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Rev 11/21/2008

Introduction

This manual provides instructions for the wiring and mounting of CTG microphones, speaker modules, and the connections and operation of the FS-400/800 Beamforming Mixers.

CTG System Components

- FS-400 or FS-800 Mixer and Teleconference Interface
- CM-01 Ceiling Microphones
- TM-01 Tabletop Microphones
- TM-02 Table Implant Microphones
- SP-01 Ceiling Speaker Modules
- Telephone dial pad
- Power adapter
- USB cable
- Mixer linking cable
- Software CD

The Software includes Setup, Recording, and Phone Dialing utilities. Please refer to the Help files for information on using the Setup and recording software. The Dialer is intuitive and needs no Help file.

We suggest checking our website periodically for updates and additions to our software library at **http://www.ctgaudio.com**

Other Components that may be connected

(***Check with CTG for compatibility by manufacturer and model***)

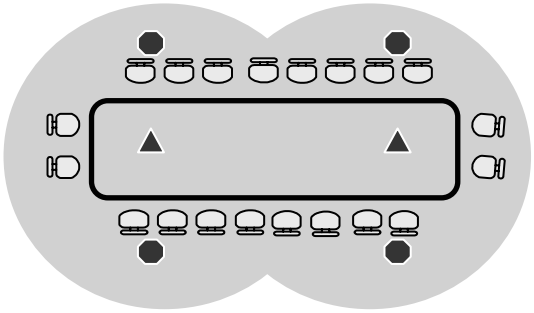
- Group videoconferencing system
- Ceiling, table, lapel, podium or handheld presentation microphone
- Recording Device
- Amplifier to drive room speakers

CTG is available to remotely assist with the design, installation and/or troubleshooting of all CTG systems at no charge. Please contact technical support with any questions or for assistance.

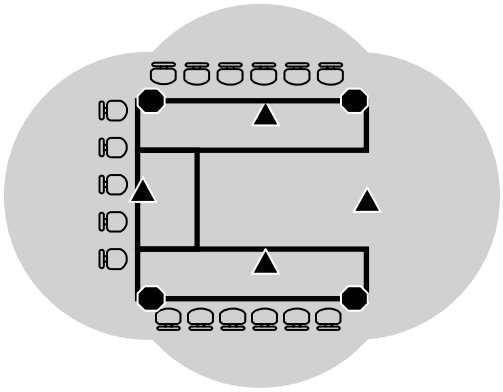
Conference Technology Group
3740 Kori Road
Jacksonville, FL 32257
904.880.5125 telephone
75.146.66.189 IP video
Email: support@ctgaudio.com

Typical Room Configurations

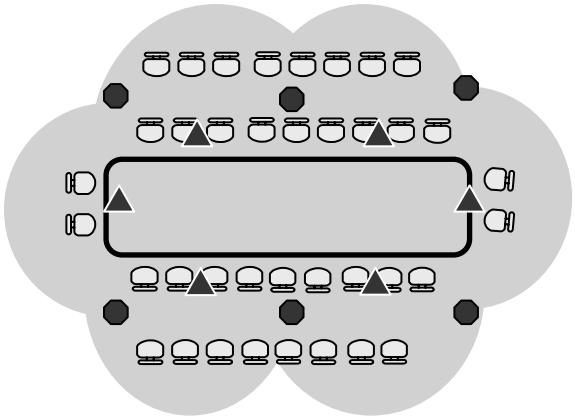
Drawings show microphone and speaker locations



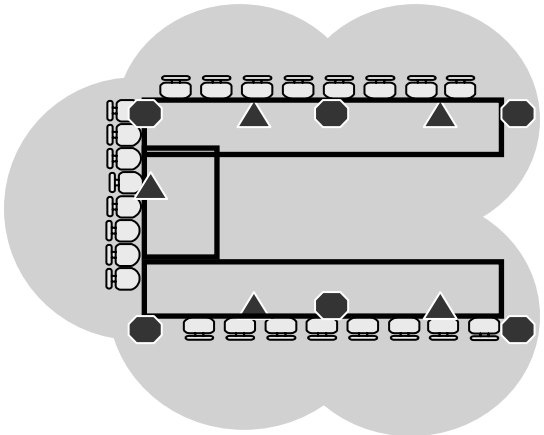
Centered conference table
25’x15’ coverage area



U-shaped tables
30’x30’ coverage area

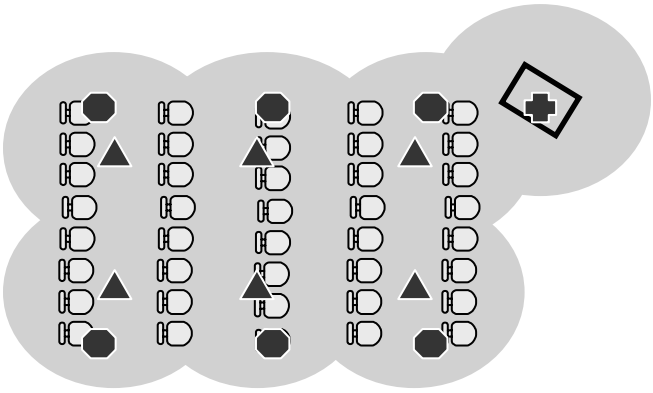


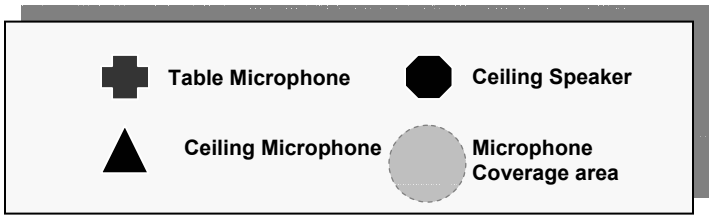
Centered conference table with perimeter seating
45’x30’ coverage area



Large u-shaped tables
40’x30’ coverage area

Training room with movable furniture
50’x30’ coverage area





Installation and wiring of CTG Microphones and Speakers

Tools Required for Installation

The following tools are recommended for the installation of the ceiling components and setup:

- **½ inch drill** – for drilling through an acoustic tile, a perfect hole will be made for the CM-01 ceiling microphone
- **Hand saw** – the ceiling speaker enclosure requires a 6 3/8-inch hole
- **Wall snake** – in most rooms, cables will need to run down through a wall and terminate at the FS-400, FS-800
- **Wire nuts** – for ceiling speakers
- **Wire Stripper**
- **Small blade screw driver** – often referred to in the industry as a "tweaker"
- **Ladder**

CTG Microphones-General

CTG microphones are true 360° Omni directional. They are electret condenser boundary microphones. The microphone itself should be flush mounted in a boundary of at least 12" in diameter. The element in the table top microphone (TM-01) is mounted in a base designed to acoustically couple to the table surface and provide an adequate boundary.

