
# *Adder ä 162/322 System*

## *Instruction Manual*

*Telecast Fiber Systems, Inc.*
*102 Grove Street*
*Worcester, MA 01605*
*Tel: 508-754-4858*
*Fax: 508-752-1520*
*www.telecast-fiber.com*

# Telecast Adder 162/322

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# Introduction

## Over vie w

The Telecast Adder™ 162 (32 channels) and Adder 322 (64 channels) are modular, multi-channel communications systems designed for the transmission of high-quality audio, data and intercom functions. The units preamplify, digitize, multiplex, transmit and receive up to 64 channels of audio information, four data channels and three dual-channel intercoms over a single optical fiber or 2 coaxial cables. Audio path evaluation is achieved using a built-in audio signal (tone) generator and level meter/monitor.

Modules contain eight connectors for mic (high or low impedance) or line level inputs, or eight output connectors for signals demultiplexed from the send/receive fiber.

The Adder 162 accepts up to four modules in any combination for a total of 32 channels in a 6RU, 10 inch high x 19 inch wide electronic equipment rack.

The Adder 322 accepts up to eight modules for a total of 64 channels in a 10RU, 17.5 inch high x 19 inch wide electronic equipment rack.

### Coaxial Cab le Input and Output

Each assembly has a coaxial input and coaxial output on which all signals are multiplexed. There is no redundancy in the coaxial system. The coaxial input is activated by an internal DIP switch on the Main PC Board. The coaxial output is always active.

### Status Indicator s

The front panel of the Adder 162/322 contains LED status indicators that monitor audio signals, the DC power source, and the communication link status.

### Batter y Bac kup

A Ni-Cad emergency battery backup is built into the assembly. Battery backup is limited to approximately 20 minutes and should be considered a short term power loss protector. The available Telecast power module (ADAP-AC-03 or Eel) provides continuous battery charging during line power operation.

### Audio Input and Output

Audio input levels are set up for each channel by switches on the front of each input module. These switches set input gain from 0 to 40 dB, input resistance to 600 Ω or 10 kΩ and a +48 VDC bias voltage to power microphones either ON or OFF. A ground lift switch is also on the front panel for use with each channel.

Audio outputs are at line level. There are no operator controls on the output module.

### Data Input and Output

The Model 162/322 assembly accepts and multiplexes four digital data signals and two remote relay closures onto the output fiber. The receiving assembly accepts the transmission, restores the digital signals and provides the switch closures. The number of data channels is fixed and independent of the number of audio channels in the assembly.

## Representative System

The flexibility offered by 64 channels of audio and the capability of having both input and output modules in a single assembly can lead to many efficient and innovative hookups. A representative system using the Telecast 322 in a 3-way split is shown in Figure 1.

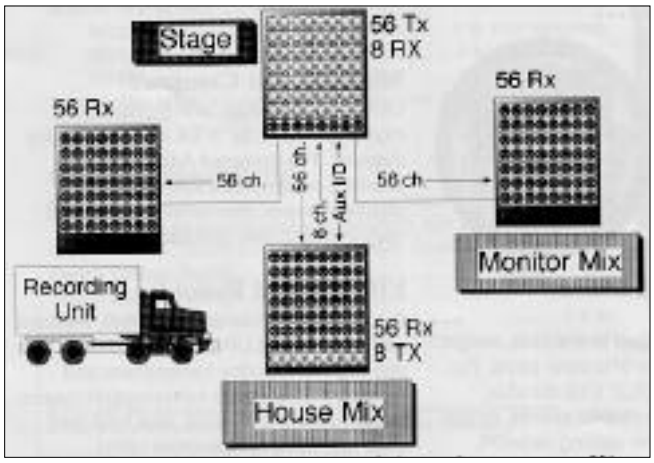



***Figure 1. Adder 322 with a 3-way Split***

## Options

Configure the 162/322 system by selecting the following options:

- AI820 8-channel Input Module
- AO820 8-channel Output Module
- 4-wire Intercom
- Clear-Com 2-wire Intercom
- RTS/Telex dual-channel Intercom
- Multi-mode WDM (Wavelength Division Multiplexer)
- Single-mode WDM

Contact Telecast for specific options.

## Unpac king

The Adder 162/322 minimum configuration consists of one input and one or more output modules. Input (Model AI820) and output (Model AO820) modules are installed and tested by Telecast prior to shipment, in accordance with customer specifications. In addition, microphone impedance and bias is preset per customer order, as is preamplifier gain for each channel. In addition to the Model 162/322 assembly with its Input and Output Modules, a system also includes:

- External power supplies (AC/DC adapters)
- Protective covers for optical connectors
- Hardware kits for rack mounting the units
- Optical fiber

After unpacking, inspect the units for mechanical damage, and electrical connectors for bent or damaged pins. Report any damage to the carrier and to Telecast Fiber Systems, Inc.

Leave the protective caps on the optical connectors until it is time to attach the fiber to the units. Replace the caps onto the connectors whenever the fiber is disconnected.

# Installation of the Assembly

Units are shipped ready for rack use. Some Adder 162/322 connections can be made at the front or rear panel, which would have been determined when the order was placed. For bench use, remove the rack mounting flanges by unscrewing them at three places along each flange.

## Line P ower

The external power supplies provided with each assembly require 120 VAC. Be sure that AC outlets are within reach of their 6-foot power cords. If your Adder is equipped with intercoms that require power (RTS or Clear-Com), you will need two such power supplies.

### Line P ower Connection

Insert the 4-pin XLR connector from the Telecast power supply into the **INPUT PO WER** Switchcraft D4M receptacle located at the upper left corner or rear of the 162, and located at the lower right corner or rear of the 322. Plug the supply into a 120 VAC line. See Figure 2 and Figure 3 for the power connector locations and Table 1 for electrical connections.

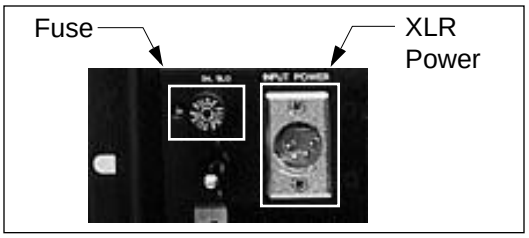


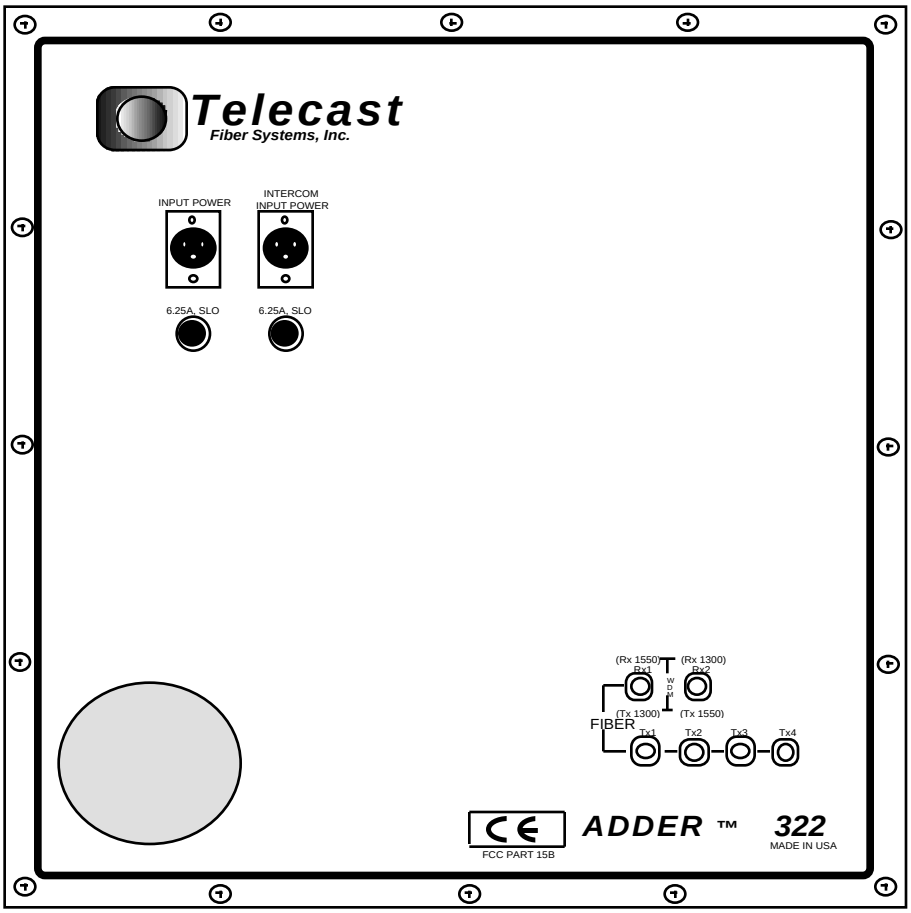

***Figure 2. Input DC XLR Power Connector and Fuse***

**Table 1. XLR Power Connections**

| Pin | Signal |
|---|---|
| 1 | ground |
| 2 & 3 | no connection |
| 4 | + input VDC |

### Input P ower Fuse

The SLO BLO power fuse in Figure 2 and Figure 3 is located next to the **INPUT PO WER** connector. Use a 6.25 Amp 5 x 20 mm approved fuse type for both Model 162 and Model 322. Be sure to use the same fuse type if replacement is required.



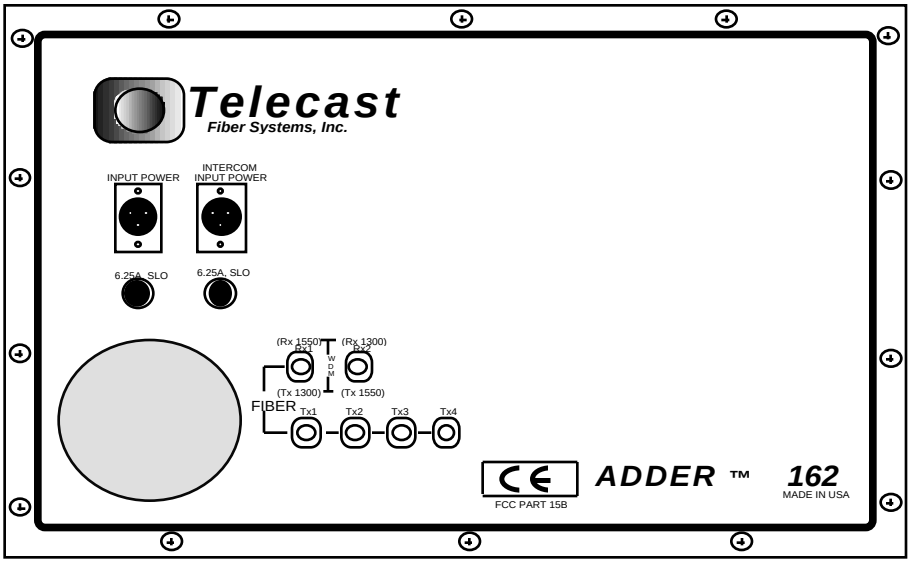




***Figure 3. Adder 162/322 Rear Panel Connections***

## DC Current Requirements

- Any 15 VDC external power supply used with the **Adder 162** must provide **2.5 amperes** continuous current.
- Any 15 VDC external power supply used with the **Adder 322** must provide **3.5 amperes** continuous current.

