

Equipment Setup Instructions for fMRI Experiments

This document outlines the setup of equipment necessary for presenting visual and auditory stimuli to and collecting button-press responses from participants in fMRI experiments. This document assumes that the researcher has already developed software for the experiment in question, and that this software is capable of interfacing with the AVOTEC equipment at I2AT. This document also assumes that all equipment is initially in a powered-down state (including the researcher's computer if this is being used for stimulus presentation). If the experiment in question does not use one or more of the elements described in this document (visual presentation, auditory presentation, button-press responses), please skip that section of the document.

Visual presentation

Overview of steps

- have technician make sure projector is in place and lens cap is removed
- have technician place projection screen and head-coil in the bore of the magnet
- identify video control system and video splitter and ensure power is off
- plug "VIDEO" cable into laptop
- turn on video control system and video splitter
- turn on stimulus presentation computer
- ensure display is being shown on projector / research control room monitor
- check screen resolution
- check screen saver / power saving settings

Initial setup

In order to present visual stimuli to participants, an MRI compatible projection system is housed at I2AT. This projection system has four components of interest to researchers: a projector, a projection screen, a head-coil based mirror, and a video control system.

The projector used for fMRI research differs from the one used for clinical research, and as such, it must be repositioned in the MRI room before the start of each experiment. The MRI technician must position the projector appropriately and ensure that the projector lens cap is removed before any other steps take place. In addition, the technician will place the projection screen into the bore of the magnet. This projection screen is fastened near the back of the magnet bore via Velcro strips.

In order to see the projection screen positioned behind his or her head, a participant will view the display through a mirror mounted on a head-coil. The MRI technician will insert the head-coil and attach the mirror. Positioning the mirror for optimal viewing of the projection screen will wait until the participant is being positioned later in the setup.

Once the physical setup of the projector, screen, and mirror is finished, the researcher should be able to setup the computer equipment in the research console area. The first step necessary to make the projector show the stimuli is to identify the video control system (see Figure 1). The video control system should be powered down. It is important that the video control system is not turned on before the projector lens cap is removed. The video control system will receive input from the stimulus presentation computer (e.g., the researcher's laptop) and send it to the projector.

In order to send input to the video control system, the stimulus presentation computer must be connected to the system. This is accomplished by connecting the VGA cable labeled "VIDEO" to the stimulus presentation computer's monitor port. For assistance identifying this port on a specific stimulus presentation computer, please see the system administrators. Once the cable is in place, the video control system should be turned on along with the video splitter located on top of the video control system.

If auditory presentation and / or button-press responses are being used, please refer to the "Initial setup" portion of those sections before continuing with the visual presentation setup.

