Telecast
Fiber Systems, Inc.

Adder™ 882i
Intercom/Data Multiplexer

Instruction Manual

Table of Contents

List of Figures

List of Tables

Introduction

The Telecast AdderTM 882i System consists of two Adder 882i fiber optic multiplexer/ demultiplexers that simultaneously send and receive multiple intercoms, eight digital datas, and four remote relay closures in each direction. These signals are transmitted on optical fibers. Audio levels for 4-Wires are set up by internal DIP switches that set amplifier gain to accept either mic or line levels. Digital inputs and outputs are RS-422 and RS-232 compatible signals. Four of the digital connectors also provide contact closure input and output. The other four connectors alternatively provide SONY CCU compatible interfaces. All connections except fiber and coax I/O and power are made via the front panel. See Figure 1.
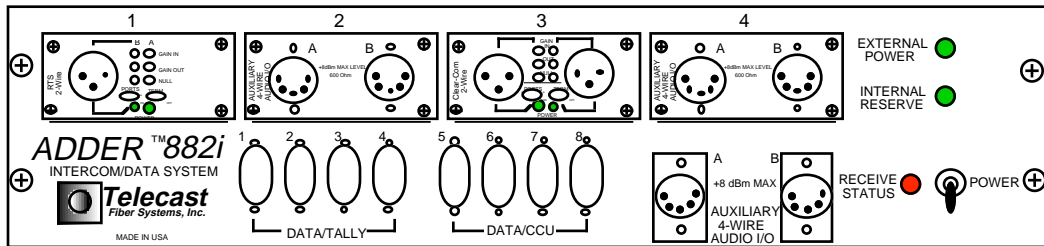
Figure 1: Front Panel of the Adder 882i

Within the Adder 882i unit, the intercom audio signals are first digitized and then multiplexed with the digital data and control signals. The combined electrical signal is converted to an optical signal, launched into the optical fiber and sent on to a second Adder 882i. This second unit receives the optical signal, converts it into an electrical data stream, demultiplexes the signals and restores the audio signals to analog levels.

An internal Ni-Cad battery provides backup in the event of line power loss.

The Adder 882i is available with several optical options and configurations.
- Standard connection with bidirectional signals carried on two optical fibers at either 1300 or 1550 nm.
- One fiber connection with optically combined bidirectional signals at 1300/1550 nm as shown in Figure 2.

In a standard two-fiber system, identical Adder 882i units are used at each location. The units both transmit at 1300 nm on the Tx ST connector and receive the 1300 nm signal on the Rx ST connector. They are connected by the two fibers so that the optical output of each box is connected to the optical input of the other.

7

In a one-fiber system, the two Adder 882 units are not identical and are configured before shipment. They must be used as a pair. The units are connected by a single fiber that is wavelength division multiplexed (WDM). One unit transmits from the Tx ST connector at a wavelength of 1300 nm and also receives at 1550 nm on the same connector. The other unit transmits from the Tx ST connector at 1550 nm and similarly receives at 1300 nm on the same connector.

Figure 3 illustrates available optical configurations of the ADDER 882i.
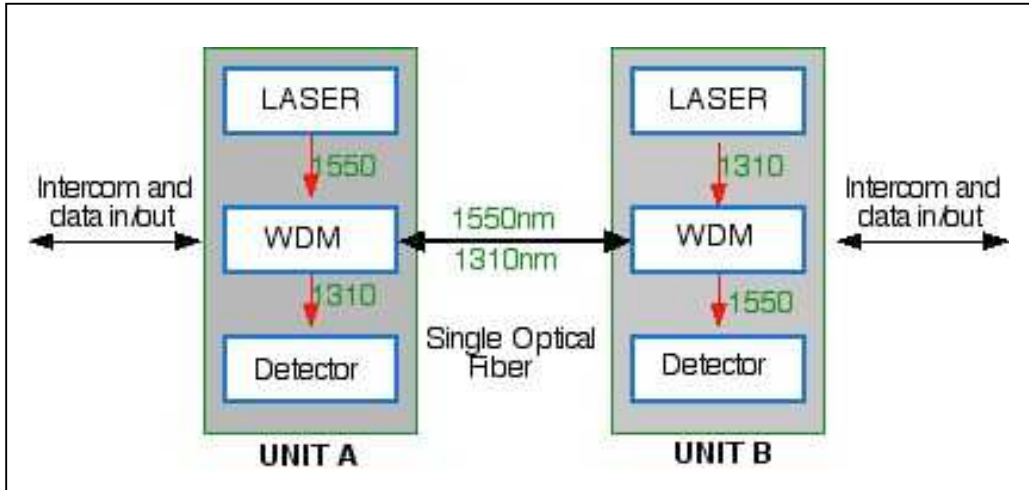
Figure 2: Single Fiber operation
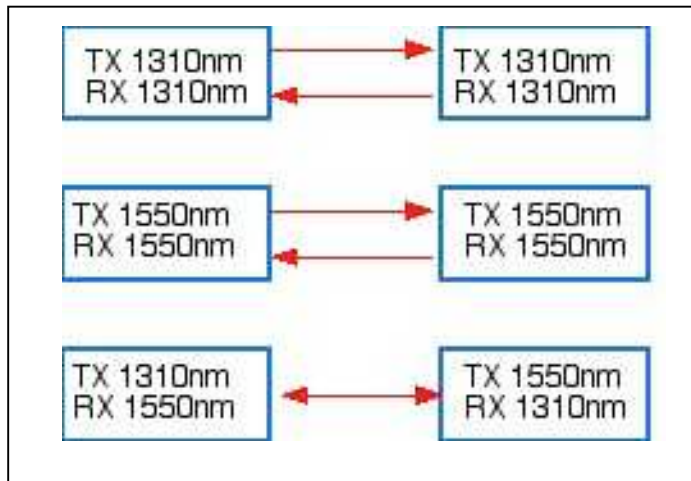
Figure 3: Other optical options

Unpacking

The Adder 882i System consists of:
- Two Adder 882i multiplexer/demultiplexer units
- Intercom Modules
- Two external power supplies (AC/DC adapters)
- Rack mount hardware
- Plastic or metal covers for optical connectors

Installation

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

Leave the protective plastic caps on the optical connectors until it is time to attach the fiber(s) to the units. Place the caps back on the connectors whenever the fibers are disconnected.