CTG microphones connect to microphone Inputs.*****

*** Each microphone must connect directly to the FS-400/800 with a "homerun" connection.**

Recommended Microphone Cable

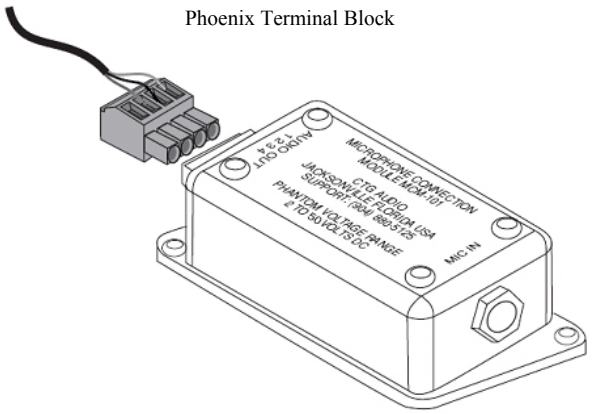
- 22 gauge single pair shielded (plenum rated) Belden® type 82761 or equivalent

CAUTION:

- Phantom voltage supplied to CTG microphones can be 2 to 50 Volts DC. The FS-400/800 microphone inputs provide 24 volts DC
- To avoid crosstalk, it is preferred microphone and speaker cable **NOT** be bundled or run together in the same conduit over long distances

Connection Module Wiring Detail

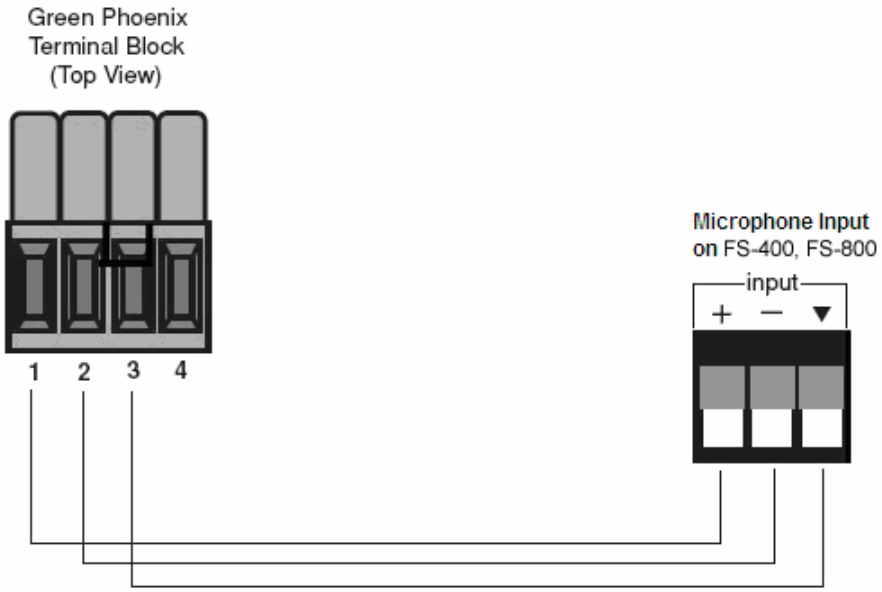
A connection module (MCM-101) is supplied with each microphone
On the MCM-101 is a four position Phoenix Terminal Block.



PHOENIX TERMINAL BLOCK CONNECTIONS:

Terminal 1….Positive
Terminal 2….Negative
Terminal 3….Shield
Terminal 4….To housing

Note:
A ground jumper between terminals 3 and 4 should be removed if the ceiling tile is foil backed or if any part of the microphone housing comes in contact with building ground.

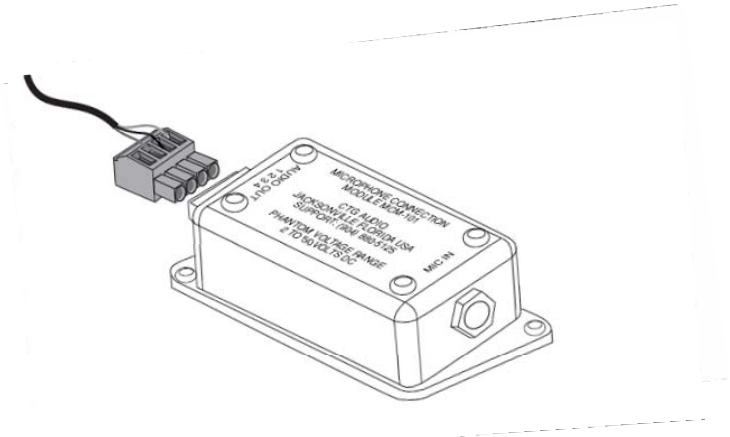


Ceiling Microphone (CM-01) Mounting Detail

(Note, ceiling microphones should not be mounted in ceilings higher than 10 feet without consulting CTG support)

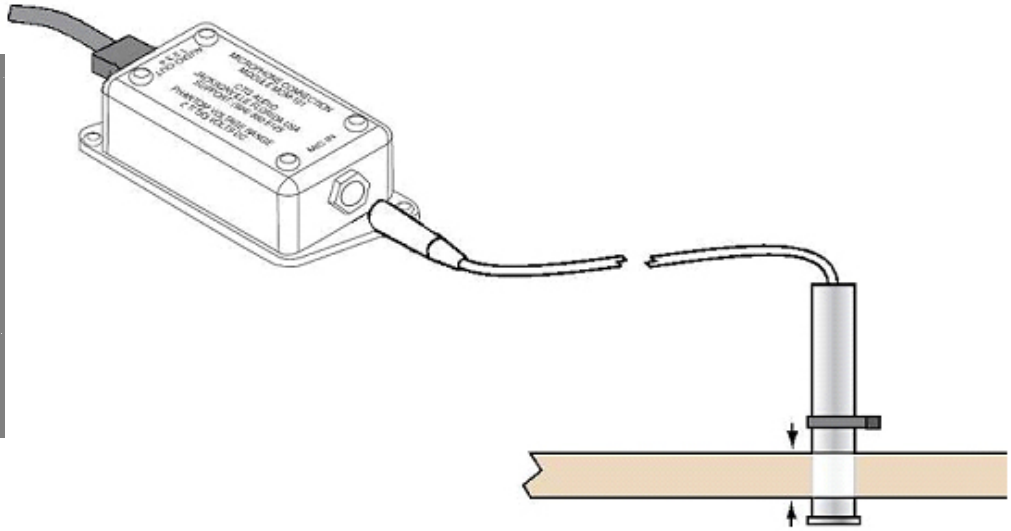
STEP 1

Wire Phoenix Terminal Block to end of cable run from the FS-400/800 microphone input and plug into connection module.