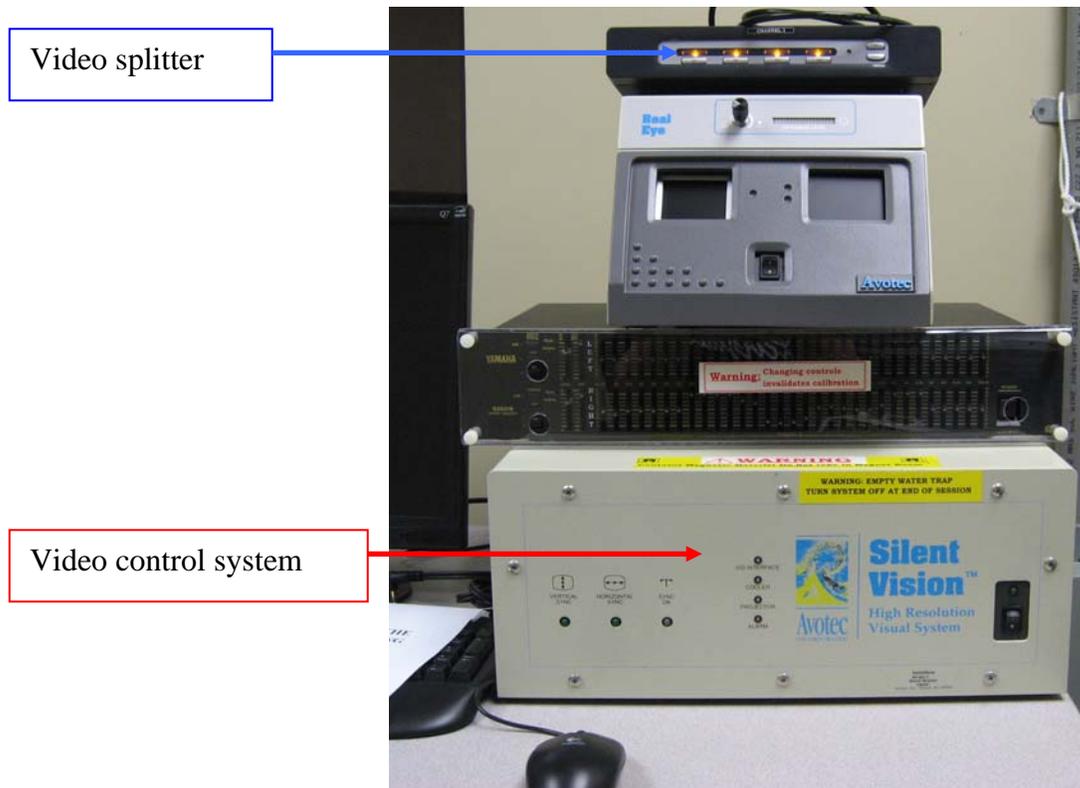


Figure 1. Video control system and video splitter

Finalizing setup

Before beginning this portion of the visual presentation setup, please be sure to refer to the initial setup portions of the auditory presentation and button-press response sections if they are necessary for the experiment in question.

Once the “VIDEO” cable is in place and the video control system / video splitter have been turned on, the stimulus presentation computer should be turned on. In most cases, the stimulus presentation computer should detect that it is connected to the video control system. The video control system monitor should display the same image as the stimulus presentation computer. This is what the projector will display to the participants. If the video control system monitor does not display the same image as the stimulus control computer, you will need to switch the video display mode of the stimulus presentation computer. For assistance with this, please see a system administrator. I2AT recommends a display resolution of either 1024x768 or 800x600. Additionally, I2AT recommends turning off screen savers and power saving settings that might cause the stimulus presentation computer to go to sleep during the experiment. A system administrator can help adjust these settings if needed.

Auditory presentation

Overview of steps

- plug “AUDIO” cable into laptop’s headphone jack
- adjust all knobs appropriately
- hold down PTT switch, turn the power on, then release PTT switch
- check the volume of the headphones

Initial setup

In order to present auditory stimuli to participants, an MRI compatible headphone system is housed at I2AT. This system has 2 components of interest to researchers: an MR compatible headphone/microphone system, and an auditory control box.

The headphones used for fMRI research differ from those used for clinical research, so the MRI technician will identify the correct headphones. The MRI technician should be informed that he or she will need to place the headphones on the participant before the scanning begins. The auditory control box located in the research console room will receive input from the stimulus presentation computer (e.g., the researcher’s laptop) and send it to the headphones.

In order to send input to the auditory control box, the stimulus presentation computer must be connected to the system. This is accomplished by connecting the cable labeled

“AUDIO” to the stimulus presentation computer’s headphone port. For assistance identifying this port on a specific stimulus presentation computer, please see the system administrators.

