of standard 2-wire or TW party line to 4-wire audio and, at the same time, converts a DC-voltage call signal or 20-kHz call signal to RS-422 data.

**Local PL:** The party-line system that connects to an EF-701M through standard microphone cable and powers the EF-701M Interface.

**Matrix Frame:** A matrix frame holds the programmable circuit cards which control an intercom system. The circuit cards connect to external intercom devices (stations, interfaces, 4-wire audio) through the RJ-45 connectors on the back panel. Each RJ-45 connector is called a “port”.

**Metric Conversions:** The following table gives common metric conversions.

U.S. to Metric Measurement	Metric to U.S. Measurement
1 inch = 25.4 millimeters	1 millimeter = .04 inch
1 foot = 0.30 meter	1 meter = 3.3 feet
1 mile = 1.6 kilometers	1 kilometer = 0.62 miles

**Modem:** MODulator/DEModulator. A device for converting an analog signal to/from a digital or optical signal for transmission and distribution over various media and networks.



**Null:** (noun) 1. Adjustment on the intercom that controls the amount of sidetone heard by the operator. 2. The degree of sidetone adjustment. (verb) To adjust the amount of sidetone heard by the intercom operator.

**Party Line:** Intercom channel on which each member can both listen and speak to every other member on the channel. Analogous to a telephone conference call with its full duplex (talk and listen) communication.

**PL:** Abbreviation for Party Line.

**RS-422:** A balanced asynchronous data connection.

**Sidetone:** The sound of your own voice transmitted through an earphone as you speak.

**Termination:** A fixed load placed upon the Clear-Com party line to maintain stability.

**Two-wire audio:** A single shielded-pair cable carrying a single channel of bidirectional (talk and listen) audio.

**TW:** Two channels of bidirectional (talk and listen) audio that are carried on a single shielded-pair cable.



# 5 SPECIFICATIONS

## EF-701M TECHNICAL SPECIFICATIONS

dBu is an absolute measurement. 0 dBu is referenced to 0.775 volts RMS

### CLEAR-COM FORMAT

#### LINE CHARACTERISTICS

Max Level Before Clipping  $\geq 20\text{dBu}$   
Impedance:  $\geq 10\text{K}\Omega$

#### SIGNALLING

Receive:  $\leq 4\text{VDC}$   
Send:  $\geq 11\text{VDC}$

### RTS FORMAT

#### LINE CHARACTERISTICS

Max Level Before Clipping  $\geq 20\text{dBu}$   
Impedance:  $\geq 10\text{K}\Omega$

#### SIGNALLING TONE

Send frequency: 20kHz  
 $\pm 1\text{KHz}$   
Receive frequency: 20kHz  
 $\pm 500\text{Hz}$   
Send level:  $\geq -6\text{dBu}$   
Receive level:  $\leq -20\text{dBu}$

### GENERAL CHARACTERISTICS

#### Frequency response:

Party Line - Matrix  
200-10KHz  $\pm 3\text{dB}$   
Matrix - Party Line  
200-10KHz  $\pm 3\text{dB}$

## Distortion

Party Line - Matrix <=0.5%  
Matrix - Party Line <=0.5%

## Noise

Party Line - Matrix <=-50dBu  
Matrix - Party Line <=-70dBu

## Max Gain

Party Line - Matrix (CC setting) 20dB ±  
3dB

Party Line - Matrix (RTS setting) 16dB ±  
3dB

Matrix - Party Line (CC setting) -5dB ±  
3dB

Matrix - Party Line (RTS setting) -1dB ±  
3dB

## Min Gain

Party Line - Matrix (CC setting) -7dB ±  
3dB

Party Line - Matrix (RTS setting) -12dB ±  
3dB

Matrix - Party Line (CC setting) -33dB ±  
3dB

Matrix - Party Line (RTS setting) -29dB ±  
3dB

## Power Requirements

Input Voltage Range

20-30VDC

Quiescent Current <=70mA

Max Current <=80mA

## Rear Panel Connectors and Controls

Party Line (1)

XLR3F

RTS (1)

DB-15F

Matrix (1) RJ-45

(2) Mode

Switches

## Front Panel Connectors and Controls

TS1 Earphone	(1) 3.5mm
Jack Socket	
Level Adjust Control	(2) Rotary
Null Adjust Control	(3) Rotary
Power Indicator LED	(1) Green
Data Indicator LED	(1) Amber

## Dimensions

Height: (41 mm) (1 RU, EIA rack)	1.62 in.
Width: (151 mm)	5.94 in.
Depth: (122 mm)	4.80 in.
Weight: (.794 kgs)	1.75 lbs.

## Accessories

Wiring diagram, adhesive backed	
testing earphone	TS-1

## 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.



# LIMITED WARRANTY

*Return Material  
Authorization (RMA)  
numbers are required  
for all returns.*

*Both warranty and  
non-warranty repairs  
are available.*

Vitec Group Communications (VGC) warrants that at the time of purchase, the equipment supplied complies with any specification in the order confirmation when used under normal conditions, and is free from defects in workmanship and materials during the warranty period.

During the warranty period VGC, or any service company authorized by VGC, will in a commercially reasonable time remedy defects in materials, design, and workmanship free of charge by repairing, or should VGC in its discretion deem it necessary, replacing the product in accordance with this limited warranty. In no event will VGC be responsible for incidental, consequential, or special loss or damage, however caused.