STEP 2

Drill ½" hole in the tile at desired location. Push microphone barrel, with attached 18" cable and mini XLR connector up through ½" hole in tile until lip stops against tile. Secure on top of tile with friction clip.



STEP 3

Plug mini XLR connector at end of 18" cable into male jack on connection module. Rest connection module on top of tile.

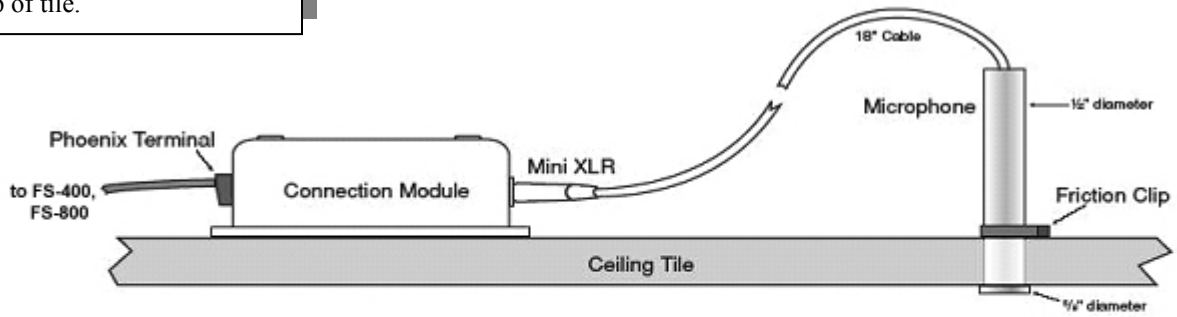
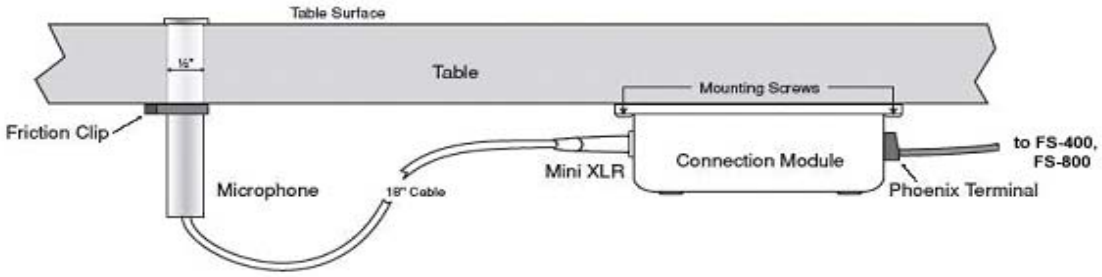
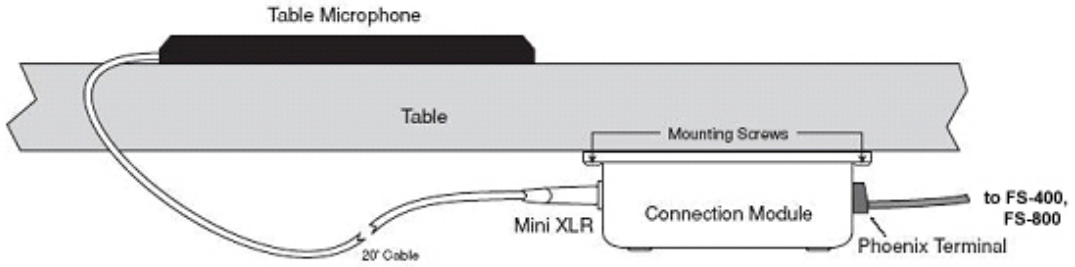


Table Implant Microphone (TM-02) Mounting Detail



Step 1:	Drill ½" hole into the table Push microphone barrel, with attached 18"cable and mini XLR through the table from surface until lip stops. Secure from underneath with friction clip.
Step 2:	Position connection module underneath the table within reach of the 18" microphone cable. Remove protective paper from the foam tape and press the bottom to table. Secure with screws provided and plug in the mini XLR from microphone cable.
Step 3:	Wire Phoenix Terminal Block to end of cable run from FS-400/800 microphone input and plug into connection module.

Table Top Microphone (TM-01) Mounting Detail:



Step 1:	Position connection module to desired location underneath table. Remove paper from the foam tape and press the bottom to table. Secure with screws.
Step 2:	Plug mini XLR from table microphone cable into module and locate microphone on the table.
Step 3:	Wire Phoenix Terminal Block to end of cable run from FS-400/800 microphone input and plug into connection module.

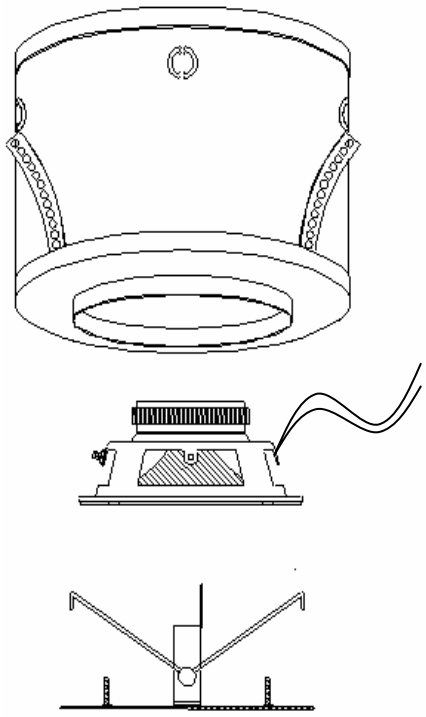
The speaker enclosures supplied will require a **6 3/8-inch** hole in the ceiling material.

Ceiling Speaker (SP-01) Mounting Detail

The speaker grills are supplied with the speakers already mounted and attached to the enclosures with torsion springs inserted into clips inside the enclosure. To remove the grille simply pull it away from the enclosure and compress the springs to detach.