**Note:** Although the Adder 162/322 assembly will operate at 10 VDC, ≥13.8 VDC is required to charge the internal backup battery. System operation below 15 VDC can cause battery charge depletion.

## Batter y Char ging

The internal battery is automatically charged whenever 13.8 VDC is provided at the **INPUT POWER** connector shown in Figure 2 on page 3. Full charge takes 16 hours, and will power Model 162 for 30 minutes and Model 322 for 15 minutes.

# Electrical Hookups

## Audio Connections

Audio I/O is via 3-pin XLR connectors with industry standard wire locations. See Table 2 and Figure 4.

**Table 2. XLR Audio I/O Cable Connections**

| Pin | Signal |
|---|---|
| 1 | Ground |
| 2 | Balanced I/O (−) |
| 3 | Balanced I/O (+) |

The XLR connectors are located on the front panel of each module. On the *input* modules, XLR connectors are female Neutrik type NC3FPR-H. On the *output* modules, XLR connectors are male Neutrik type NC3MG-H. Refer to Figure 4.

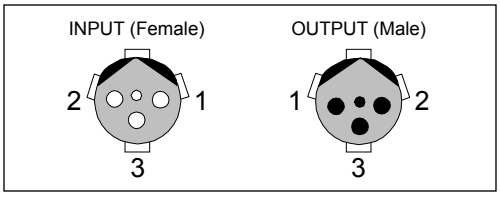



***Figure 4. XLR Connectors on Input and Output Modules***

## Digital Connections

The Model 162/322 assembly accepts and multiplexes four RS-232C or RS-422 digital data signals and two remote relay closures. The 162/322 is also used to receive a transmission, restore the digital signals and provide switch closures. The number of data channels is fixed and independent of the number of audio channels in the assembly. Both data input and output are accomplished on the same connector.

Digital signal connections are made via 9-pin D connectors; see Figure 5. The connection specifications are listed in Table 3. A 110 Ω terminating resistor placed across the balanced inputs may be needed if input cable lengths are in excess of 6 feet. Serial communications can be RS-232 at one end and RS-422 at the other, if desired.

Contact closure input is activated by pin 8 on contact to ground or to a TTL logic **0** signal level. Contact closure output is established by an isolated, normally open, dry contact built onto the Main PC Board.

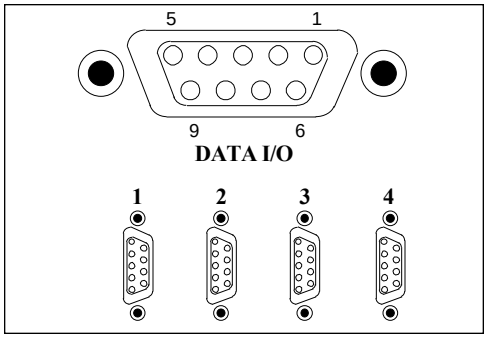



***Figure 5. 9-pin D-connectors***

**Table 3. Digital Cable Connections**

| Pin Number | Connectors 1, 2 | Connectors 3, 4 |
|---|---|---|
| 1 | RS-422 in (−) | RS-422 in (−) |
| 2 | Contact out | No connection |
| 3 | Ground | Ground |
| 4 | RS-232 out | RS-232 out |
| 5 | RS-422 out (−) | RS-422 out (−) |
| 6 | RS-422 in (+)<br>RS-232 in (+) | RS-422 in (+)<br>RS-232 in (+) |
| 7 | Contact out | No connection |
| 8 | Contact in | No connection |
| 9 | RS-422 out (+) | RS-422 out (+) |

The four digital I/O connectors are AMP 747905-2, D subminiature female or equivalent.

# Optical Connections

**WARNING Never look directly into the end of the optical fiber until it has been positively determined to be safe. Eye damage could result.**

## Optical Fiber Signals

Each 162/322 system has multiple optical connections. As a minimum, a transmit output must be connected via a suitable fiber to a receive input.

Fiber transmissions can be 100% redundant. A secondary fiber output operates with independent drivers and is always active. If the active fiber link fails, an alarm is sounded and the alternate link stays fully active. Each fiber contains all audio, intercom, digital and closure data.

Two additional, fiber outputs are available for local splits. This is useful when the same outputs are received at multiple locations.

The Adder 162/322 is compatible with industry standard ST type connectors. It may be used with installed backbone cables or with dedicated cables. Consult Telecast for information regarding compatible fiber types.

### Cable Fabrication

Assembled cables and connectors are available from Telecast Fiber Systems, Inc. For custom cable fabrication, use type ST connectors such as Telecast part number CONN-ST-M. Always follow the connector manufacturer's directions when fastening a connector to the cable. A Quick-crimp kit, part number CKIT-3M, is available from Telecast.

Connect the fibers to the Adder 162/322 at each port. Cover any unused fiber connectors. If a coaxial cable is used instead of a fiber, cover the optical connectors on the panels to protect them.

## Transmission Fiber Ports

### Multiple Fiber Versions

*Tx1, Tx2, Tx3 and Tx4 Fiber Ports*

Fiber ports Tx1, Tx2, Tx3 and Tx4 shown in Figure 6 are fully redundant. All transmit ports are always active and have independent output circuits.

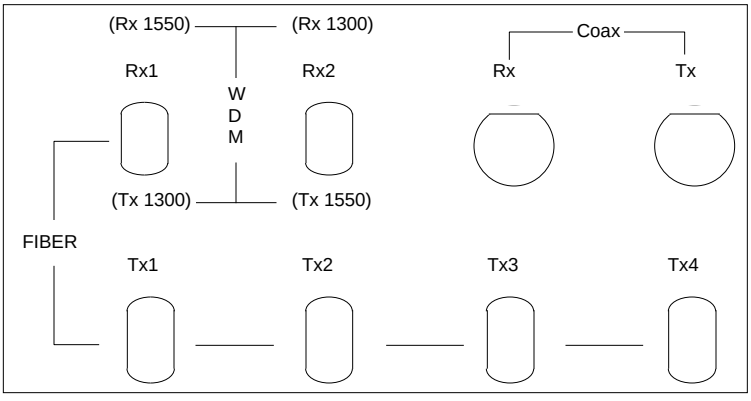



***Figure 6. Fiber and Cable Ports***

All ports carry digitized, multiplexed audio as well as digital and contact data. Each output has the same capacity with distance capabilities as shown in Table 4. Unless otherwise specified, all transmitters operate at 1300 nm except Tx2 which operates at 1550 nm.

#### *Rx1 and Rx2 Fiber Ports*

Fiber ports Rx1 and Rx2 accept the multiplexed optical signals from the output of another Model 162/322. The received signal is demuxed and sent to the output corresponding to the original input on the transmitting assembly. These fiber input ports are internally switched with preference to Rx1. If the active port fails to recognize a signal, the assembly switches to the alternate port and an alarm sounds. An alarm also sounds if neither port has a signal present.

### WDM Single Fiber Versions

The Rx ports in Figure 6 on page 7 are used to send *and* receive optical signals over a single fiber on assemblies with Telecast's Wavelength Division Multiplexer option (**WDM**). This is accomplished by transmitting on one wavelength and receiving from the same fiber on an alternate wavelength.

Since each unit is identical, Rx1 must be connected to Rx2 on the second unit to complete the optical circuit. A redundant circuit from Rx2 on the first unit and Rx1 on the second unit can be added using a second fiber.

**Note:** The Tx1 and Tx2 ports are combined with the Rx1 and Rx2 ports by the WDM. Tx3 and Tx4 remain active and are still available for local splits.

## Coaxial Cable Ports

Coaxial ports Rx and Tx carry the same data as the optical ports. The coax output is always active, however the coax input is active only when the optical receive inputs have been disabled via SW1. The coax circuit cannot be redundant.

## Cable Runs

### Fiber

The installer is responsible for providing the fiber optic cable runs, available from Telecast Fiber Systems, Inc. The *Accessory List* on page 31 shows cable and other items required for the system. Be sure that the fiber types are compatible with the intended installation distances, as shown in Table 4.

**Table 4. Distance Limits by Fiber Type**

| Fiber Core Diameter, Wavelength | Distance Limit |
|---|---|
| 50 or 62.5/125 µm | 10 km |
| 9/125 µm | 20 km |

All outputs and inputs of the standard unit are multimode (mm) and single mode (sm) compatible. Tx2 is 1550 nm and all other transmissions are 1300 nm. When the WDM option is allowed, the use of sm or mm must be specified. Distances are usually limited by fiber bandwidth.

**Note:** If the WDM is installed, the fiber used must match that of the WDM to assure performance to specifications.

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

### Coax

To use the system with coax instead of optical fiber, use Belden type 8281, 75 Ω or equivalent. Refer to *Optical Fiber or Coax Communication Selection* on page 12 for the switch settings on the Main PC Board which govern coaxial use with the Model 162/322.

## Input and Output Module Connections

Figure 7 shows an Input Module and an Output Module. The left ribbon on each module is the signal conductor; the right ribbon provides power. Each ribbon plugs into a specific spot on the Main PC Board; refer to Figure 8a on page 10.

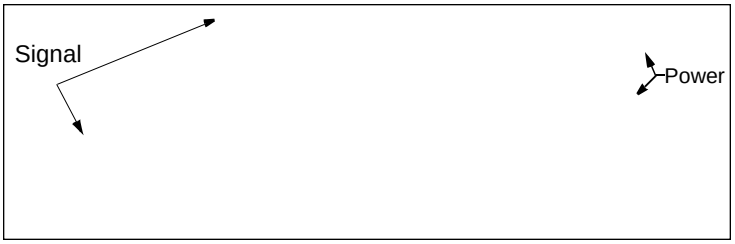



***Figure 7. Input (upper) and Output (lower) Modules for Adder Model 162/322***

Module mounting slots are numbered from the upper part of the chassis to the lower part: A to D on Model 162, and A to H on Model 322.

The Model 162/322 Main PC Board has two sets of signal and power ribbon connector terminations. See Figure 8a.

#### *Signal Ribbons (left side of main board)*

J11 to J8 are for signal ribbons A to D on Model 162/322.

J7 to J4 are for signal ribbons E to H on Model 322.

#### *Power Ribbons (right side of main board and auxiliary board)*

J24 to J21 are for power ribbons A to D on Model 162/322.

Power for modules E to H on Model 322 is supplied from an additional power supply board located below the Main PC Board. See Figure 8b on page 10.

Besides module count, number of multiplexed signals, and size, the Models 162 and 322 are identical in all respects.