The auditory control box has four knobs and two switches (see Figure 2). The four knobs are labeled “mode,” “level,” “source,” and “patient.” The two switches are labeled “power” and “ptt.” The “mode” knob controls the way input to the auditory control box is processed. It has four possible settings: “clin,” “f,” “test,” and “fx10.” The default position of this knob is “clin.” This should be changed only if there is a need to test the system or use low level audio input sources. See the system administrators if you have reason to believe this will be relevant to your experiment. The “level” knob controls the volume at which the participant hears the auditory presentation and has settings ranging from 1 to 9. I2AT recommends using a setting of 5 as default and adjusting slowly up or down if necessary. The “source” knob controls the input source for the auditory control box and has settings ranging from A to E. The default setting of this knob is “b,” indicating that the stimulus presentation computer will be inputting non-equalized audio into the system. The system administrators can assist you if you have a need to use equalized audio. The final knob, “patient,” controls the volume at which the researcher hears the participant talking from the MRI room and has settings ranging from 1 to 9. I2AT recommends using a setting of 3 as default and adjusting slowly up or down if necessary. A lower level is recommended for this knob because sound from the magnet itself will also be transmitted to the auditory control box.

The “power” switch controls if the auditory control box is on or off. When initially turned on, the box will emit a test tone. In order to stop the tone, the “ptt” switch must be depressed and released. The “ptt” or “push to talk” switch controls when the participant receives auditory input from the auditory control box source (e.g., the stimulus presentation computer) or the microphone attached to the box itself. When lifted, the “ptt” switch will mute all audio for the participant, and when depressed it will enable the researcher to speak to the participant through the attached microphone. In the middle position, the participant will hear the auditory source (i.e., the auditory stimulus presentation) as normal. If the “ptt” switch is depressed while the power is turned on, the initial test tone will not be emitted by the auditory control box.

Once the cable is in place and the settings are adjusted appropriately, the auditory control box should be turned on.

Finalizing setup

Before executing the steps in this portion of the auditory presentation setup, please be sure to refer to the initial setup portions of the visual presentation and button-press response sections if they are necessary for the experiment in question.

Once the “AUDIO” cable is in place and the auditory control box has been turned on, the stimulus presentation computer should be turned on. Before placing the headphones on the participant, a researcher should verify that the headphones are receiving the

appropriate inputs from the stimulus presentation computer and that the volume levels are set appropriately.