To simplify installation CTG attaches a twelve-inch wire to each speaker terminal so that it may be connected with wire nuts. The red wire is positive.

(**Note**: Blind mounts are available from CTG for dry wall ceilings or ceilings with inadequate space above. Tile bridges are also available as an option.)



Each speaker has a direct "homerun" connection to the speaker amplifier

Recommended speaker cable:

18 gauge twisted pair (plenum rated) Belden type 82740 or equivalent

Although the FS-400/800 mixers do not contain a speaker amplifier, it is vital that return audio from an external video codec be routed through the mixers before being connected to a speaker amplifier. This allows the return audio to be sampled to enable echo cancellation. To facilitate this there are **SPEAKER IN** and **SPEAKER OUT** connections on the rear panel of the mixers.

FS-400 and FS-800 Beamforming Teleconference Interfaces

Overview

The CTG FS-400 and FS-800 Beamforming Mixers are an advanced solution for group audio and video teleconferencing, intra-room presentations, and meetings with recording capacity. They differ only in the number of microphone inputs (4 or 8), and both include a telephone interface to connect directly to the Public Service Telephone Network (PSTN). They can also connect at Line Level to any Video codec with a suitable Line Level input connection. The FS-400 and FS-800 may be daisy chained to allow a nearly infinite number of microphones. Any mixer in the chain may be the master. The mixers provide advanced Echo Cancellation, Noise Reduction, and De-Reverberation to reduce the room reflections that can seriously degrade speech intelligibility. Simple software is provided to set audio levels for the microphone mixer and the telephone interface. Recording software is also included. A dial pad is included to dial, connect and disconnect phone calls.

Both of the mixers take advantage of the increased computational power of the latest digital processors to provide enhancements not previously available. Every attached microphone is sampled 16,000 times per second and the audio picked up by each is analyzed and compared in arrival time. Audio from any microphone that enhances intelligibility of a person speaking is combined, while audio that would degrade intelligibility is discarded. The system constantly adjusts to changes and effectively follows a moving speaker.

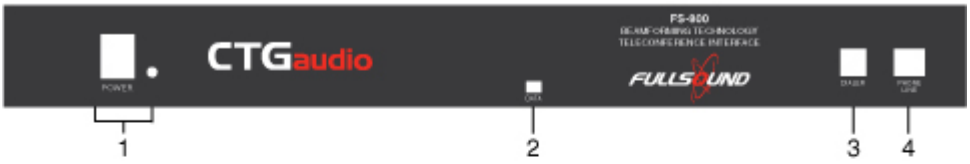
Noise Suppression- Noise suppressor acts on long term noise (HVAC noise, fans, and lighting hum.

De-Reverberation- All sounds in a room are reflected from room surfaces. A de-reverberation algorithm determines reflections by comparing the time difference with the original sound and reduces annoying room echoes. As a result rooms that have marginal acoustic characteristics for good teleconferencing are made usable.

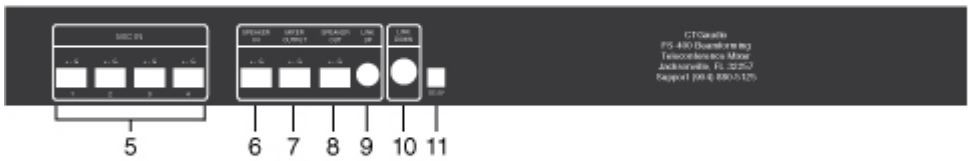
Panel Descriptions

The FS-400/800 powers the CTG microphones and can be linked to support an unlimited number of microphones. The PSTN phone line connection allows for stand alone audio conferencing and the Interfaces are easily integrated to video conferencing codec's.

Front Panel FS400, FS800



Back Panel FS400



Back Panel FS800

Front panel of FS-400 or FS-800

1. **Power on/off Switch with LED indicator**
2. **USB mini B:** Used for PC Communication, both audio and setup
3. **Dialer:** Input for dial pad to dial, connect and disconnect calls
4. **Phone Line:** Input (standard RJ11) to connect phone line from wall plate

Back panel of FS- 400

5. **Microphone inputs (1-4):** CTG ceiling microphones, table microphones, or implant microphones are connected here.

6. **Speaker In (mandatory):** This is the return audio from the video codec

7. **Output:** This output is connected to a line level input of the video codec

8. **Speaker Out:** This will be connected to the speaker amplifier.

9. **Link Up:** This is an expansion port which allows multiple units to be linked together and function as one system for large rooms.

10. **Link Down:** This is an expansion port which allows multiple units to be linked together and function as one system for large rooms.

11. **Power Connector: USB:** Power supply through USB mini B @ 5 V DC automatically adjusts to 110 to 240 volt mains.

Back Panel FS- 800

12. **Microphone inputs (1- 4):** CTG ceiling microphones, table microphones, or implant microphones are connected here

13. **Speaker In (mandatory):** This is the return audio from the video codec

14. **Mixer Output:** This output is connected to a line level input of the video codec.

15. **Speaker Out:** This will be connected to the speaker amplifier.

16. **Link Up:** This is an expansion port which allows multiple units to be linked together and function

17. **Microphone inputs (5-8):** CTG ceiling microphones, table microphones, or implant microphones are connected here.

18. **Link Down:** This is an expansion port which allows multiple units to be linked together and function as one system for large rooms.

19. **Power Connector** USB provided power supply through USB mini B at 5 VDC automatically adjusts to 110 to 240 volt mains.