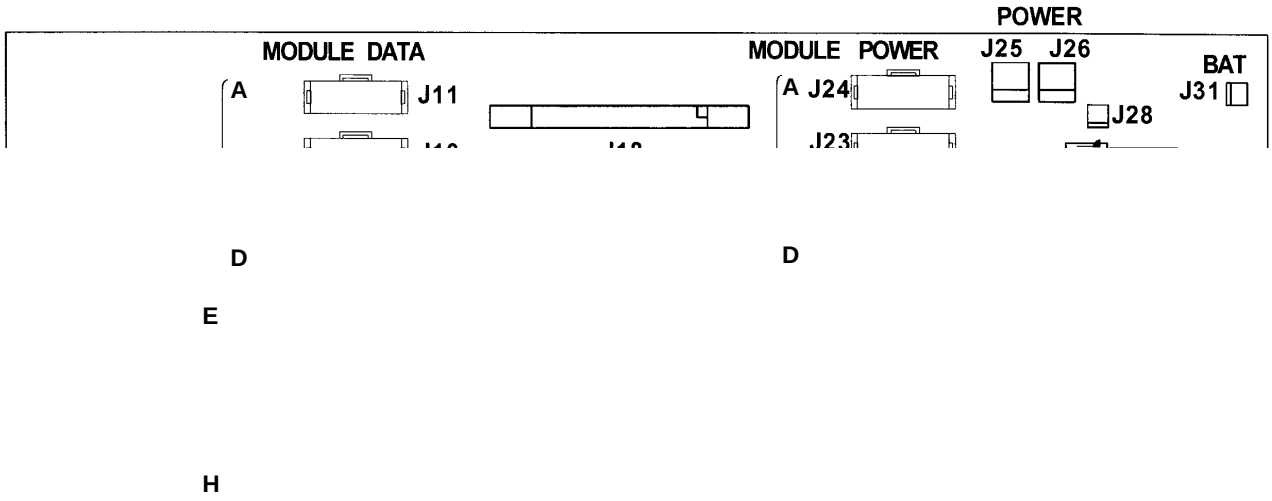



*Figure 8a. Model 162 Main PC Board*

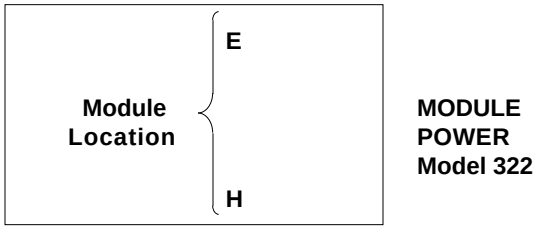



*Figure 8b. Model 322 Auxiliary Power PC Board*

## Remo ving and Replacing Modules

Figure 9 shows a Model 162 assembly and Figure 10 shows a Model 322 assembly.

***Figure 9. Model 162 Assembly***

***Figure 10. Model 322 Assembly***

To change the configuration of your Adder 162/322 assembly:

1. Switch the power to the assembly OFF.
2. Loosen the two mounting screws at the left and right of the module.
3. Unplug the ribbon connectors at either end of the modules. Note that the connections have spring locks that must be squeezed to be removed.
4. Change the module, and plug the respective signal and power connectors back into their ports on the module. Tighten the mounting screws.

**Note:** Be sure to maintain the module location number from top to bottom in terms of module location and connector position on the Main PC Board. An output module at a given position must correspond to an input module at the same position at the originating assembly.

**Note:** Pins on the ribbon connectors are very small in order to best use the very limited amount of spacein the Adder. Be carefil not to bend pins when mating ribbon cables to their connectors.

## Optical Fiber or Coax Comm unication Selection

### Switc h Settings

Switches on the Main PC Board control connectors between Adders over either fiber or coax. Locate SW1 in the lower left corner of the Main PC Board (Figure 8a on page 10).

To receive from optical fiber, configure SW1 according to Figure 11.

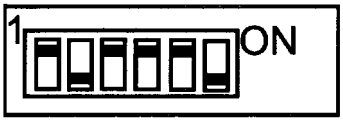



***Figure 11. Optical Fiber Receive Switch Setting***

To receive from coax, configure SW1 according to Figure 12.

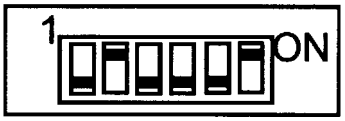



***Figure 12. Coaxial Cable Receive Switch Setting***

### Coax Length

Configure SW2 according to the length of coaxial cable being used. Refer to Figure 13.

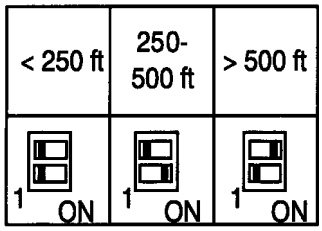



***Figure 13. Coaxial Cable Length Setup***

The maximum length of coaxial cable that can be used on any single run between assemblies is 1000 feet.

## Audib le Alarm Settings

An audible alarm is provided to indicate error conditions. This alarm can be deactivated by the front panel ALARM ON/OFF-RESET switch. Refer to Figure 19 on page 18. In addition, the REMOTE POWER and LOCAL POWER alarms can be disabled internally by SW6. Locate SW6 in the upper right corner of the Main PC Board (Figure 8a on page 10).

### Local P ower Alarm

The LOCAL POWER ALARM indicates a failure in the external power input at this unit. To configure the alarm for local power, configure SW6 according to Figure 14.

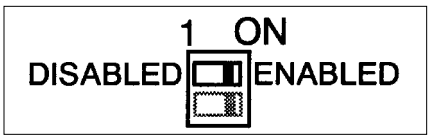



***Figure 14. Alarm Switch — Local***

### Remote P ower Alarm

**Note:** Newer versions of the Adder 162/322 have replaced SW2 with coax auto-eq circuitry.

The REMOTE POWER ALARM indicates a failure in the external power input at the *remote* unit (i.e., the unit transmitting to this unit).To configure the alarm for remote power, configure SW6 according to Figure 15.

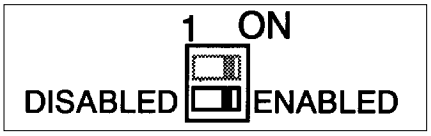



***Figure 15. Alarm Switch — Remote***

**Note:** Alarms are latching. If an alarm occurs, the Audible alarm will sound until the front panel alarm switch is set momentarily to OFF.

## Audio Signal Setup

The switches for line or mic input levels, gain, and ground are positioned below the audio connectors on the front panel of each input module. There are eight sets of switches, one set for each channel. Channels are numbered left to right from 1 to 8. The panel switch markings for channels 4 and 5 are shown in Figure 16.

The Model 162/322 system uses high frequency preemphasis on all audio channels. Maximum level at 1 kHz with all gain switches off (unity gain) is +18 dBm. Maximum level at 20 kHz is 10dB lower, or +8 dBm.

The green LED indicates that a signal 30 dB below maximum, or -12 dBm or greater is present at the channel input. The red LED indicates *clipping*, indicating that the A/D converter for the channel is at or near overload and *input gain or level must be reduced.*

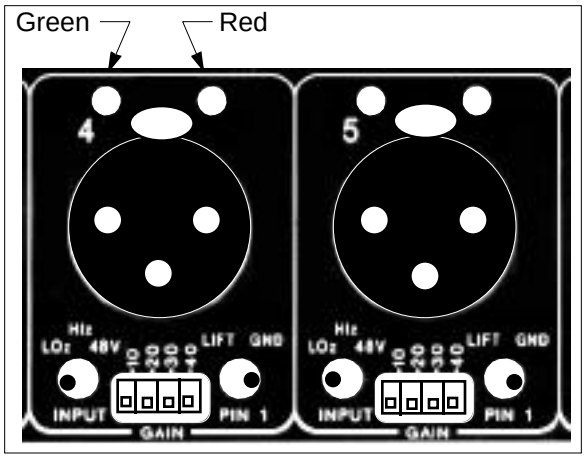



***Figure 16. Input Audio Channel Switch Markings***

Each channel setting should be carefully checked.

Output module gain is fixed. Maximum module output is +18 dBm, at 1 kHz, corresponding to A/D clipping.

The **LOz /HIz /48V INPUT** switch (Figure 16) coupled with the input gain switches (Figure 17 on page 15) result in the input signal levels shown in Table 5.

**Table 5. Input Signal Levels**

| **LOz, 600 Ω balanced** | | **HIz, 10 kΩ balanced** | |
|---|---|---|---|
| Unity gain | +18 dBm peak | Unity gain | +16 dBV peak |
| +10 dB | +8 dBm peak | +10 dB | +6 dBV peak |
| +20 dB | −2 dBm peak | +20 dB | −4 dBV peak |
| +30 dB | −12 dBm peak | +30 dB | −14 dBV peak |
| +40 dB | −22 dBm peak | +40 dB | −24 dBV peak |

# Input Module Setup

Use Table 6 to assist in setting up the front panel switches on each input module. You will be setting up:

- Input Gain: **0**, **+10**, **+20**, **+ 30**, and **+40** dB
- Input Impedance and Bias Voltage: **LOz** (600 Ω), **HIz** (10 kΩ) or **48 V** (always at 10 kΩ)
- Input Ground **LIFT** or **GND**

### Gain

1. Determine the appropriate input gain for each channel and enter the value in Table 6. Refer to Figure 17 for the front panel switch settings.

**Note:** Only one switch should be ON at a time as gain settings are NOT additive.

| Input Source | Switch Settings | Gain |
|---|---|---|
| Line + 18 dBm |  | 0 dB |
| Line + 8 dBm |  | +10 dB |
| Hi Output MIC |  | +20 dB |
| Med Output MIC |  | +30 dB |
| Lo Output MIC |  | +40 dB |

***Figure 17. Input Audio Gain Switch Settings***

### Impedance

2. Determine the need for each channel's input impedance at 600 Ω or HIz. Most systems operate better in the HIz mode.
   a. If 48 V phantom power is needed, set the LOz/HIz/48 V switch to 48 V. With 48 V ON, the impedance is always HIz. The phantom supply is limited to a maximum combined load of 60 mAmps per 32 channels, which is about 2 mAmps per input channel with all channels in use. Source impedance is 5000 Ω. When fewer than the 32 loads are used, the current at each input can be increased, limited by the 5000 Ω source resistance, up to a total of 60 mAmps for all active loads. Always set *unused* phantom power switches to LOz or HIz to be sure 48 VDC is not applied where it is not needed.

### Grounding

3. Determine the switch setting for Pin 1.
   a. When using 48 V phantom power, the PIN 1 switch on the front panel (Figure 16 on page 14) **must** be set to GND. Do **not** set this to LIFT unless required to eliminate ground loops.
   b. If phantom power is not being used, set this switch to the requirements of the channel's signal source. Make the appropriate entries in Table 6.
4. Double check your table and position each switch.
5. After your system is fully set up and operating, use the built-in signal generator to check for adequacy of signal levels or for possible amplitude overload in any part of the channel path.