Rack Mounted Installation

Units are shipped ready for rack mount. Each "ear" adapter is held in place by two #10 flat head screws (see Figure 4).
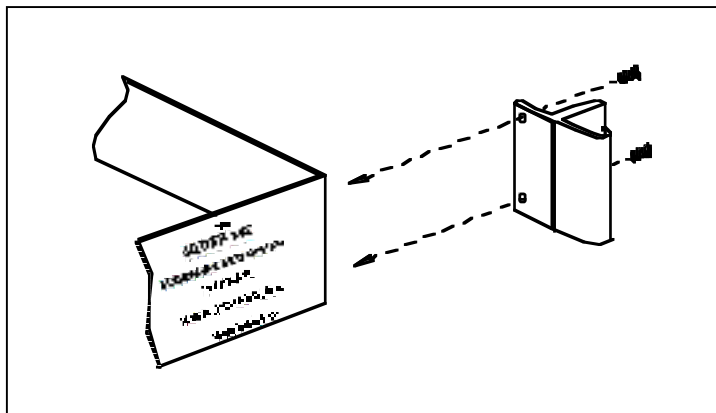
Figure 4: Installing the Rack Mount Adapters

Place the units in their intended locations before attaching any cables or wires. This will prevent accidental damage to the cables or their connectors.

Fiber Optic Installation

The installer is responsible for providing the fiber optic cable runs that are available from Telecast Fiber Systems, Inc. Refer to the Accessory List on page 18 of this manual for the cable and other items required for system installation. Be sure that the fiber core diameters are compatible with the intended installation distances as shown in Table 1.

| Fiber core diameter	Maximum fiber length
50 micron	5 km (3 miles)
62.5 micron	3 km (2 miles)
8 micron (single mode)	10 km (6 miles)

Table 1: Maximum Fiber Lengths

The units have been configured at the factory for the fiber type with which they are going to be used. Mark or tag the optical fibers when they are installed, carefully avoiding the fiber tip, so that their identity is known at both ends. If there is confusion about the identity of the two fibers, illuminate the end of one fiber with a flashlight and look for the light at the other end.

WARNING: Do NOT use the Adder 882i optical output for this purpose. Never look directly into the end of the optical fiber while either end of the system is operating. Eye damage is possible.

Inspect the fiber ends and clean them 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.

Audio Setup

The setup switches for line or mic input levels are inside on the mother-board of the Adder 882i. Setup steps are not required if all inputs are at the factory default 600 W, 0 dB gain, line level. This would include Clear-Com and RTS intercoms. Setup is required for 4-Wire intercoms if mic level inputs are used, if 5 kW input impedance is required, or if the optional 10 dB boost/cut is desired on line inputs.

Procedure

1. Determine which inputs will be used for 4-Wire applications where the 10 dB boost/cut can be used.
2. Copy Table 2 and fill in the required I/O characteristics.
3. With the power switch off, take off the top cover of the unit by removing the #4 flat head screws at each corner.

10

4. With the rear of the unit facing you (connector end), move the slide
   switches shown in Figures 5 and 6 to match the settings in Table 2.
   The controls are arranged in pairs.
5. Replace the top cover and gently reinstall the screws.

In Figure 5, A refers to the first numbered channel and B refers to the second
numbered channel of the pair.

UNIT A SWITCH SETTING	1	2	3	4	5	6	7	8	8	10
MIC IN (0 or +40db gain)										
LINE IN (0 or +10db gain)										
Input Impedance (600 or 5k)										
LINE OUT (0 or –10db gain)										
UNIT B SWITCH SETTING	1	2	3	4	5	6	7	8	8	10
MIC IN (0 or +40db gain)										
LINE IN (0 or +10db gain)										
Input Impedance (600 or 5k)										
LINE OUT (0 or –10db gain)										