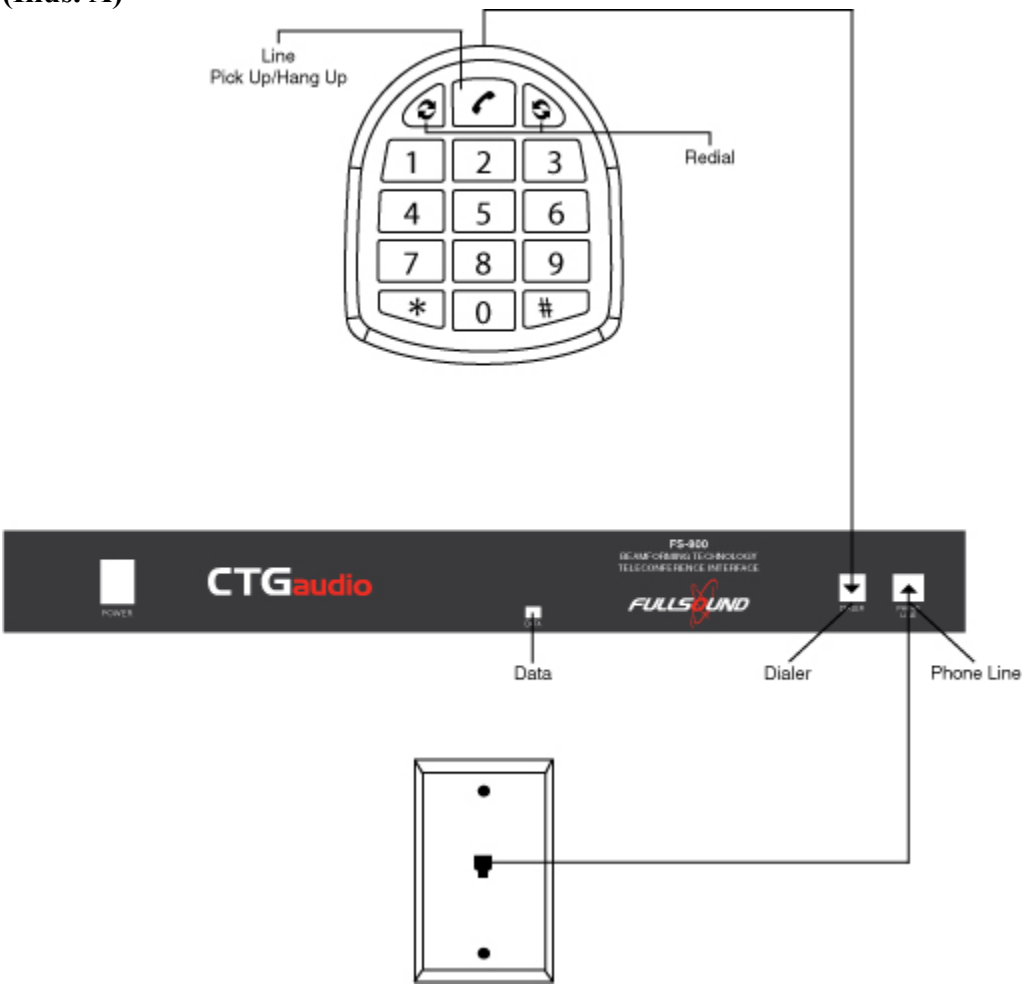
Connecting and Placing Audio Conference Calls

For audio teleconferencing over standard analog PSTN phone lines there are two options. First connect the FS-400/800 to the standard RJ-11 telephone wall jack from the similar jack marked Phone Line on the mixers front panel.

1. A software dialer, similar to the hardware dial pad but with additional capabilities, such as Flash, Mute, Volume, and Number Recall is included on the supplied software CD, and may be used instead of the hardware dialer shown below through the USB Data port.

2. Or attach the included hardware telephone dial pad to the narrower jack marked **Dialer.** To place a call press the button at the top of the dial pad showing a telephone handset, and dial when the dial tone is heard, to hang up after the conference, press the same button again**.** (see Illus. A) **Telephone volume level can be adjusted with the CTG Setup Software (Page 18).** There are two additional buttons at the top of the dial pad that can be pressed to conveniently redial the last dialed phone number.

(Illus. A)



Calibration for Audio Conferencing

It is important to maintain "standard transmission levels" with handsets, speakerphones and conference phones. The standards that reference "Send Loudness Ratings" (SLR) are described in the ITU's G. 111 standard and also referenced in the P. 340 standard. The goal is to maintain a dynamic range >20db as described in the videoconferencing calibration section. The speech level should average +6db to ensure a comfortable level at the far end.

In General, the audio level of people speaking in the distant rooms should be about the same as a person speaking in the same room with you.

Integration to Video Conferencing

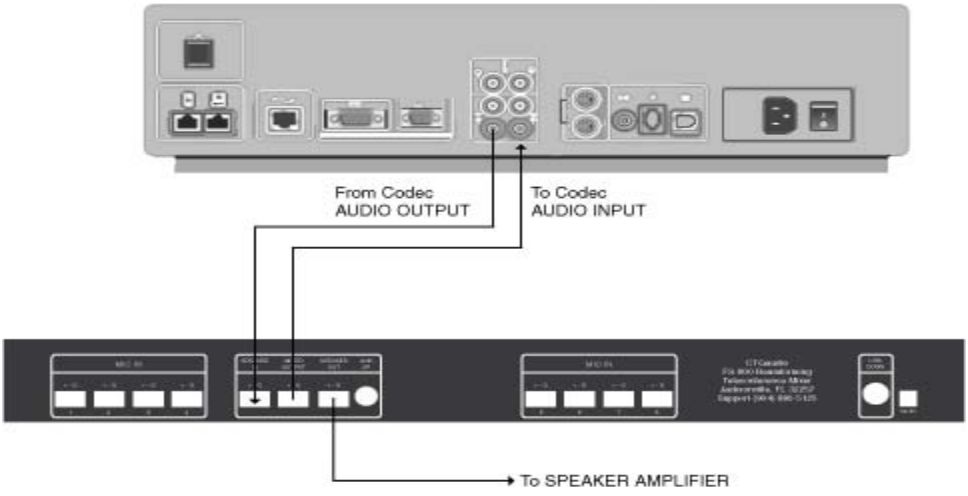
Codec Compatibility

The FS-400 and the FS-800 are compatible with almost all video codec's.

Connecting the Codec

The FS-400/800 Output should be connected at line level to a video codec. CTG will provide the appropriate connecting cable for the particular codec model if known. The following illustration shows the connection between video codec and the microphone mixer. For specific illustrations and instructions to connect to commonly used codecs refer to the support section of **www.ctgaudio.com** or call CTG support at **(904) 880-5125**