**Table 6. Input Module Switch Settings**

| | Channel Number | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Input Module No. 1** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Input Levels: 0, +10, +20, + 30, and +40 dB | | | | | | | | |
| Impedance: LOz (600 Ω), HIz (10 kΩ) or 48 V (@10 kΩ) | | | | | | | | |
| Microphone Ground: LIFT or GND | | | | | | | | |
| **Input Module No. 2** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Input Levels: 0, +10, +20, + 30, and +40 dB: | | | | | | | | |
| Impedance: LOz (600 Ω), HIz (10 kΩ) or 48 V (@10 kΩ) | | | | | | | | |
| Microphone Ground: LIFT or GND | | | | | | | | |
| **Input Module No. 3** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Input Levels: 0, +10, +20, + 30, and +40 dB | | | | | | | | |
| Impedance: LOz (600 Ω), HIz (10 kΩ) or 48 V (@10 kΩ): | | | | | | | | |
| Microphone Ground: LIFT or GND | | | | | | | | |
| **Input Module No. 4** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Input Levels: 0, +10, +20, + 30, and +40 dB | | | | | | | | |
| Impedance: LOz (600 Ω), HIz (10 kΩ) or 48 V (@10 kΩ) | | | | | | | | |
| Microphone Ground: LIFT or GND | | | | | | | | |
| **Input Module No. 5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Input Levels: 0, +10, +20, + 30, and +40 dB | | | | | | | | |
| Impedance: LOz (600 Ω), HIz (10 kΩ) or 48 V (@10 kΩ) | | | | | | | | |
| Microphone Ground: LIFT or GND | | | | | | | | |
| **Input Module No. 6** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Input Levels: 0, +10, +20, + 30, and +40 dB: | | | | | | | | |
| Impedance: LOz (600 Ω), HIz (10 kΩ) or 48 V (@10 kΩ) | | | | | | | | |
| Microphone Ground: LIFT or GND | | | | | | | | |
| **Input Module No. 7** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Input Levels: 0, +10, +20, + 30, and +40 dB | | | | | | | | |
| Impedance: LOz (600 Ω), HIz (10 kΩ) or 48 V (@10 kΩ): | | | | | | | | |
| Microphone Ground: LIFT or GND | | | | | | | | |
| **Input Module No. 8** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Input Levels: 0, +10, +20, + 30, and +40 dB | | | | | | | | |
| Impedance: LOz (600 Ω), HIz (10 kΩ) or 48 V (@10 kΩ) | | | | | | | | |
| Microphone Ground: LIFT or GND | | | | | | | | |

# Auxiliary Items

## Signal Generator/Monitor

A signal (tone) generator provides a clean output by which any channel and path can be checked from the audio input right through to the demultiplexed output at the receiving unit. Both signal level and frequency are controllable and signal levels are calibrated and displayed on a scale on the front panel.

The signal generator provides a convenient means for testing an audio channel. As seen in Figure 18, the generator has two controls. The **LEVEL dBm** control sets the power for the generator/monitor (including speaker and amplifier) to off or sets the levels to one of three calibrated levels of -20 dBm, 0 dBm or +8 dBm. The second control, **FREQUENCY** , sets the output to a choice of four frequencies ¾ 20 Hz, 400 Hz, 1 kHz, and 20 kHz.

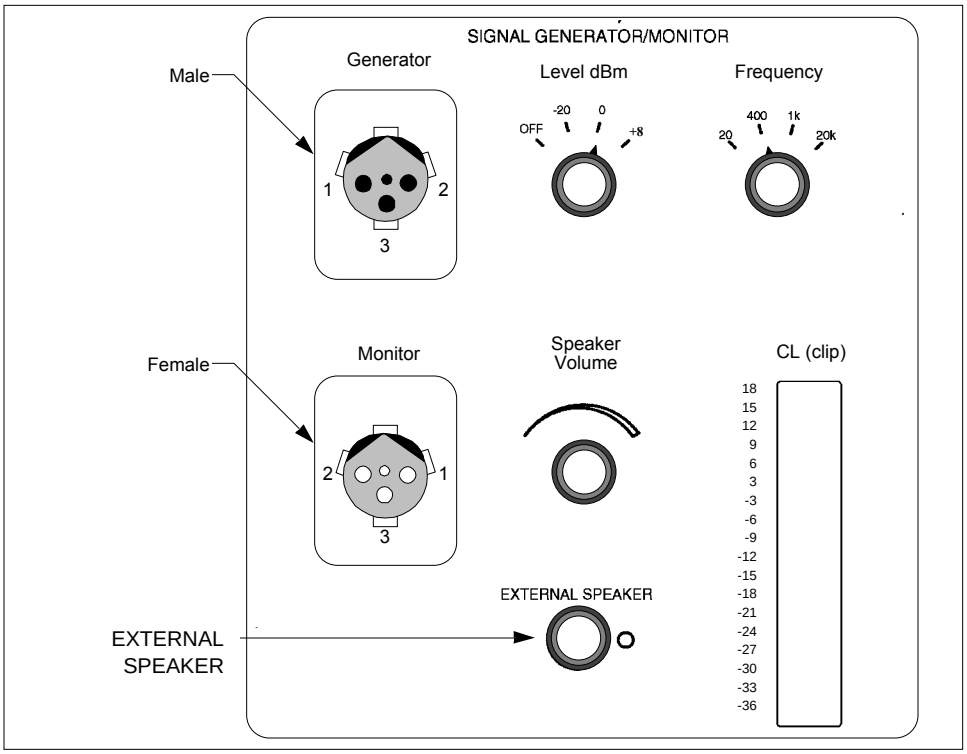



***Figure 18. Signal Generator/Monitor***

To use the signal generator:

1. Connect the output labeled **GENERATOR** by cable to any of the audio input points on an input module.

   The Model 162/322 multiplexes that signal, sends it on the fiber, and demuxes it at the receiving assembly, which is then output at the same position as the original input.

2. Connect the output channel by a cable to that unit's **MONIT OR** input connector. Switch the **LEVEL** to any setting other than OFF to enable the power to the monitor circuits. A signal level is displayed on the level meter. Adjust the volume on the internal loudspeaker to hear the signal (100 Hz - 10 kHz).
3. An external loudspeaker or headphones ( 8Ω or more) may be connected to the **EXTERNAL SPEAKER** by adjusting the speaker volume knob, as shown in Figure 18.

This monitor scheme can be used with program audio as well as the generated test tone.

## Status Indicator s

LED indicators are located on the assembly front panel and on the input and output modules at each connector.

### Front P anel

The LEDs on the front panels of the assembly are shown in Figure 19.

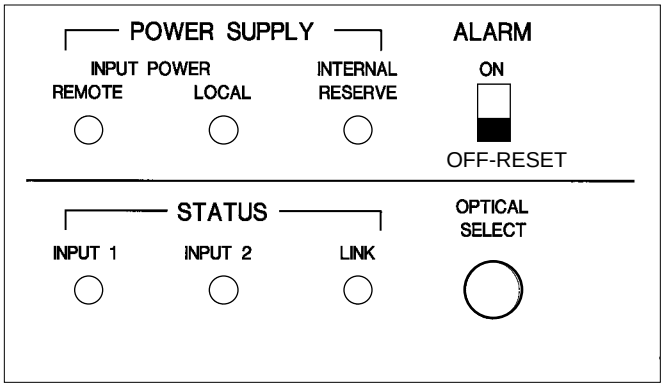



***Figure 19. Panel Indicators, Signal Status and Power***

### Power Suppl y

**INPUT PO WER**

- When a data connection (fiber or coax) exists between the local and remote units, the bi-color **REMO TE** LED is green if the remote unit's external power input is good. This indicator turns red if the external input power to the remote unit fails, or if the data path from the remote unit is lost
- The **LOCAL LED** is green when the external power input to this unit is present. If the power to this system fails, the LED turns red.
- The **INTERNAL RESER VE** LED is green when the internal battery is charged. It turns red when the unit is operating from this battery. Operating time from this battery is limited.

**STATUS**

- When a fiber data connection exists between the local and remote units, the LED corresponding to the active input will be green. If the coax input is in use, neither **INPUT ST ATUS** LED will be green.

The system will automatically switch to the alternate input if data errors are detected on the active input. For example, say input Rx1 is the active input and its **INPUT 1 STATUS** LED shows green. If the fiber is cut, the **INPUT 1 STATUS** LED will turn OFF. The system will switch to input Rx2 and the **INPUT 2 STATUS** LED will show green. The system will continue to operate from **INPUT 2** as long as the fiber is good.

- **LINK ST ATUS** is a bi-color LED which indicates the condition of data being received. The LED shows green when receiving good data and shows red when no data is being received or the data contains excessive errors. When **LINK ST ATUS** is red, the **INPUT STATUS** LEDs are gated OFF.
- Select **COAX** by the internal switch to enable the **COAX** input and corresponding LED. This disables the **FIBER** inputs and corresponding **INPUT** LEDs. **LINK STATUS** still operates as above. There is no automatic switch between coax and fiber.
- The **OPTICAL SELECT** switch toggles between **INPUT 1** and **INPUT 2**, and is useful for testing whether the fibers are good.

The audible **ALARM** is controlled by the **ALARM ON - OFF/RESET** switch. This is a latching alarm requiring it to be momentarily set to OFF then back to ON to quiet the alarm after it is triggered. The following conditions are monitored and will trigger an audible alarm when there is an error and the **ALARM** switch is in the ON position:

| | |
|---|---|
| Link Status | Always Active |
| Local Power | Defeatable by SW6 |
| Remote Power | Defeatable by SW6 |
| 2-wire intercom power short | If the option is installed |

### Received Signal Le vel

Each channel input or output connector has two LEDs: the left LED is green, and the right LED is red. Figure 20 shows the LEDs on the output module; location, function and color are the same on the input module.

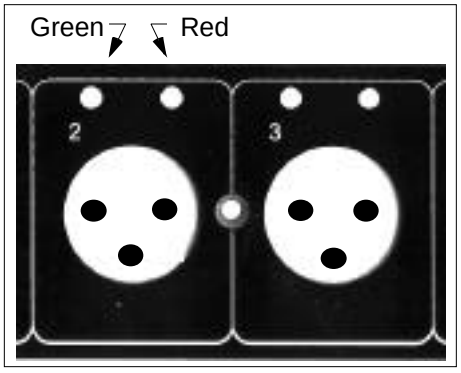



***Figure 20. Output Module LED Indicators***

**GREEN** Indicates that a signal of at least −12 dBm is present at the respective channel.

**RED** Indicates that the signal in the channel is approaching or at the clipping level of +18 dBm. Reduce the signal level by setting gain switches at the respective channel on the input module.

# System Interconnections

There are four common interconnection configurations for the Model 162/322.

### Confi guration #1 — Standar d Full Duple x Operation

- Audio inputs and outputs
- Data inputs and outputs
- Full intercom

Refer to Figure 21 when wiring for standard operations.

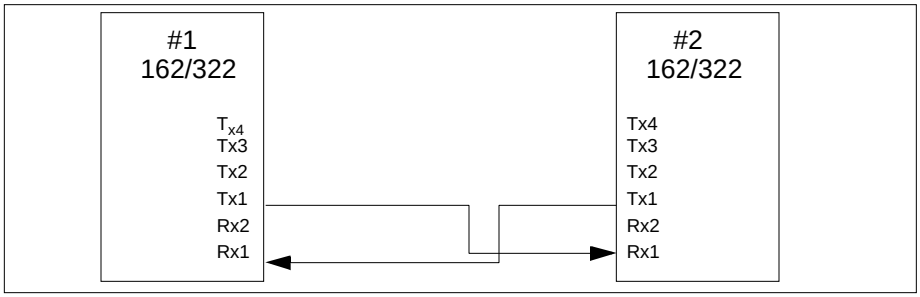



***Figure 21. Standard 2-Fiber Connection***

### Confi guration #2 — Operation with Fiber Redundanc y

Add a second fiber pair. Refer to Figure 22 when wiring operations with fiber redundancy.

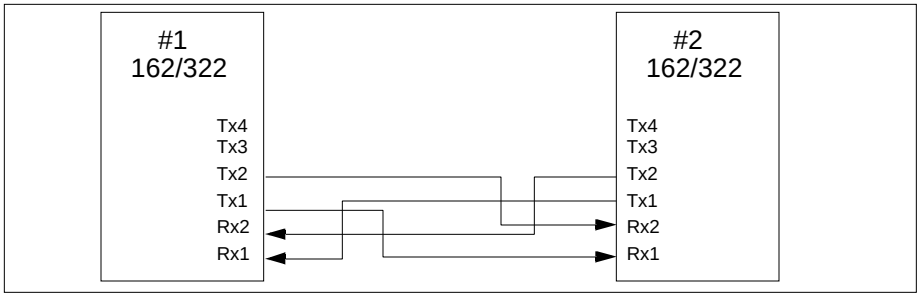



***Figure 22. 4-Fiber Connection for Fiber Redundance***

### Confi guration #3 — Unidirectional Operation

Refer to Figure 23 when wiring for unidirectional operations.