## WARRANTY PERIOD

The product may consist of several parts, each covered by a different warranty period. The warranty periods are:

- Cables, accessories, components, and consumable items have a limited warranty of 90 days.
- Headsets, handsets, microphones, and spare parts have a limited warranty of one year.
- UHF wireless IFB products have a limited warranty of one year.
- UHF wireless intercom systems have a limited warranty of three years.
- All other Clear-Com and Drake brand systems and products, including beltpacks, have a limited warranty of two years.

The warranty starts at the time of the product's original purchase. The warranty start date for contracts which include installation and commissioning will commence from the earlier of date of the Site Acceptance Test or three months from purchase.

## **TECHNICAL SUPPORT**

To ensure complete and timely support to its customers, VGC's User Support Center is staffed by qualified technical personnel. Telephone and email technical support is offered worldwide by the User Support Center.

The User Support Center is available to VGC's customers during the full course of their warranty period.



Instructions for reaching VGC's User Support Centers are given below.

**Telephone for Europe, Middle East and Africa:** +49 40 6688 4040 or +44 1223 815000

**Telephone for the Americas and Asia:** +1 510 337 6600

**Email:** [vitec.support@AVC.de](mailto:vitec.support@AVC.de)

Once the standard warranty period has expired, the User Support Center will continue to provide telephone support if you have purchased an Extended Warranty.

For latest contact information please refer to the Service and Support section at [www.clearcom.com](http://www.clearcom.com).

## **WARRANTY REPAIRS AND RETURNS**

Before returning equipment for repair, contact a User Support Center to obtain a Return Material Authorization (RMA). VGC representatives will give you instructions and addresses for returning your equipment. You must ship the equipment at your expense, and the support center will return the equipment at VGC's expense.

For out-of-box failures, use the following contact information:

**Europe, Middle East and Africa**

Tel: +44 1223 815000 Email: [customerservicesEMEA@vitecgroup.com](mailto:customerservicesEMEA@vitecgroup.com)

### **North America, Canada, Mexico, Caribbean & US Military**

Tel: +1 510 337 6600 Email: [customerservicesUS@vitecgroup.com](mailto:customerservicesUS@vitecgroup.com)

### **Asia Pacific & South America**

Tel: +1 510 337 6600 Email: [customerservicesAPAC@vitecgroup.com](mailto:customerservicesAPAC@vitecgroup.com)

VGC has the right to inspect the equipment and/or installation or relevant packaging.

For latest contact information please refer to the Service and Support section at [www.clearcom.com](http://www.clearcom.com).

## **NON-WARRANTY REPAIRS AND RETURNS**

For items not under warranty, you must obtain an RMA by contacting the User Support Center. VGC representatives will give you instructions and addresses for returning your equipment.

You must pay all charges to have the equipment shipped to the support center and returned to you, in addition to the costs of the repair.

## EXTENDED WARRANTY

You can purchase an extended warranty at the time of purchase or at any time during the first two years of ownership of the product. The purchase of an extended warranty extends to five years the warranty of any product offered with a standard two-year warranty. The total warranty period will not extend beyond five years.

**Note:** VGC does not offer warranty extensions on UHF wireless intercom systems, or on any product with a 1-year or 90-day warranty.

## LIABILITY

THE FOREGOING WARRANTY IS VGC'S SOLE AND EXCLUSIVE WARRANTY. THE IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ANY OTHER REQUIRED IMPLIED WARRANTY SHALL EXPIRE AT THE END OF THE WARRANTY PERIOD. THERE ARE NO OTHER WARRANTIES (INCLUDING WITHOUT LIMITATION WARRANTIES FOR CONSUMABLES AND OTHER SUPPLIES) OF ANY NATURE WHATSOEVER, WHETHER ARISING IN CONTRACT, TORT, NEGLIGENCE OF ANY DEGREE, STRICT LIABILITY OR OTHERWISE, WITH RESPECT TO THE PRODUCTS OR ANY PART THEREOF DELIVERED HEREUNDER, OR FOR ANY DAMAGES AND/OR LOSSES (INCLUDING LOSS

OF USE, REVENUE, AND/OR PROFITS). SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES OR THE LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU. IN ANY EVENT, TO THE MAXIMUM EXTENT PERMITTED UNDER APPLICABLE LAW, VGC'S LIABILITY TO CUSTOMER HEREUNDER SHALL NOT UNDER ANY CIRCUMSTANCES EXCEED THE COST OF REPAIRING OR REPLACING ANY PART(S) FOUND TO BE DEFECTIVE WITHIN THE WARRANTY PERIOD AS AFORESAID.

This warranty does not cover any damage to a product resulting from cause other than part defect and malfunction. The VGC warranty does not cover any defect, malfunction, or failure caused beyond the control of VGC, 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 approved by VGC, and shipping damage. Products with their serial numbers removed or defaced are not covered by this warranty.

This warranty does not include defects arising from installation (when not performed by VGC), lightning, power outages and fluctuations, air conditioning failure, improper integration with non-approved components, defects or failures of customer furnished components resulting in damage to VGC provided product.

This limited warranty is not transferable and cannot be enforced by anyone other than the original consumer purchaser.

This warranty gives you specific legal rights and you may have other rights which vary from country to country.