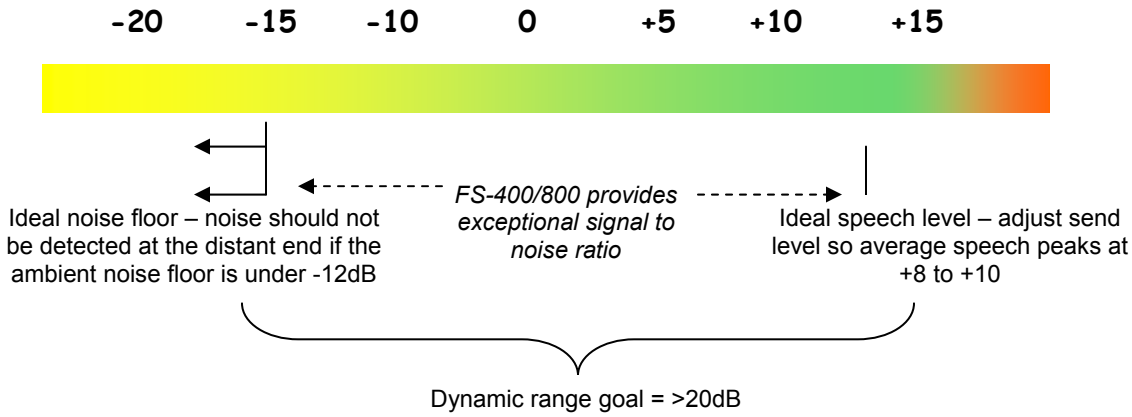
Codec (Rear Panel): N***OTE:*** *This Illustration is a simulated codec panel and does not represent any particular brand.*



Calibration for Video Codec

It is **important** to maintain "standard transmission levels" to be compatible with other systems.

The following illustration details the targeted send level.



Some codecs have an audio meter that displays the transmission level.

Ideally the output level of the mixer should be adjusted so voices peak between +5 to +10 dB. CTG technical support can assist in determining the proper send level over a video call.

During calibration, the volume control indicator of the video codec should be set at about mid-range. Typically the video codec will display an on screen graphic that will indicate the incoming audio level when a volume key is pressed.

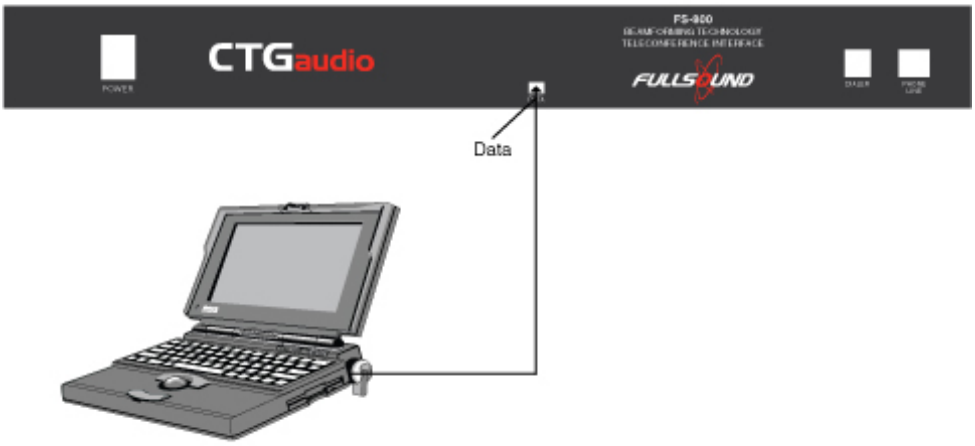
Recording a Conference

Audio recordings can be made of a conference by connecting a computer to the front panel USB Jack on the FS-400/800 and recording to a computer hard drive. This may also be used to record meetings within a room. When another recording device is used to record within a room (no teleconferencing) the output jack on the back panel can be connected at line level to a recorder. (See Illus. B)

Easy to use CTG Windows recording software is included. Instructions for recording can be found in the recording software utility help file.

(Illus. B)

Recording both ends of a conference or in-room meeting/presentation on computer hard drive



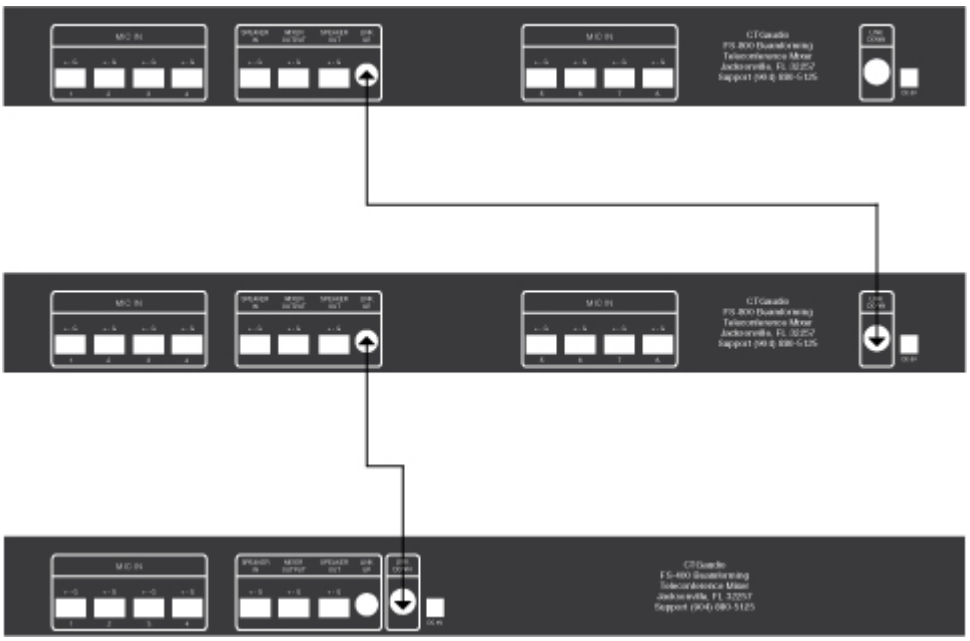
Using another recording device to record within a room

(Note: when using the FS-400/800 output for recording within a room, a codec or other line level device may not be connected)

Linking Multiple Mixers

A short linking cable is provided with every mixer. Any number of FS-400 and FS-800 mixers can be linked to support any number of microphones required. The link connectors on each end of the cable are different to prevent being plugged into the wrong **LINK** jack. (see illus E) Any mixer in the chain can act as a master or slave, Any software level change made to any mixer will be applied to all the mixers in the chain.