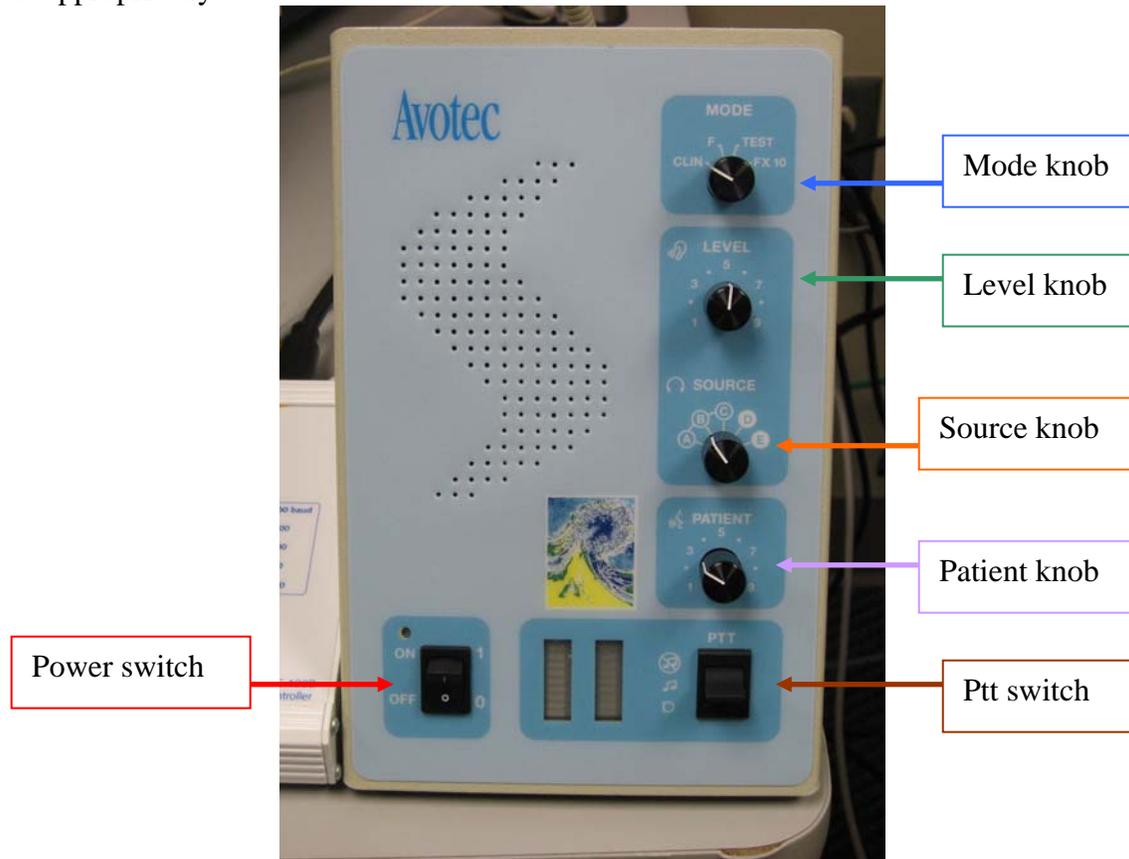


Figure 2. Auditory control box.

Button-press responses

Overview of steps

- check for presence of serial port or USB port on stimulus presentation computer
- if there is a serial port, plug “RESPONSE” cable into serial port
- if there is no serial port, use the Keyspan USB-to-Serial adaptor to connect the “RESPONSE” cable to a USB port
- install software for the adaptor if necessary
- set response pad mode and speed

Initial setup

In order to collect button-press responses from participants, an MRI compatible response pad system is housed at I2AT. This system has four components of interest to researchers: a set of two 2-button response pads, a response control box, a serial input cable, and a USB-to-Serial adaptor.

The response control box will receive input from the response pads, and send this input to the stimulus presentation computer (e.g., the researcher's laptop). In order to receive input from the response control box, the stimulus presentation computer must be connected to the system. This is accomplished by connecting the cable labeled "RESPONSE" to the stimulus presentation computer. If the stimulus presentation computer has a free serial port, the "RESPONSE" cable can plug directly into that port. If there is no free serial port, then a USB port must be used instead. In this case, the USB-to-Serial adaptor must also be used. One end of the adaptor plugs into the "RESPONSE" cable, while the other end plugs into the stimulus presentation computer's USB port. If the adaptor is used, software must be installed specifically on the stimulus presentation computer to make the adaptor function properly. For assistance identifying ports on a specific stimulus presentation computer or for assistance installing the necessary software, please see the system administrators.

Once the "RESPONSE" cable is in place, the response control box will need to be set up for the experiment in question. There are two settings that can be controlled from the back of the response control box (see Figure 3): mode and speed. The mode should be set to a specific setting depending on the software being used on the stimulus presentation computer. If E-Prime is being used, press the mode adjustment button until the LED next to "E-Prime / MEL" is lit (see Figure 4); if using SuperLab, press mode adjustment until the LED next to "Lumina" is lit. There are two modes available for use with Presentation: Cedrus RB Series, and ASCII / MEDx. The mode selected should be determined by the settings in your Presentation-based experiment. Other software may use specific modes. See the system administrators for help if necessary. I2AT recommends that the speed on the response control box be set to 9600. This should only be changed if using a different baud rate for data input. See the system administrators if you have questions about the speed setting.

When properly connected, the response control box will show when a response pad button is pressed or a scanner trigger occurs by lighting one of the button-response LED lights.