Table 2: 4-Wire Inputs

Figure 5: 4-Wire setup switches

These are printed
On the PC Board
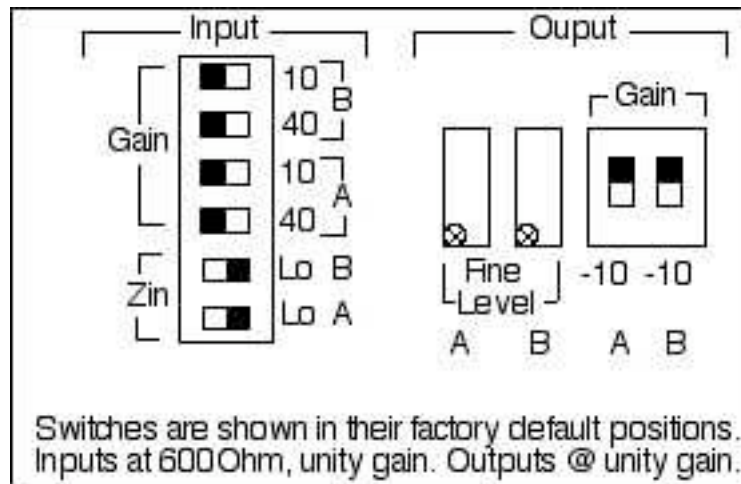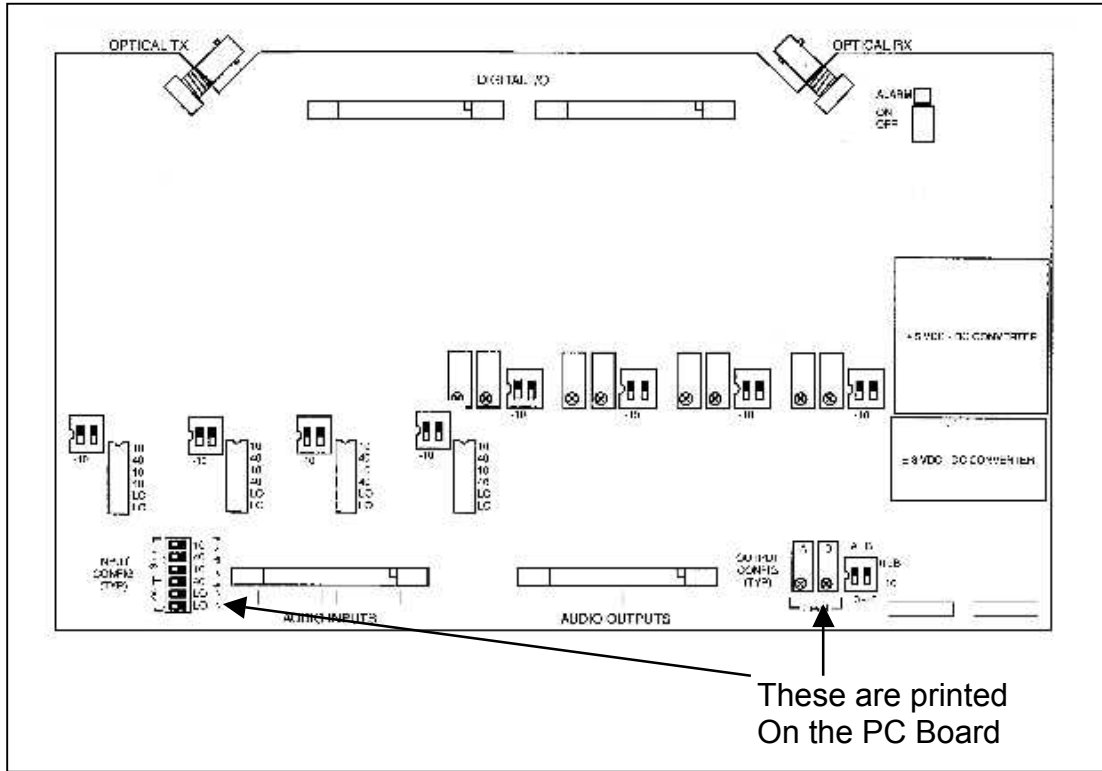
Figure 6: Main PCB

Optical Connections

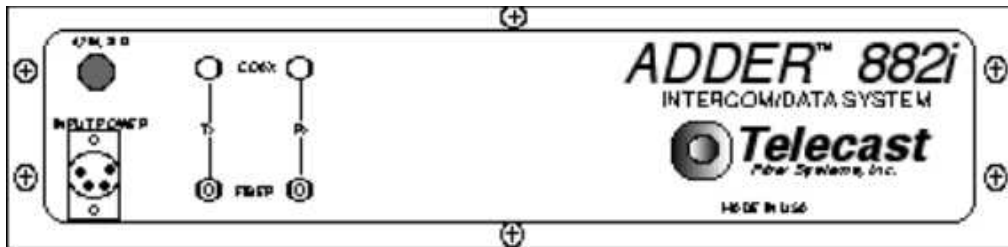Refer to Figure 7 before beginning the optical connections.

Figure 7: Optical Connectors on the Rear Panel

WARNING: Never look directly into the end of the optical fiber while either end of the system is operating. Eye damage is possible.

The Adder 882i is compatible with industry standard ST type connectors. It may be used with installed backbone cables or with dedicated cables.

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-QC, is available from Telecast.

On a two fiber system, connect the cables so that the Tx at one end connects to Rx at the other end. On a one-fiber system, connect the fiber optic cable to the Adder 882i Tx connector at each end. The Rx ST bulkhead may or may not be installed on one-fiber units.

In the same way, the system can be operated on two coaxial cables at distances up to 300m. By connecting a coax from the TX on one side to the RX on the other, a link can be made. You cannot run optical and coaxial links simultaneously. These connectors are located directly above the optical connectors on the rear panel.

The coax link can also be used with our Diamondback and Diamindback2 products. See those respective manuals for details.

Electrical Connections

Intercom Modules

Up to four intercom modules can be installed into the 882i. Two 4-Wires come built-in on each 882i. Three types of intercom modules are available from Telecast and shown in Figure 11 on page 10:
      • Two balanced 4-wires
      • Two Clear-Com 2-wires
      • RTS compatible dual-channel 2-wire
Note: A 2-wire system can be interconnected with a 4-wire system or a different type of 2-wire system but not all intercom functions will work (for example, calling).

The intercom connectors are 3 or 5-Pin Male XLR's; Switchcraft E3MST-AU or E5MST-AU.

4-wire Auxiliary (balanced)

4-wire Auxiliary (balanced) intercoms use an individual 5-pin XLR on each of the two channels in each module. Refer to Figure 8. XLR pin functions are given in Table 3. Intercom Module Gain is 0 dB.

NOTE: 50 dB of gain may be added to 4-wire module inputs for MIC level applications via a switch on the intercom Aux-piggyback board. See Audio Setup on page 4.