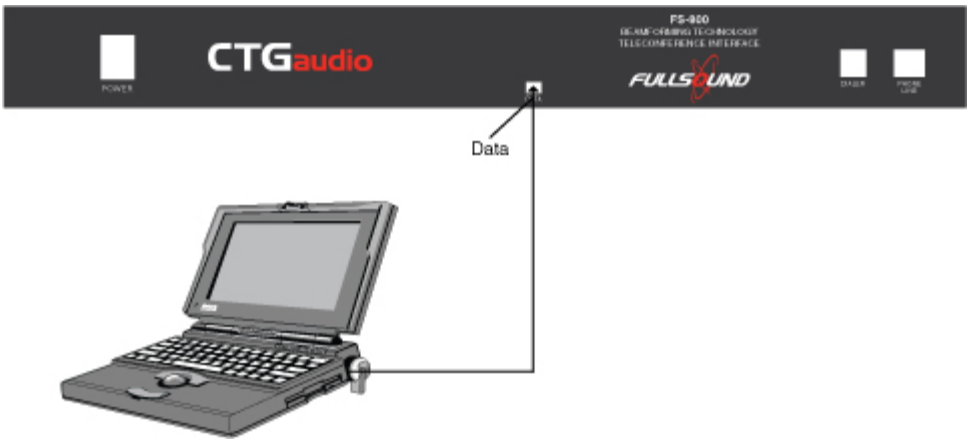
(Illus. E)



CTG Software

To load and use setup software, connect USB cable to front panel data port,(see illus. D)

(Illus. D)



The CTG Audio Setup Utility is designed to help you control the audio levels coming in and going out of your CTG product. This utility will:

1) Identify the CTG device you are using and indicate whether it's connected (or not connected).

2) Set the audio levels to a comfortable default value. Once you modify the levels the unit will save and restore your preferred levels anytime you connect a unit or open the audio utility (you can choose not to save your settings and to go back to the default values).

3) The utility will allow you to control the level of signal going to and coming back from your telephone. It will also allow you to control the level and balance of the bridge (the connection between your telephone counterpart and VoIP counterpart in PSTN versions)

This utility is not necessary in order to use your CTG system. Some audio levels (VoIP) can be controlled through your Windows mixers while others that are not controlled by Windows (telephone and bridge) are set to a comfortable default level. However, this utility adds another level of control that some users prefer to have.

An important feature of the utility is the ability to disable / enable the bridge connection. This is intended to prevent your telephone counterpart from hearing unwanted sounds coming out of your computer.

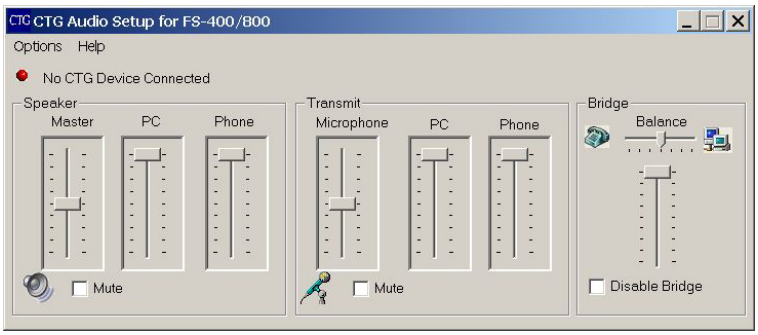
The software must be installed to a laptop or desktop computer running Microsoft Windows 98 or newer, and connected to the FS-400 or FS-800 mixer with the provided USB cable to the front Data Port on the mixer. The indicator will turn from Red to Green and indicate the device is connected. If you already have an older version of the CTG

Audio Setup you will need to uninstall it first. Please go to "**Start**" -> "**Control Panel**" -> "**Add or Remove Programs**", look for "**CTG Audio Setup**" and choose "**Remove**".

Locate the installation file downloaded to your PC or use the Provided CD. Run the installation wizard by double-clicking on the file icon and choosing "**Run**". Follow the instructions on the installation wizard, and click finish when done. A shortcut for the CTG Audio Setup Utility will automatically be placed on your Windows' desktop screen after installation. Once installed, you can double-click on the shortcut to launch the utility.

To uninstall this software use the Windows Add / Remove utility. To do so click on "**Start**" -> "**Control Panel**" -> "**Add or Remove Programs**". After clicking "**Add or Remove Programs**" you should scroll down the list of software applications installed on your PC until you find "**CTG Audio Setup**". Once found, click on the "**Remove**" button next to it and then click "**Yes**".

Advanced Control Panel



The advanced control panel allows you to control:

Speaker:

- Level of signal coming from the **PC** (VoIP communication)

- Level of signal coming from the **Phone** (or VCA)

- **Master** volume controlling directly the signal broadcasted on the device's loudspeaker

Transmit:

- Level of signal sent to the **PC** (VoIP communication)

- Level of signal sent to your **Phone** (or VCA)

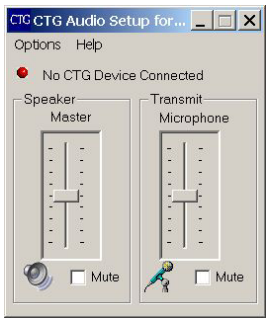
- Master volume controlling directly the level of your internal microphone's signal

In addition, the "**Bridge Bar"** controls the level of the signal going from your phone counterpart to the PC counterpart and back (see illustration below). Dragging the bar up or down will increase (or decrease) the two levels simultaneously (when the two parties complain that the signal is too low for example). Moving the balance bar left or right will increase one side of the communication while simultaneously decreasing the other.

When checking the "**disable bridge box**" the communication from the PC going into the telephone is blocked while the communication from the telephone to the PC is always open (to allow recording). The purpose of blocking is to prevent your telephone counterpart from hearing unwanted sounds from your PC (such as internet pop-ups).

Basic Control Panel

The basic control panel includes two "master" sliders that control the signal going out (microphone or transmit) and the signal coming in and broadcasted on your device's loudspeaker (Speaker)



If you have a CTG device connected to your PC, a green dot will appear with a message saying "Connected to FS – 400/800". If no device is detected a red dot will appear with a message "No CTG Device Connected"

You can mute your microphone and loudspeaker by checking the mute boxes underneath the appropriate boxes.

Adjusting Volume Settings

The first time you run the utility, the levels of the audio signals are set to a comfortable level. Simply drag the slider bar up or down to adjust the levels to fit your preference.

Anytime you change the volume levels of the audio, the new settings are saved. Every time you connect your CTG device, or turn on your PC, these setting will be applied. If you changed the volume setting through another utility and wish to restore your settings, simply open the utility by clicking on the CTG icon and your setting will be restored.

You can restore the factory setting by going to "**Options**" and clicking on "**Restore default volume levels**".

You can also select not to save your last setting by going to "**Options**" and un-checking the "**Save volume levels on exit**" option.