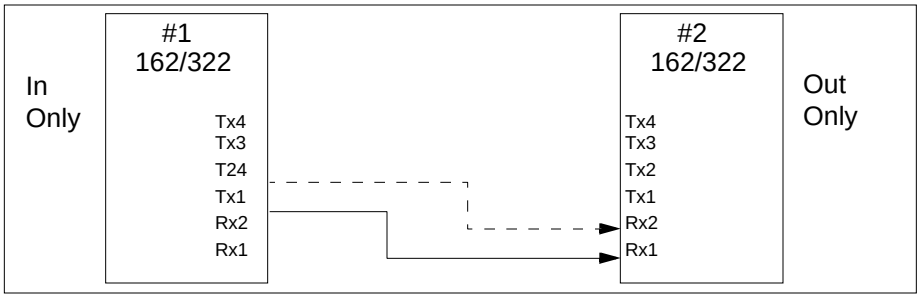



***Figure 23. Unidirectional Fiber Connections***

### Confi guration #4 — Operation using the Wavelength Division Multiple xer

Refer to Figure 24 when wiring for operations using the WDM.

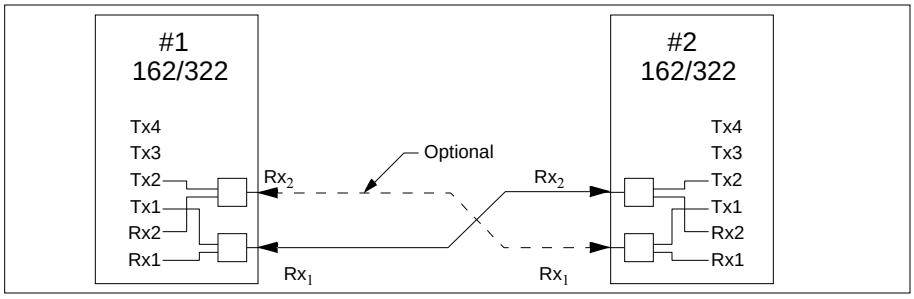



***Figure 24. Fiber Connections using WDM***

## Powering Up

**Note:** Never try to move the power switch on any front panel without first disengaging its lock by pulling on the switch lever.

With power OFF at both units, check all electrical and optical connections as described under *Installation of the Assembly* on page 3. Firmly seat all connectors.

To operate the power switch:

1. Pull the lever away from the panel.
2. Move it *up* for power ON, or *down* for power OFF.
3. Switch ON the power to all Adder 162/322 units.

The power switches at all connected units must be ON for the system to achieve normal function.

Verify that:

- Green **EXTERNAL POWER** LEDs are illuminated.
- **LINK STATUS** LED is green if the fibers are connected.
- **INPUT 1** or **INPUT 2** LEDs are green, one at a time.

If you do not get this result, refer to *Troubleshooting* on page 32.

You may connect or disconnect any optical, audio, data, or intercom plug while the power is on. If an optical fiber port is not in use, be sure that it is covered.

## Intercom Modules

Up to three dual-channel intercom modules can be installed in the Adder 162/322. Three types of intercom modules are available from Telecast:

- Balanced 4-wire
- Clear-Com 2-wire
- RTS/Telex compatible 2-wire

Intercom modules are located at the top of the assembly in the Model 162 and along the right side on Model 322 as shown in Figure 25. Modules are designated COM1, COM2 and COM3 as seen in Figures 25 and 26.

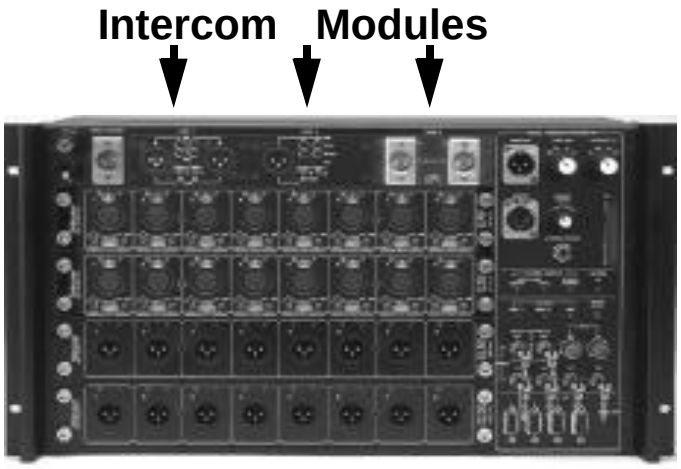



***Figure 25. Model 162 Intercom Locations***

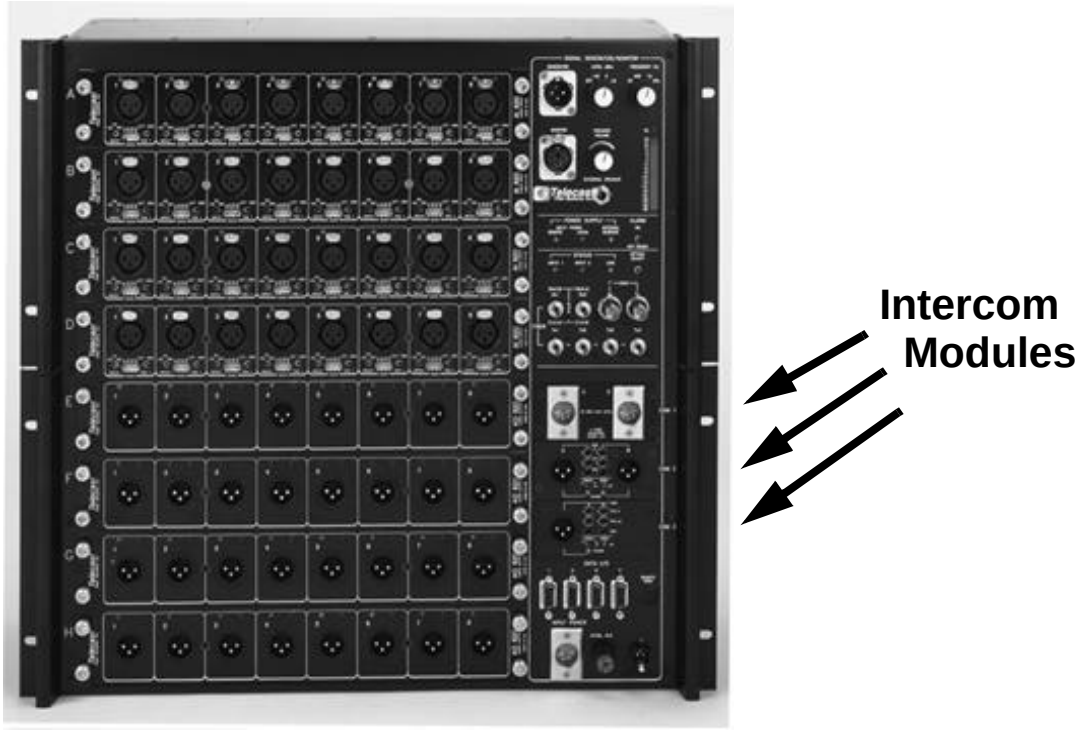



***Figure 26. Model 322 Intercom Locations***

Intercoms can be of any type in any location in the assembly. However, for proper operation of the intercom channel, the same placement order must be followed at any other assembly in the system of Adders.

**Note:** A 2-wire system can be interconnected with a 4-wire system at another Adder 162/322, but not all intercom functions will work (for example, *calling*).

If an optical split output is used to connect fiber to additional receiving locations, the intercom signals will be present at the receiver, but transmission back to the originating unit will not be possible.

## Inter com Connections

### 4-wire A uxiliar y (balanced)

4-wire Auxiliary (balanced) intercoms use an individual 5-pin XLR on each of the two channels in each module. Refer to Figure 27. XLR pin functions are given in Table 7. Intercom Module Gain is 0 dB.

**Note:** 50 dB of gain may be added to 4-wire module inputs by DIP switches on the mother board for MIC applications. See *Intercom Setup Switches* on page 26.

**Table 7. 4-Wire Intercom Connections**

| Pin No. | Function | Impedance | Signals |
|---|---|---|---|
| 1 | Ground | | |
| 2 | Input (+) | 600 Ω input | **LINE** : +8 dBm<br>**MIC** : − 32 dBm |
| 3 | Input (−) | | |
| 4 | Out (+) | ≥600 Ω load | +8 dBm |
| 5 | Out (−) | | |

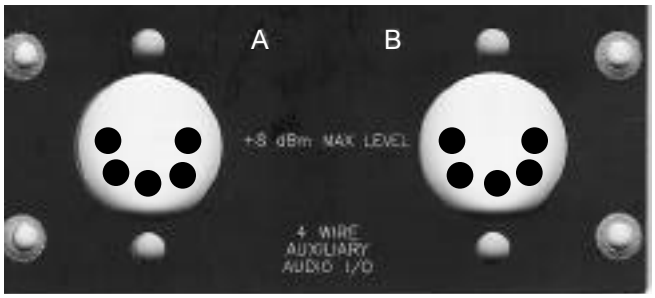



***Figure 27. Intercom Panel: 4-Wire Auxiliary (balanced)***

### Clear -Com

Clear-Com intercom modules have a 3-pin XLR connector for each of the **A** and **B** channels. This Telecast module fully supports the Clear-Com signaling protocol and signal levels. The Clear-Com Intercom Connections are listed in Table 8.

**Table 8. Clear-Com Intercom Connections**

| Pin No. | Function |
|---|---|
| 1 | Ground |
| 2 | +VDC power |
| 3 | Audio |

**Note:** When using the Clear-Com external power supply, pin 3 termination must be lifted on the power supply to prevent motor-boating.

Clear-Com channel operation is optimized by the use of the front panel adjustments shown in Figure 28 and listed below:

- Input Gain, ±10 dB
- Output Gain, ±10 dB
- Null

Switches are also provided for the channel pair for:

- Dry unpowered (**d**), or Wet powered (**w**) **PORTS**
- 200 Ω **on** or **off** terminations **TERM**

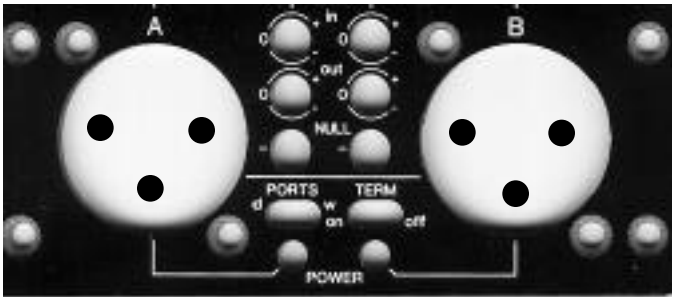



***Figure 28. Intercom Panel: Clear-Com***

The Telecast Clear-Com interface is compatible with powered or unpowered belt packs as well as fixed equipment. You may power 5 to10 belt packs with each intercom module from the internal power supply. Many more belt packs can be added if powered externally. Refer to your intercom manufacturer's documentation for additional system details.