PIN #	FUNCTION	Impedance	Signals
1	Ground		
2	Input (+)	600 Ohm Input	MIC: +8 dBm
3	Input (-)		LINE: -32 dBm
4	Output (+)	>=600 Ohm Load	+8 dBm
5	Output (-)		

Table 3: 4-Wire Intercom Connections

Figure 8: 4-Wire (Balanced) intercom Module
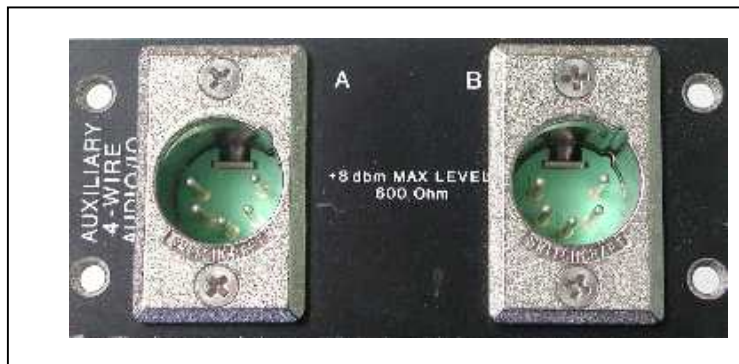
Clear-Com

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 4.

Pin #	Function
1	Ground
2	+ VDC Power
3	Audio

Table 4: Clear-Com Intercom Pin-out

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

Clear-Com operations are optimized by the use of the front panel adjustments shown in Figure 9 and listed below:
- Input Gain, ±10 dB
- Output Gain, ±10 dB
- Null

Switches are also provided for:
- Dry/unpowered (d), or Wet/powered (w) PORTS
- 200 Ohm on or off terminations TERM

Figure 9: Clear-Com 2-Wire intercom Module

The Telecast Clear-Com interface is compatible with powered and unpowered belt packs as well as fixed equipment. You may power 5 to10 belt packs with each intercom module from theViper's 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 (wet/powered), the TERM to ON and then center each of the INPUT gain, OUTPUT gain and NULL controls. Re-adjust these controls to optimize performance as required.

RTS/Telex

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

RTS operations are optimized by the use of front panel adjustments as shown in Figure 10 and listed below.
- Input Gain, ± 10 dB
- Output Gain, ± 10 dB
- Null

15

Table 5 lists the RTS/Telex pin numbers and intercom connections. Switches are also provided for:
  • Dry/unpowered (d), or Wet/powered (w) PORTS
  • 200 W ON or OFF terminations TERM

Figure 10: RTS 2-Wire intercom Module

The interface is compatible with powered and unpowered belt packs as well as fixed equipment. You may power 5 to 10 belt packs with each intercom module. 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 then center each of the INPUT gain, OUTPUT gain and NULL controls. Re-adjust these controls to optimize performance as required.

Pin #	Function
1	Ground
2	+ VDC Power & Ch.1 Audio
3	Ch.2 Audio

Table 5: RTS Intercom Pin-out

Intercom Module Replacement

Intercom modules within the Viper 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 882i mother-board.

Cable Harnesses

Two multi-conductor cable harnesses connect to the intercom module within the 882i. These cables connect the module to power and signal sources. The first has ten conductors and connects the data sub-assembly board to the intercom module. The second has three conductors and supplies power from the DC-DC converter mounted against the side panel of the 882i. The connectors are Amp-

16

MTA type connectors and they fit all three module types. Use care when inserting and removing these connectors. When using a 4-Wire module, the 3-pin power connector is not used since no power is required. Be careful to locate this jumper in a location where it will not cause an electrical short with other components. To change an intercom module in the assembly:

1. Turn the power OFF.
2. Remove the four screws that attach the module to the 882i frame.
3. Pull the module half-way out and disconnect the two multi-conductor cables.
4. Remove module.
5. Carefully insert the new module half-way and attach the two multi-conductor cables.
6. Re-install the four mounting screws.
7. Turn the power ON.

Digital Data

Digital signal connections are made via the 9-pin "D" connectors described in Table 6 and illustrated in Figure 11. A 110 W terminating resistor placed across the balanced inputs may be needed if cable lengths using 110 W twisted pairs are in excess of 6 feet. The serial communications protocol can be RS-232 at one end and RS-422 at the other, if desired.

Contact closure input is activated by connecting it to ground. Contact closure output is an isolated dry contact.

If SONY CCU interface operation is selected, RS-422 and RS-232 functions are not available at that connector

The digital I/O "D"connector is AMP 747905-2.

PIN #	Connectors1-4 (Left)	Connectors 5-8 (Right)	
		Serial Comm	CCU Data
1	RS422 in (-)	RS422 in (-)	No Connection
2	Contact Out	No Connection	CCU I/O Jumper to Pin 6
3	Ground	Ground	Ground
4	RS-232 Out	RS-232 Out	No Connection
5	RS-422 Out (-)	RS-422 Out (-)	Jumper to Pin 8
6	RS-422 In (+) RS-232 In	RS-422 In (+) RS-232 In	CCU I/O Jumper to Pin 2
7	Contact Out	No Connection	No Connection
8	Contact In	No Connection	Jumper to Pin 5
9	RS422 out (+)	RS422 out (+)	No Connection