Push to Talk Feature

Using the Push to Talk Feature

By default your CTG device is an “Open Mic” device. You can mute the microphone, but in the normal mode of operation the microphone is open.

The Audio Setup Utility provides an option to use your system in a Push to talk mode. Go to “**Options**” and select the “**Push to Talk mode**”. A Red button will appear on your screen indicating your microphone is “normally muted”. Click on the button with your mouse and hold (or the space bar) to open the microphone. When the microphone is on the button will turn green and will stay open as long as you keep pushing down on the button.

Switching back to “open microphone” mode is done by closing the button panel, or by un-checking the mode in the “**Options**” menu

Troubleshooting Guide

General:

System installers are urged to contact CTG support when adjusting the system to take advantage of free technical support and have the comfort of knowing the system is functioning optimally. CTG's support is equipped with video, which can add an additional dimension when aiding with a system installation. Frequently, when a system does not function as expected, it is due to poor connections between components of a system and/or faulty cables. These would be initial areas to inspect. Typically when speaking into a CTG microphone during a teleconference nothing will be heard from the local speakers. This is normal as the sound is being sent to the distant end.

Based on support calls these are some of the more common problems and suggested solutions:

- **Distant room hears audio but complains the level is too low**

Adjust the microphone level slider in the FS-400/800 software until level is satisfactory.
**Test each microphone in the room to determine they are on.

- **Local room cannot hear distant end participants**

Make sure the input and output cables are not reversed at either end. The output from the FS-400/800 must connect to the input of the teleconference interface. The audio output of the codec must connect to the **Speaker In** terminal of the FS-400/800, and the input to the speaker amplifier must connect to the Speaker Out of the FS-400/800

- **The distant end complains of hearing echo or feedback**

Your send or receive levels may be set too high for the echo canceller to function normally. Speaker and microphone cables may be run in intimate proximity to each other resulting in induced crosstalk. High and low level signal cables should not be bundled together or routed close together through the same conduit for any significant distance.

- **The microphones are picking up excessive room noise**

The send (output) level may be set too high in the FS-400/800 software increasing the microphone sensitivity level. The Microphone slider in the CTG software should be moved down until all or most of the ambient noise disappears without the loss of adequate voice pickup.

CTG Technical Support
Phone: (904) 880-5125
Video IP: 75.148.66.189
www.support@ctgaudio.com

Component Specifications

CTG FS-400 and FS-800 Specifications

Microphone Inputs (4 or 8)

Number of inputs:	4 or 8 (with limitless chaining capability)
Type:	Phantom powered balanced Input
Connector:	Phoenix Balanced
Phantom Voltage:	24 Volt
Input Impedance (load):	590 ohm
Maximum input level:	60 mVpp (input gain 30)
Frequency response:	20 Hz - 8 KHz

Speaker Input

Type:	Balanced Input (single ended can also be implemented by connecting the negative input to GND)
Connector:	Phoenix Balanced
Input Impedance:	5 K ohm
Maximum input level:	2 Vpp
Frequency response:	20 Hz - 8 KHz

Speaker Output

Type:	Differential
Connector:	Phoenix Balanced
Maximum output level:	2 Vpp
Output Impedance	<60 ohm
Frequency response:	20 Hz - 8 KHz
THD+N	<-50dB
Dynamic range:	90 dB

Expansion Unlimited daisy chain capability

Protection Features:

Power supply input:	Not protected - Input voltage should not exceed 6V DC, only use included power supply
Speaker and audio out:	Both protected against short circuit at the output

Dimensions

Width with rack ears	19 inches (482mm)	Without mounting ears	16.5 inches (420mm)
Height	1.75 inches (45mm)		
Length	8 inches (203mm)		

Weight	FS-400	4.25 Lbs (1,93Kg)
	FS-800	4.50 Lbs (2.04Kg)

Telephone Hybrid

Bandwidth	30-4000 Hz +/- 0.4 dB (limited to PSTN bandwidth)
Acoustic Echo Cancellation (AEC) tail length	150 ms
Line Echo Cancellation (LEC) tail length	25 ms
Telephone noise cancellation	10dB

Residual noise attenuated to the noise level (after the NR) to avoid pumping

Certifications

Complies with the Federal Communications Commission's (FCC) Rules and Regulations 47 CFR Part 68, and the Administrative Council on Terminal Attachments (ACTA)-adopted technical criteria: TIA-968-A, Telecommunications – Telephone Terminal Equipment –Technical Requirements for Connection of Terminal Equipment To the Telephone Network, January 2003 with Addendums TIA-968-A-1,
TIA-968-A-2, TIA-968-A-3, TIA-968-A-4

CTG Microphones: CM-01, TM-01, TM-02.

All versions of the CTG microphone utilize a special pressure sensitive, tensionless low-mass element enhanced with an integrated FET low noise amplifier. Their characteristics result in ultra smooth frequency response providing excellent feedback stability for teleconferencing applications. Their high temperature stability assures exceptional system performance in fixed gain situations.

Element	Electret Condenser, RFI Suppressed
Frequency range	10 – 20,000 Hz
Phantom Voltage	2 – 50 Volts DC
Acoustical Mode	Boundary effect Pressure Transducer
Temperature Stability	+/- 0.02 dB per degree F maximum
Operating Current	50 μA maximum
Impedance	200 Ohms nominal, balanced, after connection module
Output level ref 1mW/10dynes/cm^2	-57 dBm (-51 dBm when mounted)
Equivalent Noise level A weighted	28 dB SPL (-22 dB SPL when mounted)
Equivalent Vibration Sensitivity	70db (1 KHz SPL equivalent of 1G)
Dimensions CM-01/TM-02	Tube Diameter .5", Length 3""
Dimensions TM-01	Base Diameter 5.75" Height .625
Dimensions Connection Module	4.375" x 2.10" x 1.32"

SP-01 Ceiling Speaker Module

The SP-01 uses a 4-inch loudspeaker designed for voice communications.

Speaker Size	4-inch (10cm)
Frequency Response	60Hz – 18KHz
Magnet Weight	10oz Ceramic
Coil Impedance	8 Ohms
Power Handling	10 Watts
Depth	2.25-inch
Grille	7.375-inch, bright white
Enclosure	depth – 6.5 inches (16.5cm)
Weight	6 pounds (13.2Kg)

Returns

Defective or Damaged Components

If you suspect you have a defective or damaged component contact CTG technical support to troubleshoot. If confirmed a component is defective or damaged a Return Material Authorization (RMA) number will be issued along with instructions for returning the product.

Installation Notes