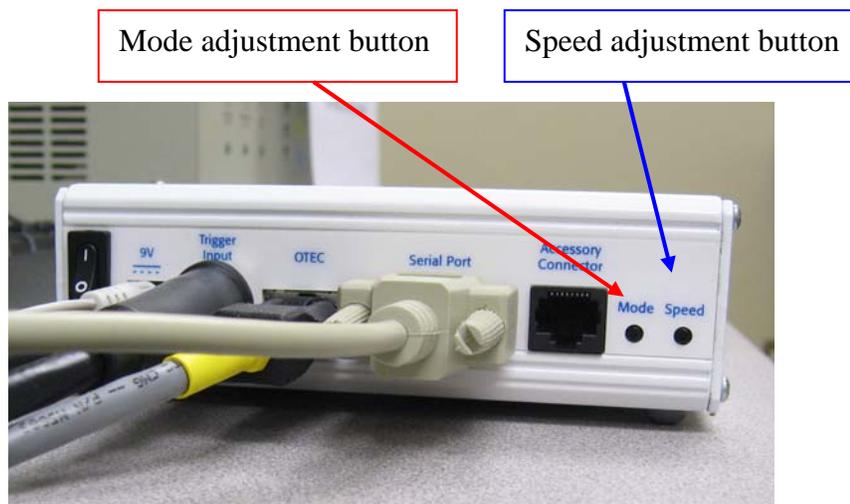


Figure 3. Back of response control box.

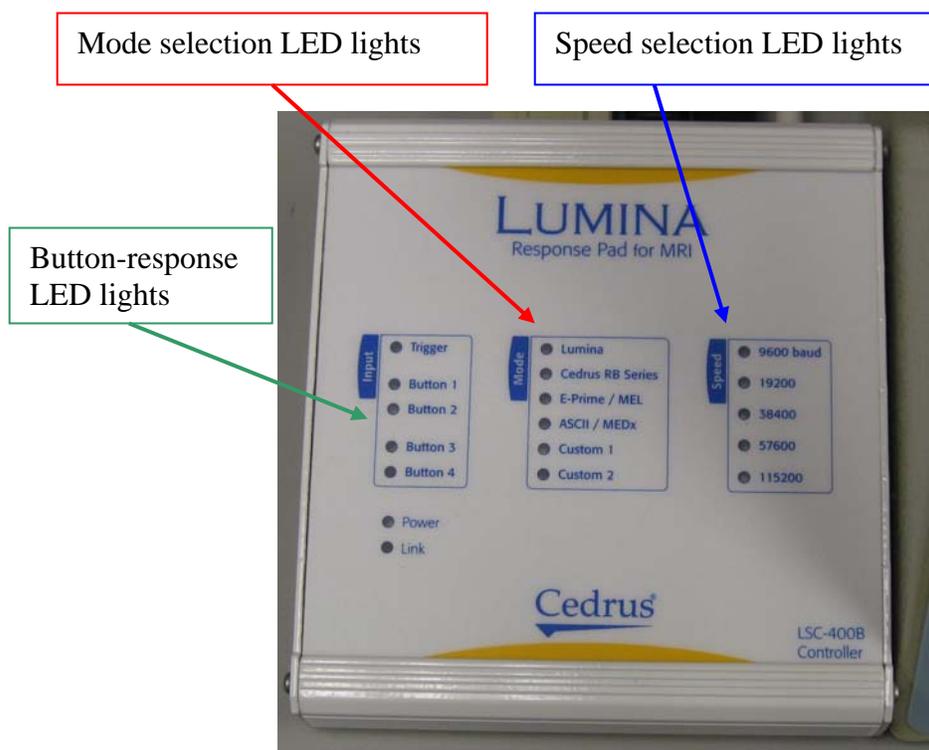


Figure 4. Front of response control box.

Finalizing setup

Once the “RESPONSE” cable is in place, the stimulus presentation computer should be turned on. If any of the button-response LED lights remain lit, this indicates that either one of the buttons on the response pads is being held in, or that there is a problem with the MRI trigger cable. If the lights remain on after checking the response pads for depressed buttons, see the system administrator for assistance.