Table 6: Data Connections

17
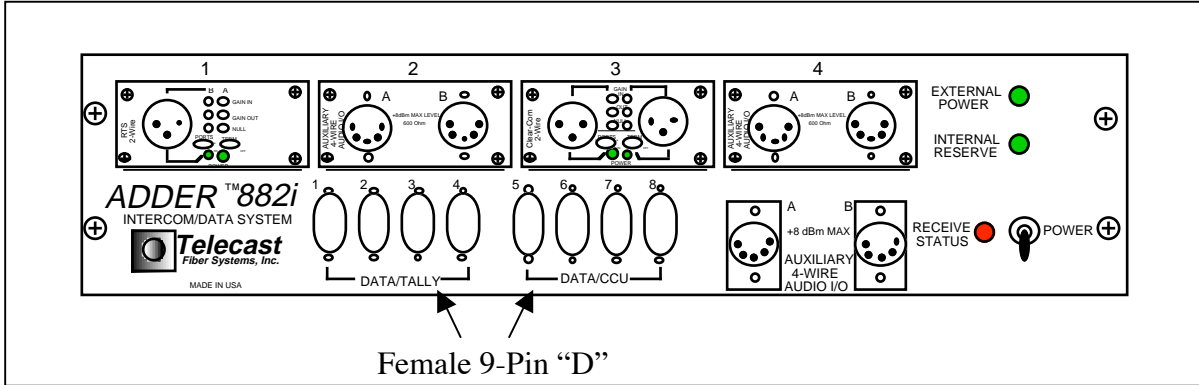
Figure 11: Data "D" Connectors

Power Connection

When using the standard Telecast power supply, connect the 4-pin XLR connector to the Adder 882i and plug the supply into a 120 VAC line. See Figure 12.
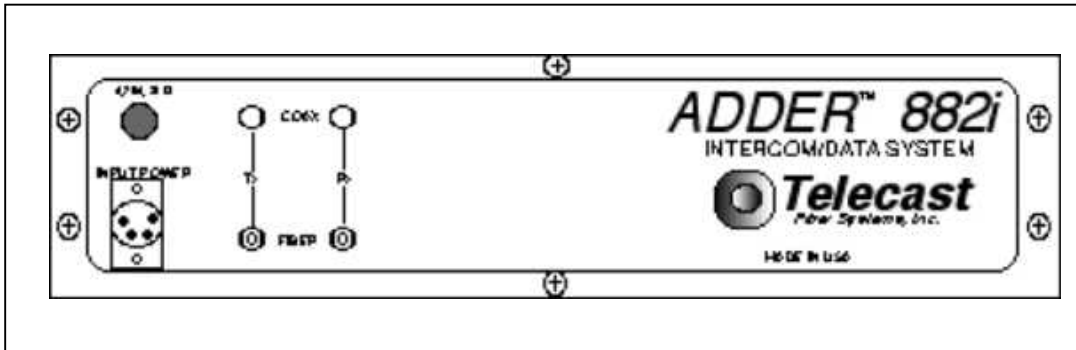
Figure 12: Power Connector and Fuse locations

Any power supply used with the Adder 882 must supply 1.5 amperes continuous current. Use the wiring connections shown in Table 7. The power connector is Switchcraft D4M.

Pin #	Signal
1	Ground
2	Not used
3	Not used
4	+12-24VDC (<30VDC MAX)

Table 7: Power Connector Pin-out

18

Input Power Fuse

The 2 ampere time delay power fuse is accessible from the rear panel (see Figure 13). Be sure to use the same fuse type if replacement is required.

Operating Details

Battery Charging

Charge the internal UPS batteries at a minimum 13.8 VDC for 16 hours (40 mA trickle charge) by attaching each unit to its external power supply. This will permit battery operation for up to 20 minutes during line power losses.

Indicators

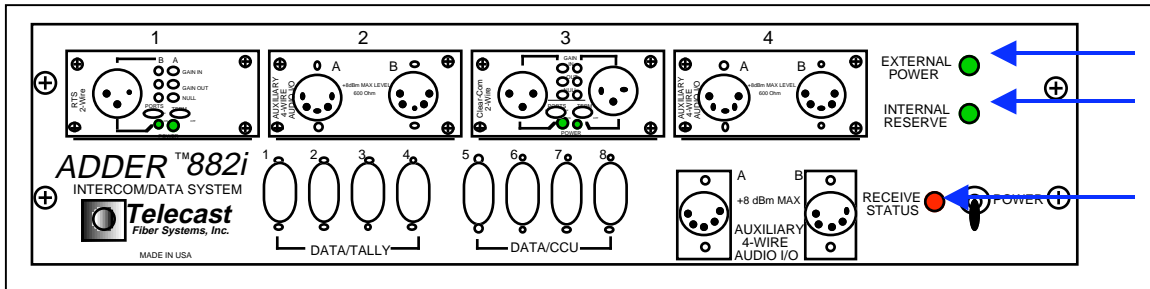The three LEDs on the front panel are shown in Figure 13.

Figure 13: Front Panel LED Indications

• **External Power**   When this green LED is illuminated, an external supply of between 12 and 24 VDC is connected.

• **Internal Reserve** This LED is illuminated green when the power is on and the internal battery is adequately charged. This LED lights after one half hour of charge. There may be a few minutes of reserve after the indicators extinguish. This LED is illuminated red when the internal battery is discharging.

• **Link Status**   This red LED is on when the fiber optic link is not properly attached, or the system units are not communicating properly. This indicator is meaningful only if one of the other two LEDs is on.

An audible alarm has been incorporated into the Adder 882 in addition to the LED indicators on the front panel. This alarm alerts the user that the internal batteries are discharging. A defeat switch for the audible alarm is located inside the unit on the main circuit board.

19

Powering Up

A locking switch is provided to prevent inadvertent power turn off. Never try to move the front panel switch without first pulling on the switch lever to disengage its lock.

With power OFF at both units, check all electrical and optical connections as described in Installation on page 2. Firmly seat and latch 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.

The power switches at both units must be on for the system to achieve normal function.