For operation with a belt pack, set the **PORTS** to **w** (powered), the **TERM** to ON and center each of the **INPUT** gain, **OUTPUT** gain and **NULL** controls. Readjust these controls to optimize performance as required.

### RTS Tele x

RTS modules provide a two-channel intercom on a single 3-pin XLR connector. This Telecast module fully supports the RTS signaling protocol and signal levels.

RTS channel operation is optimized by the use of front panel adjustments as shown in Figure 29 and listed below.

- Input Gain, ± 10 dB
- Output Gain, ± 10 dB
- Null

Table 9 lists the RTS Telex pin numbers and intercom connections.Switches are also provided for the channel pair for:

- Dry unpowered (**d**), or Wet powered (**w**) **POR TS**
- 200 Ω **ON** or **OFF** terminations **TERM**


***Figure 29. Intercom Panel: RTS Telex***

The interface is compatible with powered or unpowered belt packs as well as fixed equipment. You may power 5 to 10 belt packs with each intercom module. Refer to the note on page 23 and to your intercom manufacturer's documentation for additional system details.

For operation with a belt pack, set the **PORTS** to **w** (powered), the **TERM** to ON and center each of the **INPUT** gain, **OUTPUT** gain and **NULL** controls. Readjust these controls to optimize performance as required.

**Table 9. RTS Telex Intercom Connections**

| Pin No. | Function |
|---|---|
| 1 | Ground |
| 2 | +VDC power & Channel 1 Audio |
| 3 | Channel 2 Audio |

## Inter com Module Replacement

Intercom modules (up to three) within the Adder 162/322 are installed by Telecast in accordance with your purchase order. Should you want to change or add modules, you may have to reset certain switches on the Main PC Board of the Adder 162/322 assembly.

### Cab le Harness

A multi-conductor harnessed cable built into the Adder 162/322 runs behind the module locations. This cable connects the module to power and signal sources. There is a AMP-MTA type connector for each module on this harness; the connector fits all module types.

### Inter com Setup Switc hes

For Four-Wire Intercoms, three 2-unit slide switches on the Main PC Board inside the assembly may have to be reset depending on the choice of input level. Switch settings relate to the **MIC** or **LINE** input levels.

A few audio modules will have to be removed from the assembly to gain access to these switches. Refer to Figure 8a on page 10. The switches are detailed in Figure 30.

- Channels **A** and **B** within modules 1, 2, and 3 shown in Figure 25 on page 22 are configured on the Main PC Board by **SW3** (channels **1**,**2**), **SW4** (channels **3**,**4**), and **SW5** (channels **5,6** ), respectively, in Figure 30.

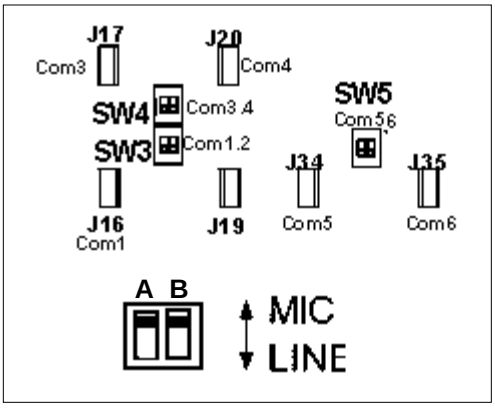



***Figure 30. MIC - LINE Switches***

To change an intercom module in the assembly:

1. Turn the power OFF.
2. Remove the screws that hold the module to be replaced.
3. Remove the Input and Output modules at locations 3 and 4 from the bottom of the assembly to gain access to the Main PC Board (see *Removing and Replacing Modules* on page 11).
4. Check that the intercom switch settings are appropriate for the new module to be inserted.
5. Connect the multi-conductor cable to the respective intercom module.
6. Set the module in place and fasten the mounting screws. Replace the Input and Output modules.
7. Turn the power ON.

# Theory of Operation

The Adder 162/322 circuit block diagram shown in Figure 31 is a representative system with one 8-channel module in each unit. The Adder 162/322 operating as a transmitter accepts up to 32/64 audio inputs and up to four digital inputs. Time division multiplexes them onto a single optical fiber or coaxial cable.

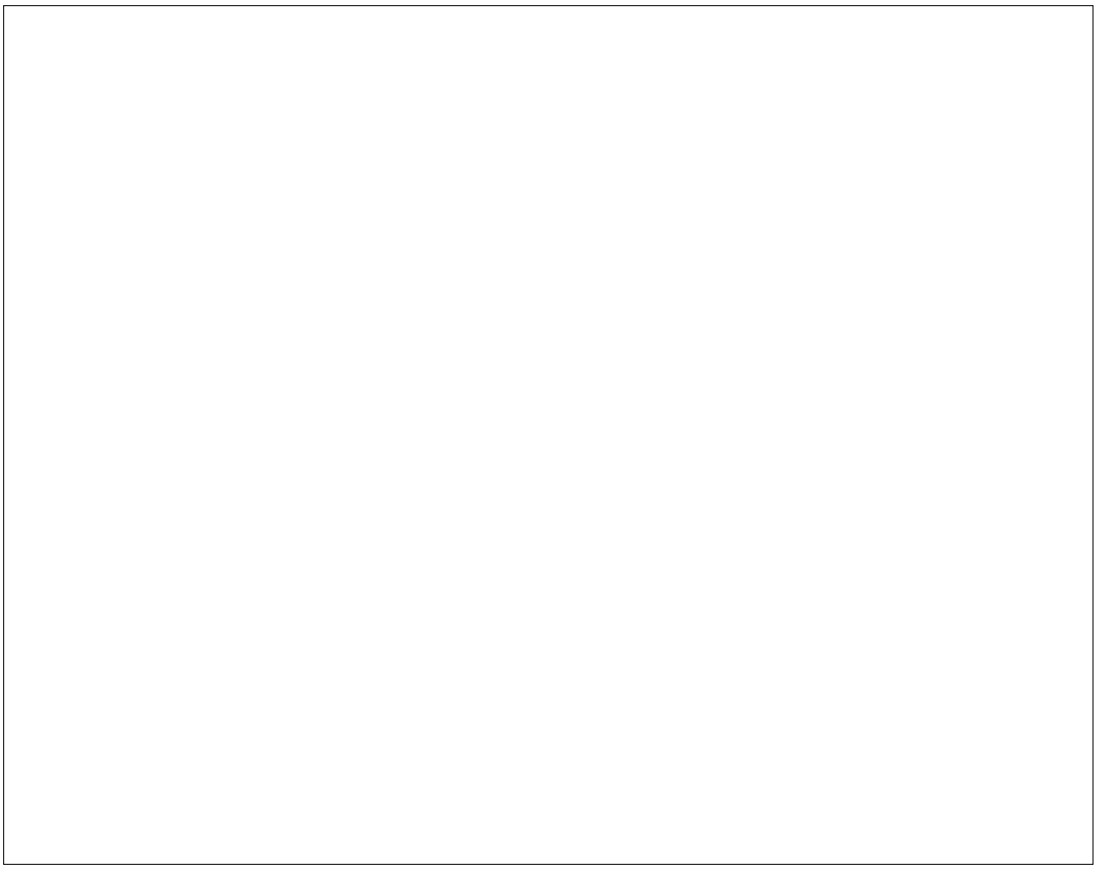


***Figure 31. Electronic Block Diagram***

Demultiplexed signals are fed to corresponding output connectors on an output module. 2 coaxial cables may be optionally used instead of fiber optic cable. However, redundant coaxial cable operation is not available.

All signals on the fiber or coaxial cable are digital, and therefore relatively insensitive to transmission level variations.

## Data Connector s 1 and 2

The digital input buffer circuit accepts both data signals (RS-232, RS-422) and contact closures and delivers this information to the multiplexer. The closure handling portion of the circuit accepts information only from D-subminiature data connectors 1 and 2. Refer to Figure 32.

The circuit accepts a contact closure indicated by the switching of pin 8 to ground level pin 3. This can also be accomplished by a TTL connection closure with pin 3 as the ground reference.

The digital output buffer circuit accepts the demultiplexed data and contact closure signals and provides them at appropriate levels to the D-subminiature data connectors. Refer to Figure 33.

The output closure output is via an SPST-NO *1 FORM A* relay; this closure is isolated and not ground referenced.

## Data Connector s 3 and 4

These connectors omit contact and relay closure capability. The pin wiring for digital data on connector 3 and 4 is the same as on connectors 1 and 2.