3. Switch on the power to both Adder 882i units.

Verify that the green external power LEDs are illuminated, and that the red link status LEDs do not light. If you do not get this result, refer to the Troubleshooting Chart on page 18. Remember that LINK LED OUT at both ends indicates that the units are locked and functioning properly.

Theory of Operation

The Adder 882i circuit block diagram is shown in Figure 15. The unit has two basic functions: multiplexing signals onto an optical fiber, and demultiplexing signals from an optical fiber. The Adder 882i accepts up to ten intercom inputs, eight digital inputs and four remote relay closures and time division multiplexes them onto a single optical fiber.
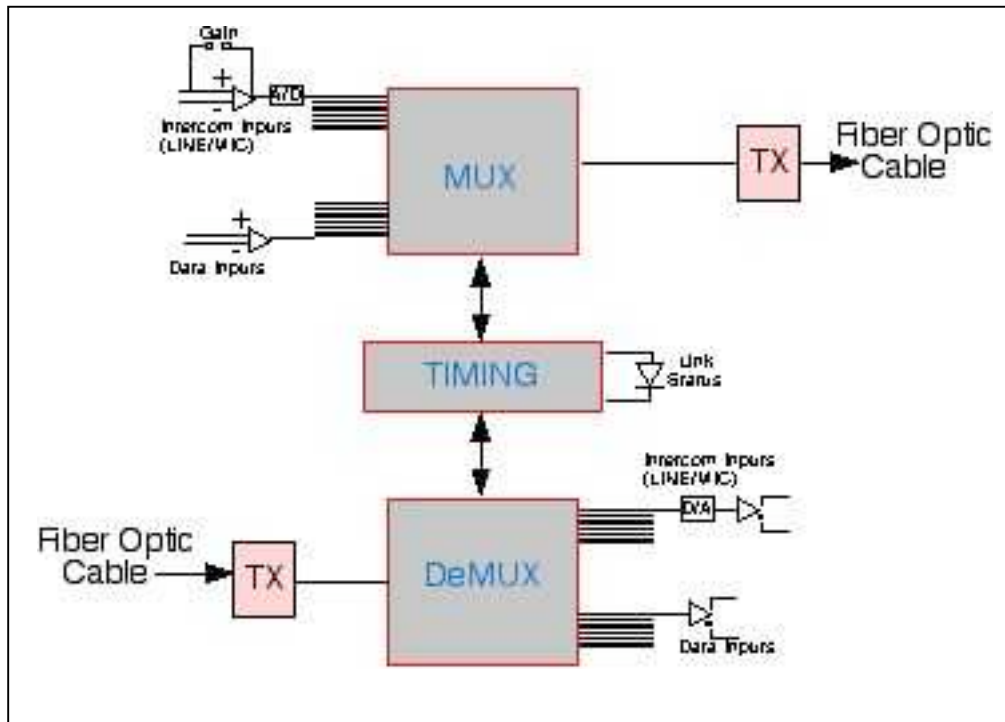
Figure 14: Electronics Block Diagram

All signals on the optical fiber are digital and, therefore, relatively insensitive to transmission level variations. As a demultiplexer, the unit separates the multiplexed signals it receives from the optical fiber and converts the audio information back into analog signals. There is a one-to-one correspondence between inputs and outputs at opposite ends of the system. Intercom inputs and outputs are on their respective Intercom Modules located on the front panel. Refer to Figure 1 on page 7.

21

Digital I/O

The digital input buffer circuits shown in Figures 15 and 16 accept and drive industry standard RS-422, RS-423, and RS-232 signal levels. These circuits may be used to convert from one signal format to another.

The digital output circuit shown in Figure 16 can be configured by the user to provide SONY CCU compatible I/O; contact closure circuits are not provided on connectors 5-8. Refer to Table 6, "Digital Cable Connections," on page 17 for instructions on selecting the CCU capability. When this option is selected, the RS-422 and RS-232 serial communications for that connector are not available.
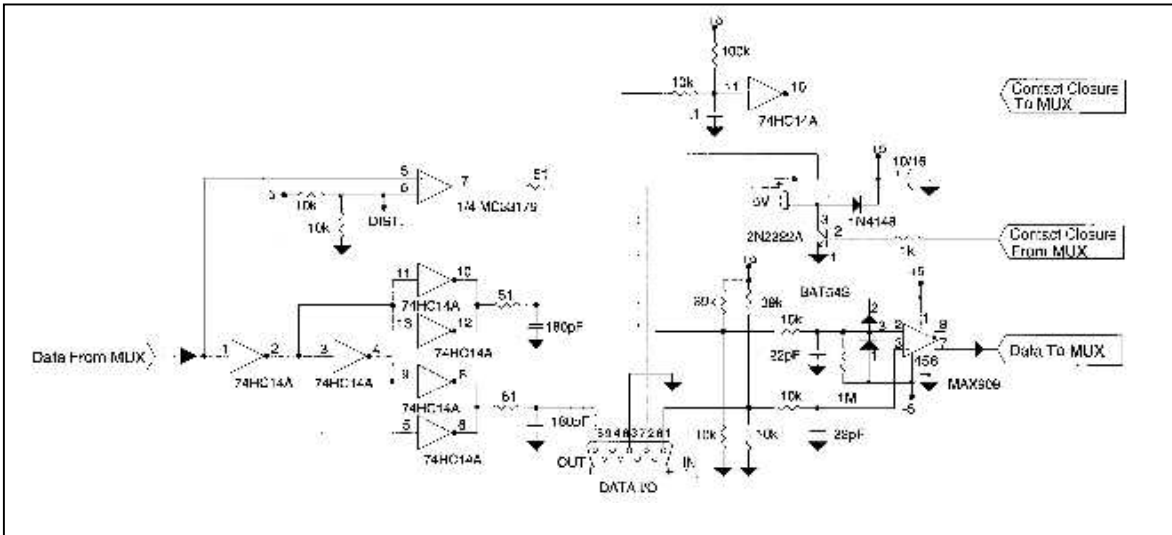

Figure 15: Digital I/O Connectors 1-4

The circuits in Figure 16 also provide contact closure inputs and outputs. The contact closure inputs are made by connecting pin 8 to ground (pin 3). This may be accomplished with a TTL output referenced to pin 3 as ground. The output contact closure is an SPST-NO relay and is not ground referenced.
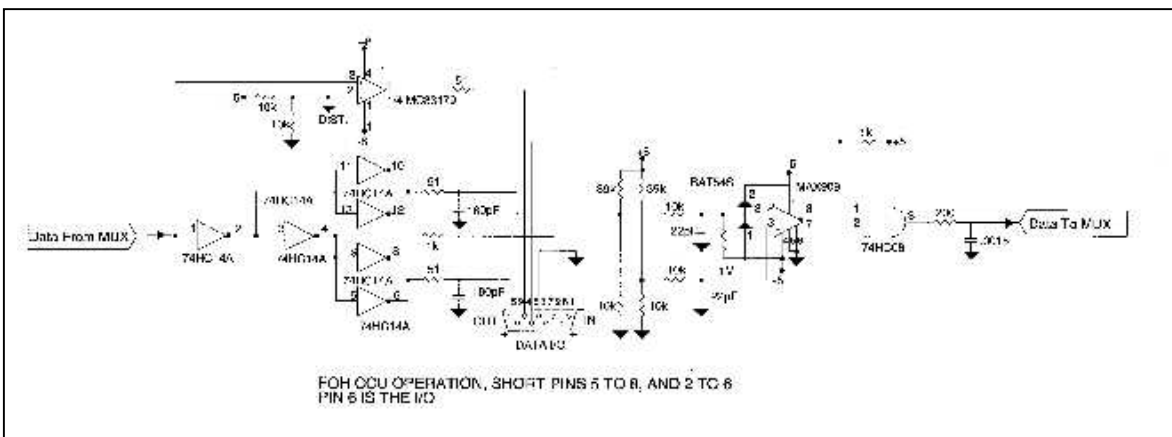

Figure 16: Digital I/O Connectors 5-8

22

Optical

The optical output is generated from a high power LED or Laser coupled to an optical fiber. User connections are made at a bulkhead type ST connector at the rear panel. The transmission fiber must be matched to the fiber pigtail type specified at the time of manufacture. The input uses a pin diode and amplifier to convert the optical signal back into an electrical signal. The optional single-fiber system uses a wavelength division multiplexer to combine and then to separate the two colors used. The main circuits in the Adder 882i are described in Table 8. The basic setup is illustrated in Figure 2 on page 8.

| A/D	High speed analog to digital converters located in each intercom
Multiplexer	Sequentially presents 8 RS-422 digital inputs and 8 digitized audio signals from the A/D converters to the optical output driver
De-Multiplexer	Takes sequential digital signals from the PIN diode and separates them into 20 separate line; 8 to the D/A converters and 8 to the RS-422 transmitters
D/A	High speed digital to analog converters located at each audio channel convert the digitized signal back to analog audio
Battery Charge	The battery charger, Figure 18, is active whenever the 882i is receiving DC power between 12-24VDC. Charging current is limited to a trickle level. Full charge will take 16 hours.

Table 8: Adder 882i Main Circuits
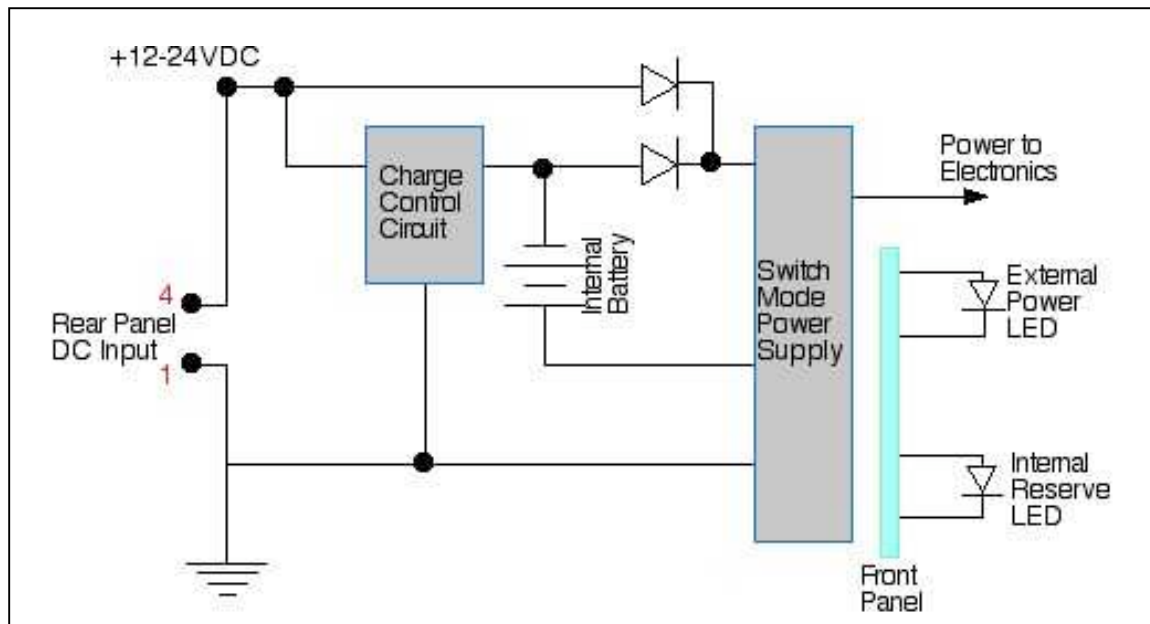
Figure 17: Battery Charging Block Diagram

Preventive Maintenance

Carry out the following procedures every two years:
- • Replace the internal Ni-Cad battery pack.
- • Verify the adequacy of optical power at the far end of each optical fiber. Use an optical power meter such as the one in the Accessory List.