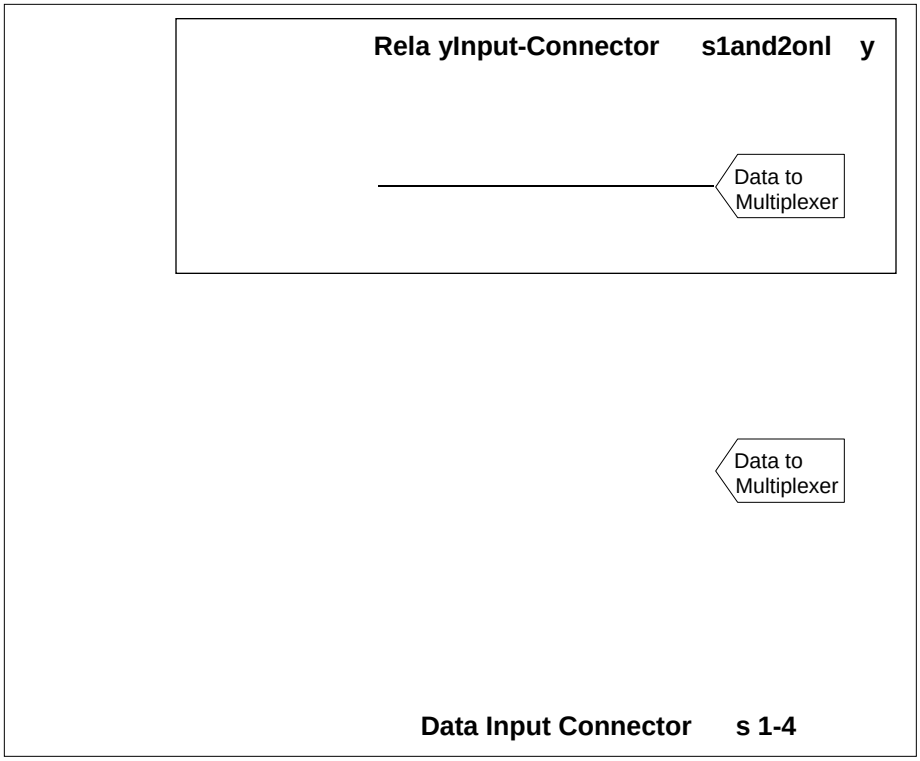



***Figure 32. DATA and Relay Digital Input Circuit***

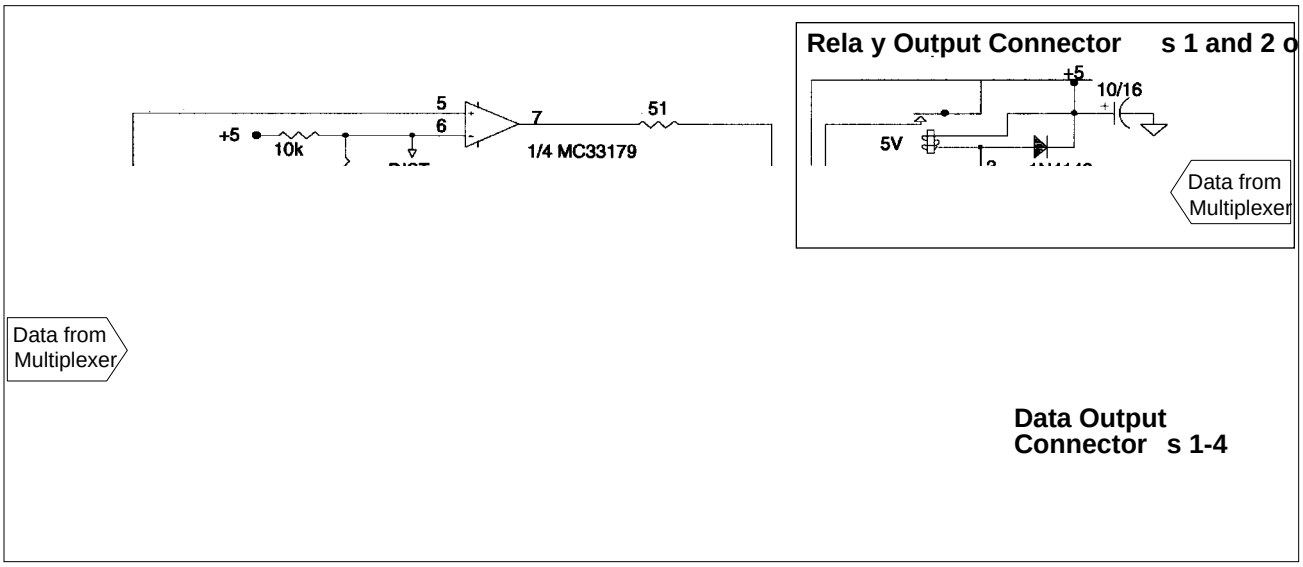



***Figure 33. Digital Data Output Circuit***

## Audio Cir cuits

### Output

The audio output circuit is shown in Figure 34. The output impedance between pin 2 and 3 is 30 Ω, balanced. Output characteristics are given in *Intercom Interface* on page 34.

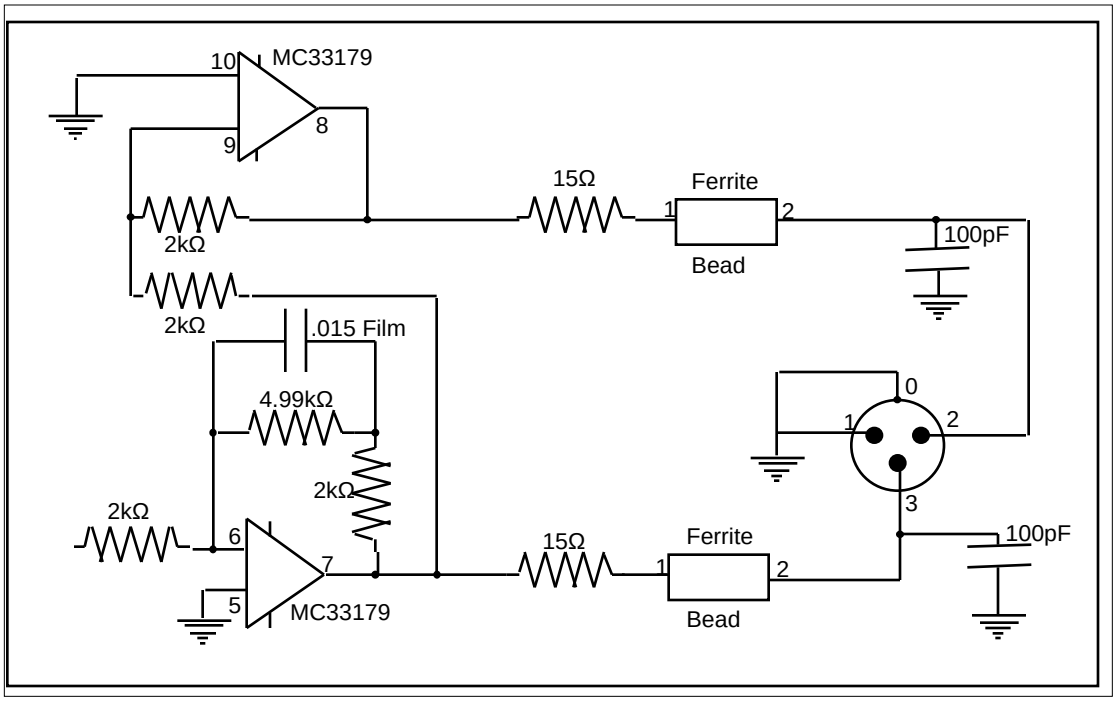



***Figure 34. Audio Output Circuit***

**Note:** Unbalanced operation is possible by using pins 1 and 3. **Do NOT short pin 2 or 3 to ground** or severe distortion will result.

### Input

The audio input circuit can be set to have a balanced impedance of 600 Ω or 10 kΩ. The audio input circuit can accept a wide range of signal levels by the use of scaling DIP switches on the input module front panel and also supply 48 VDC for condenser microphone bias; see Figure 35. Refer to *Specifications* on page 33 for details.

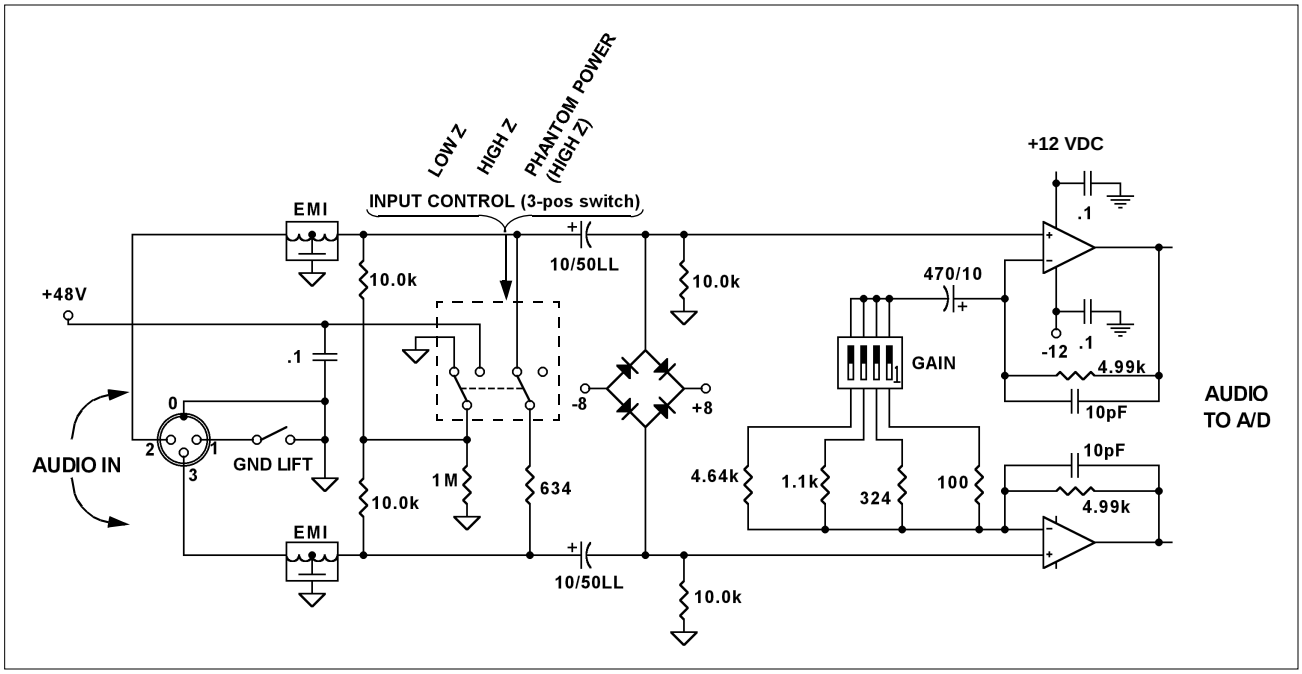



***Figure 35. Audio Input Schematic***

The main circuits in the Adder 162/322 are described in Table 10.

**Table 10. Adder 162/322 Main Circuits**

| | |
|---|---|
| **A/D, Input** | High speed analog to digital converters located in each audio channel. |
| **Multiplexer, Input** | Sequentially presents four RS-232/422 digital inputs, two contact closures and up to 64 digitized audio signals from the A/D converters to the optical output driver. |
| **Demultiplexer, Output** | Takes sequential digital signals from the *pin* diode and separates them: up to 64 to the D/A converters, four to the RS-422 transmitters and two to the contact closure relays. |
| **D/A, Output** | High speed digital to analog converters located in each audio channel convert the digitized signal back to analog audio. |
| **Battery charger, Model 162/322 Assembly** | The battery charger (see Figure 36 on page 31) is active whenever an Adder 162/322 unit is receiving DC power between 13.8 and 18 VDC. Charging current is limited to a trickle level at any voltage input. Full charge takes 16 hours. |

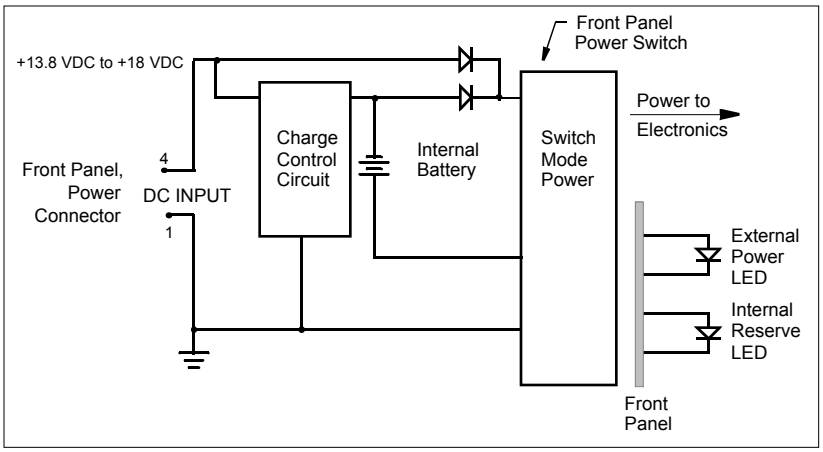



***Figure 36. Battery Charger Block Diagram***

The optical output is generated from a high power Lased Diode coupled to the fiber. User connections are made at a bulkhead type ST connector on the front panel of the assembly. Transmission cable must be matched to the fiber pigtail type specified at the time of manufacture.

The input uses a **PIN** Photodiode and amplifier to convert the optical signal back into an electrical signal.

# Preventive Maintenance

A high capacity Ni-Cad rechargeable battery pack is mounted to the top cover for easy accessibility. Replace this battery pack approximately every two years or as required. Replacement battery packs are available from Telecast. Dispose of batteries in accordance with local regulations.

1. Move the power switch to OFF.
2. Remove the ten screws holding the top cover.
3. Remove the four screws holding the battery bracket.
4. Disconnect the battery and replace it.
5. Replace the bracket and cover.

The battery is connected to the main system board via a polarized 2-pin connector, and is secured by a bracket and four screws.