Accessory List
The following accessories are available from Telecast:
- • Optical power meter kit
- • Cable repair kit
- • Loop-back cable to localize signals during installation test
- • Replacement Ni-Cad battery pack
- • Quick-crimp kit to attach ST connectors to fiber optic cable
- • Prefabricated cables built to custom lengths

Troubleshooting

If you are unable to resolve the problems with your Adder 882i System, call Telecast Fiber Systems, Inc. at 508-754-4858 and ask for our service department. To return a unit for repair, obtain a return material authorization (RMA) number from Telecast service.

Symptoms	Possible Cause	Corrective Action
No operation, All indicators off	No power	Make sure power switches on both ends are on and that the external power supplies are delivering 13.8-24VDC
No operation. INTERNAL RESERVE LED off	Battery depleted or either power switch off	Make sure power switches on both ends are on. Recharge battery
Normal operation. INTERNAL RESERVE LED RED	Internal battery depleted	The light should go GREEN after 1/2 hour of use w/ AC adapter. If not, replace battery
No operation. LINK STATUS LED on	Optical failure	Check your fiber link with an optical power meter. Is the unit on the other end powered and working?
Very low audio signal output	Mic Input gain set at 0db	Set internal switch to +40db
Distorted audio signal output	Line input set at +40db	Set internal switch to 0db
Internal reserve battery fails quickly	Reserve battery uncharged	Connect to ext. power source of 13.8-24VDC for 16 hrs.
System goes dead when ext. power is removed	Reserve battery dead or not connected properly	Check battery connection. Replace battery if necessary.

Table 9: Troubleshooting

Specifications

Audio Characteristics

Input Signal Levels
600 W balanced (low Zin)
Unity gain	+8 dBm peak
+40 dB	-22 dBm peak

Output Signal Level
30 W, balanced output into 600 Ws
Unity gain   +8 dBm peak
Frequency response @ +8 dBm, from DC to 22 kHz ± 0.2 dB

Total Harmonic Distortion
From 20 Hz to 20 kHz (@ +8   dBm) <0.05%

Intermodulation Distortion (SMPTE Method)
60 Hz + 3 kHz, mixed 4:1 @ +8 dBm   <0.04%

Signal to Noise Ratio (unweighted)
20 Hz to 20 kHz, AVG (ref to +8 dBm)   >90 dB

Digital Characteristics

Serial Communications

Data Interface	Signal Level	Data Rate
RS-422	Balanced TTL levels	0-150 kBits/sec*
RS-423	TTL levels	0-150 kBits/sec*
RS-232	± 8 Vp-p	0-38.4 kBits/sec
Sony CCU**	RM-M7, RM-P3 or compatible	0-20 kBits/sec
Jitter	1.12 msecs	

*Higher rates possible dependent on user system jitter tolerance.
** Request Telecast Application Note for more information.

Contact Closure

Input	TTL "1" or open circuit	Remote contact open
	TTL "0" / shorted to circuit gnd	Remote contact closed

Output (Form 1A SPST-NO isolated contacts)
Voltage	200 VDC
Switched current	500 mA
Carry current	1.2 A
Contact resistance	200 mW

Optical Characteristics

System Margin Data (1-fiber/2-fiber)

	1300 nm	1550 nm
Operating Wavelength	1300 nm	1550 nm
TX Output into cable	-15/-13 dBm	-15/-13 dBm
RX Sensitivity	-28/-30 dBm	-28/-30 dBm

Power Requirements

Voltage   12 to 24 VDC
Current   1.5 amperes, maximum @ 13.8 VDC
NOTE: Although the units will operate at 12 VDC, 13.8 VDC is required to charge the internal reserve battery.

CAUTION: Absolute maximum voltage is 30 VDC. Equipment damage may occur at higher voltages.

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.

EXCEPT FOR THE EXPRESS LIMITED WARRANTY AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP CONTAINED HEREIN, TELECAST FIBER SYSTEMS, INC. MAKES NO WARRANTY OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, AND ALL WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND OTHER WARRANTIES OF WHATEVER KIND ARE HEREBY DISCLAIMED BY TELECAST FIBER SYSTEMS, INC. THIS LIMITED WARRANTY SETS FORTH EXCLUSIVELY ALL OF TELECAST FIBER SYSTEMS, INC.'S LIABILITY IN CONTRACT OR OTHERWISE IN THE EVENT OF A DEFECTIVE PRODUCT.

WITHOUT LIMITATION ON THE FOREGOING, TELECAST FIBER SYSTEMS, INC. EXPRESSLY DISCLAIMS ANY LIABILITY WHATSOEVER FOR ANY DAMAGES INCURRED DIRECTLY OR INDIRECTLY IN CONNECTION WITH THE SALE OR USE OF, OR OTHERWISE IN CONNECTION WITH, THE PRODUCT, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS AND SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER CAUSED BY NEGLIGENCE OR OTHERWISE, REGARDLESS WHETHER TELECAST HAS BEEN GIVEN ADVANCE NOTICE OF THE POSSIBILITY THEREOF.

THIS WARRANTY IS GIVEN BY TELECAST IN LIEU OF ANY OTHER WARRANTY EXPRESSED OR IMPLIED.