With a full charge, this battery will operate Model 162 for 30 minutes and Model 322 for 15 minutes. Operation time varies with module complement in the assembly.

## Accessor y List

The following accessories are available from Telecast:

- Optical power meter kit
- Cable repair kit with Quick-crimp kit to attach ST connectors to fiber optic cable
- Loop-back cable to localize signals during installation test
- Prefabricated cables built to custom lengths

# Troubleshooting

**Table 11. Troubleshooting Chart**

| Symptoms | Possible Cause | Corrective Action |
|---|---|---|
| No operation, all indicators are *OFF* | No power | Make sure all units have their power switches *ON*, and that their external supplies are delivering between 12 and 18 VDC. |
| INTERNAL RESERVE LED *OFF* | Battery depleted and either power switch *OFF* | Make sure both units have their power switches *ON*. Recharge battery. |
| INTERNAL RESERVE LED *red* | External power loss or internal battery depleted | The light becomes green after a 1/2 hour of use with the AC power adapter. If the light does not turn green, replace the battery. |
| No operation, RX STATUS red LED *ON* | Fiber or coax communications failure | Check for broken or disconnected fibers and faulty wires, or that the Adder 162/322 unit on the other end is operational. |
| Very low signal output on one audio channel | Microphone on input with 0 dB selected | Move input module front panel slide switches to a higher gain setting. |
| Signal distorted on one channel | Line input with gain setting too high | Move input module front panel slide switches to a lower gain setting. |

# Measuring Optical Power

The optical fibers couple power from the transmitters to the receivers. Operation of this system hinges on the correct optical power levels. These levels can be measured with an **OPTICAL POWER METER** such as the Telecast model PMTR-ST-3W or equivalent. The power meter is calibrated in units of dBm, or power referenced to 1 milliwatt expressed in dB where 0 dBm is 1 milliwatt and −30 dBm is 1 microwatt.

To determine the transmitter output, use a short cable terminated with the appropriate connectors, generally ST-style to connect the power meter to the transmitter output. Set the meter to the same wavelength as the transmitter. The meter should show a power level greater than -10 dBm.

Once the complete cable is installed and connected, measure the power at the receiver inputs. Remove the connector from the receiver input. If the system is operating an **ALARM** may occur. Connect the cable to the power meter. The measured power should be in the range of −10 to −26 dBm.

To insure reliable system operation, a system margin must be maintained. Telecast recommends a minimum margin of 3 dB or more. To insure this margin, the power measured at the receiver must be in the range of −10 to −23 dBm preferred.

# Specifications

## System Characteristics

| | |
|---|---|
| Transmission Method | Digital Time Division Multiplexed (TDM) system |
| Aggregate Data Rate | 147.5 Mbps |

## Audio Characteristics

| | |
|---|---|
| Modules | 8 channel INPUT (AI820) or<br>8 channel OUTPUT (AO820) modules |
| Number of Modules | |
| Model 162 | 4 (total channels 32); any combination |
| Model 322 | 8 (total channels 64); any combination |
| Analog-Digital Conversion | 20 bit delta sigma |
| Sample Rate | 48 ksamples/sec |
| Amplitude Frequency Response | |
| @ +8 dBm | 20 Hz to 22 kHz ± 0.2 dB |
| Total Harmonic Distortion | |
| @ + 8 dBm, 20 Hz to 20 kHz | < 0.05% |
| @ + 18 dBm, 1kHz | < 0.01% |
| Intermodulation Distortion (SMPTE) | |
| @ + 8 dBm | 60 Hz + 3 kHz mixed 4:1< 0.04% |
| Signal to noise ratio (unweighted) | |
| 20 Hz to 20 kHz, re: + 18 dBm | >102 dB |
| Throughput Delay | ~1 millisecond plus<br>5 microseconds per km of fiber or<br>1.5 microseconds per 1000 feet |
| Interchannel Phase Delay | < 1 degree at 1 kHz |

### AI820 Input Module

| | |
|---|---|
| Connector | Female 3-pin XLR |
| Input Impedance | 600 or 10 kΩ, balanced (Switchable) |
| Maximum Input signal levels | @ 1kHz |
| 600 Ω balanced (Low Z) | |
| Unity gain | + 18 dBm peak |
| + 10 dB | + 8 dBm peak |
| + 20 dB | − 2 dBm peak |
| + 30 dB | − 12 dBm peak |
| + 40 dB | − 22 dBm peak |
| 10 kΩ balanced (High Z) | |
| Unity gain | + 16 dBV peak |
| + 10 dB | + 6 dBV peak |
| + 20 dB | − 4 dBV peak |
| + 30 dB | − 14 dBV peak |
| + 40 dB | − 24 dBV peak |
| + 50 dB | − 34 dBV peak |

### AO820 Output Module

| | |
|---|---|
| Connector | Male 3-pin XLR |
| Output Impedance | 30 Ω balanced |
| Maximum Output Level | + 18 dBm @ 1kHz, 600 Ω |

## Inter com Interface

| | |
|---|---|
| Total Intercom Channels | 6 |
| Compatibility (each of three modules) | |
| 4-wire (standard) | (2) balanced, non-powered, 5-pin male XLR<br>Switchable MIC/LINE input, line output only |
| ClearCom (option) | (2) unbalanced powered 3-pin male XLR |
| RTS (option) | (1) unbalanced stereo powered 3-pin male XLR |
| Signal to Noise Ratio (RE: + 8 dBm) | > 90 dB |
| Frequency Response @ + 8 dBm | |
| 80 Hz − 20 kHz | +1/− 3dB |

## Digital Characteristics

| | |
|---|---|
| Connector | (4) 9-pin Female “D” (Telecast Pinout) |
| Data Channels | (1) channel per connector, (4) total |
| Maximum Data Rate | |
| RS-442 | > 150,000 bps |
| RS-232 | > 20,000 bps |
| Jitter | < 330 ns (3.07 MS/s) |
| Throughput Delay | ~ 0.90 microseconds plus<br>5 microseconds per km of fiber or<br>1.5 microseconds per 1000 feet |

## Contact Closure (T all y)

*Input*

TTL **1** or open circuit (remote contact open)
TTL **0** or shorted to circuit ground (remote contact closed)

*Output (Form 1A SPST-NO isolated contacts)*

| | |
|---|---|
| Switch Voltage | Rating 50 VAC/DC |
| Switch Current | Rating 0.5 Amps |
| Maximum Carry Current | 0.5 Amps |
| Contact Resistance | < 0.5 Ω |

## Mec hanical/Electrical/En vir onmental

| | 162 | 322 |
|---|---|---|
| Dimensions (W x L x D) | 10 x 16.75 (19) x 6 in<br>25.4 x 42.5 x 15.2 cm | 17.5 x 16.75 (19) x 6 in<br>44.5 x 42.5 x 15.2 cm |
| Weight | 15 pounds (6.8 kg) | 22 pounds (9.8 kg) |
| Power Requirements | | |
| Current | 3.0 Amps maximum | 4.5 Amps maximum |
| Power | 30 watts maximum | 45 watts maximum |
| Thermal | 100 BTUs maximum | 150 BTUs maximum |
| External Input Voltage | 15 VDC nominal, 10-18 VDC operating | |
| Operating Temperature Range | - 40 to + 60 °C | |
| Operating Humidity Range | 10-90%, non-condensin | |

## Optical Characteristics

| | | |
|---|---|---|
| Transmit Optical Wavelength | | |
| $Tx_1$, $Tx_3$, $Tx_4$ | 1300 nm | |
| $Tx_2$ | 1550 nm | |
| Optical Connectors | ST compatible | |
| Two fiber system (standard) | MM | SM |
| Minimum Transmit Power | − 10 dBm | - 10 dBm |
| Minimum Receiver Power | − 28 dBm | - 28 dBm |
| Available Loss Margin | 18 dB | 18 dB |
| One fiber system (WDM option) | MM (LW1 option) | SM (SW1 option) |
| Minimum Transmit Power | − 12 dBm | - 12 dBm |
| Minimum Receiver Power | − 26 dBm | - 26 dBm |
| Available Loss Margin | 14 dB | 14 dB |
| | | |
| Fiber Optic Distance Limits | 10 km | 20 km |
| (within available optical loss margin) | 30,000 feet | 60,000 feet |

## Coax Characteristics

| | |
|---|---|
| Impedance | 75 Ω |
| Recommended Cable Type | Belden 8281 |
| Connectors | BNC |
| Distance Limits | 305 meters<br>1,000 feet |

## Repair

If unable to resolve the problems with your Adder 162 or 322 System, call Telecast Fiber Systems, Inc. for assistance at 508-754-4858 and ask for our service department. To return a unit for repair, you must obtain a return material authorization (RMA) number from Telecast service.

# Warranty

## LIMITED WARRANTY STATEMENT

Telecast Fiber Systems, Inc. (“Telecast”) expressly warrants to Buyer that the Products supplied shall be free from defects in materials and workmanship for a period of 12 months following the date the Products are delivered to Buyer (the “Warranty Period”). Telecast's liability under this limited warranty shall be limited, at its option, to providing refund of purchase price for Products, or replacing or repairing Products shown to be defective either in materials or workmanship. Buyer's sole and exclusive remedy for breach of warranty shall be such refund, replacement or repair.

A claim of defect in materials or workmanship in any Product shall be allowed only when it is submitted in writing to Telecast Fiber Systems, Inc. within seven days after discovery of the defect, and in any event within the Warranty Period. No claim shall be allowed in respect of any Product which has been altered, neglected, damaged or stored in any manner which adversely affects it. In order to obtain service under the terms of this warranty, Distributor’s customer or Distributor must notify Telecast of the defect prior to the expiration of the applicable warranty period and obtain a Return Authorization Number from Telecast. In no event may products be returned to Telecast or to Distributor for warranty service without having obtained from Telecast a Return Authorization Number.

This limited warranty applies only to new and unused Products delivered to Buyers located within the United States of America, or to international Buyers if sold through an authorized Distributor organization, and shall not extend to any equipment not manufactured by Telecast Fiber Systems, Inc., even though such equipment may be sold or operated with the Products. In addition, this limited warranty shall be void and of no further force or effect whatsoever if the Product is repaired or modified by any person other than an authorized representative of Telecast Fiber Systems, Inc. without the consent of Telecast Fiber Systems, Inc. This warranty shall not apply to any defect, failure or damage caused by improper use or inadequate maintenance and care. Nor shall this warranty apply to any damage caused in whole or in part by attempts by personnel other than Telecast’s personnel, as approved in advance in accordance with the foregoing provisions, to open, install, repair, or service the Product; nor to damage resulting from improper connection with incompatible equipment; nor to damage to a unit which has been modified by personnel other than Telecast personnel.

Products returned to Telecast for warranty service shall be shipped, freight prepaid to Telecast. Telecast will return the repaired product or ship a replacement, freight prepaid, to either Distributor or Distributor’s customer, as requested by Distributor’s customer, at a location within the United States or, at Telecast’s option, to Distributor’s location in the case of international sales.

This limited warranty shall also apply to Products that replace defective Products and Products that have been repaired by authorized representatives of Telecast Fiber Systems, Inc., but only for the original Warranty Period. The Warranty Period shall not be extended by reason of defect, or any period of time during which the Product is not available to Buyer because of defects or repairs, without the express written consent of Telecast Fiber Systems, Inc.

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