

3.3. SyncBox

The SyncBox is designed for synchronization of stimulus presentation and MR image acquisition in fMRI experiments. The SyncBox receives the trigger signals coming from the MR scanner during image acquisition and forwards the trigger signal to the PC presenting the stimuli, giving the user full flexibility with respect to how the trigger signal from the MR scanner is transmitted to the PC. User settings can be entered manually through the user interface on the SyncBox unit, or automatically via the stimulus presentation program.

The SyncBox can also be operated in simulation mode. This is useful for the development and testing of experimental paradigms outside the MR environment. By simulating the trigger signals coming from the MR scanner during image acquisition, paradigms can be developed and tested in the office, minimizing the need for expensive MR scanner time.

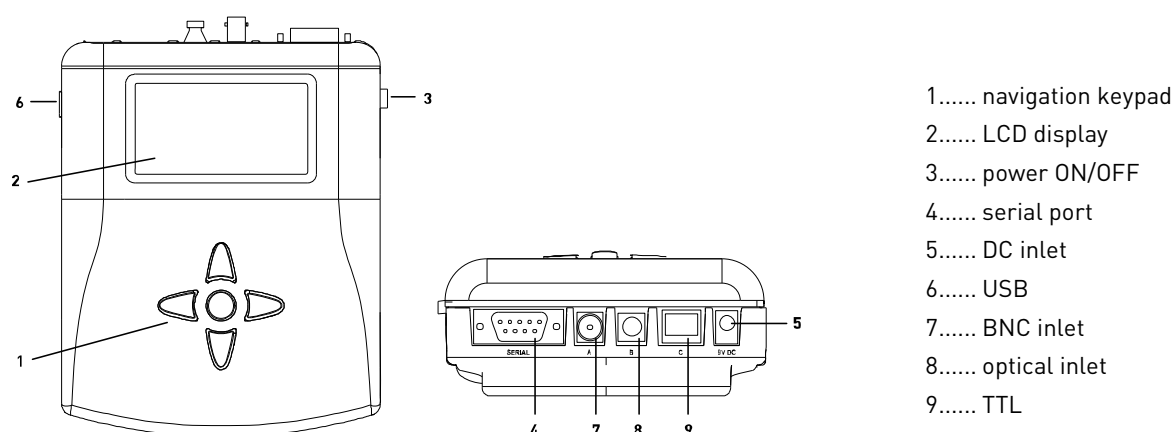


Figure 21: Top and back view of the SyncBox.

Turn on the SyncBox using the power ON/OFF (3) switch on the right side of the SyncBox unit.

The 5-button navigation keypad (1) allows for easy navigation through the menu. Use the up and down, right and left arrows to navigate through the menu. The round button in the middle is used as “enter” or “confirm”.

3.3.1. Interfacing the SyncBox with the stimulus presentation PC

USB Interface

When connected to the stimulus presentation PC via USB, the SyncBox can be recognized by the PC as a Human Interface Device (HID) or as a serial port. The two different modes - HID or serial interface - are chosen in the Options menu (for more details, refer to section 3.3.2).

HID mode

When connected via USB, the SyncBox will be recognized by the PC as a Human Interface Device (HID)/keyboard. No drivers are needed. The letter “s” will be sent to the stimulus presentation PC when a trigger signal is received from the MR scanner (for more details on specifying the signal sent to the stimulus presentation PC, refer to section 3.3.2).

For OS language settings other than English, the trigger signal from the SyncBox may correspond to a different letter. You can check this by opening a text editor (e.g., Notepad) and operating the SyncBox in Simulation mode. The letter corresponding to the trigger signal will appear in your document.

Serial mode

To operate the SyncBox in serial mode via USB a driver is required. This driver is included on the User Manual CD. Operating the SyncBox in serial mode allows for two-way communication between the

SyncBox and the PC, which is required for operating the SyncBox in Computer mode (for more details on operating the SyncBox in Computer mode, refer to section 3.3.2).
When operated in serial mode, the ASCII code for the character “s” will be sent to the stimulus presentation PC when a trigger signal is received from the MR scanner. Note that the SyncBox needs to be running (either in Simulation or Synchronization Mode). For more details on specifying the signal sent to the stimulus presentation PC, refer to section 3.3.2.

The settings for the serial port are listed below:

serial interface parameter	setting
bits per second	57600
data bits	8
parity	none
stop bits	1
flow control	none

Parallel Interface

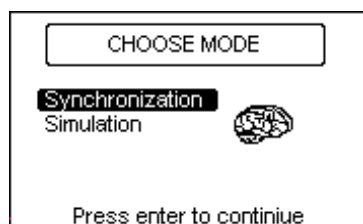
The SyncBox has a standard TTL output for the synchronization signal. The output is “active high”. The signal has a duration of 50 ms and is available on output C. The synchronization signal is located on pin 10 of the Presentation parallel interface cable provided with the system.

Serial Interface

See USB Interface – Serial mode; no additional driver required.

3.3.2.SyncBox Operation Modes

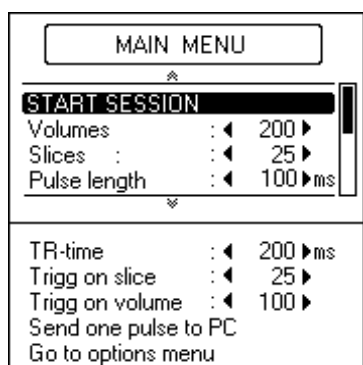
Manual Mode



CHOOSE MODE:

Choosing "Synchronization" will turn the SyncBox into Synchronization mode. The SyncBox will wait for trigger pulses from the scanner. The SyncBox will send trigger pulses to the PC according to your settings in the main menu (see below).

Choosing "Simulation" will turn the SyncBox into Simulation mode. The SyncBox will simulate trigger signals according to the specified settings.



MAIN MENU:

In accordance with your MR acquisition settings, enter the following details:

Volumes: the number of volumes the SyncBox should expect during one session

Slices: the number of slices that one volume consists of

If your MR scanner only sends a trigger signal on each volume, always set this value to 1.

Pulse length: the time the scanner takes to acquire one slice

The value can only be set in Simulation mode. The parameter is removed from the menu in Synchronization mode.

TR-time: the time from the beginning of acquisition of one volume to beginning of acquisition of the next volume

The value can only be set during Simulation mode.

Trigg on slice: SyncBox sends a signal to the PC on specified slices

Pressing the right button when the value is set to 1 you can specify on which slice the SyncBox sends a signal to the PC.

Pressing the left button when the value is set to 1 you will find two more options, "each" and "rand". By selecting "each" the SyncBox will send a signal to the PC on each slice in the selected volumes.

By selecting "rand" the SyncBox will send a signal on an occasional slice in the selected volumes.

If your MR scanner only sends a trigger signal on each volume, always set this value to 1.

Trigg on volume: SyncBox sends a signal to the PC on specified volumes. The SyncBox will send a pulse on the first slice of each volume.

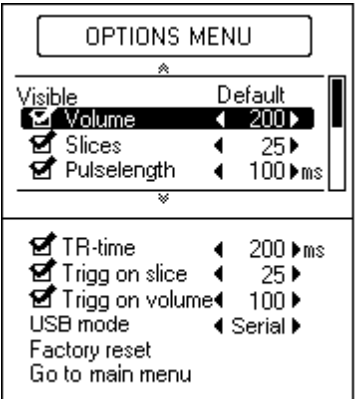
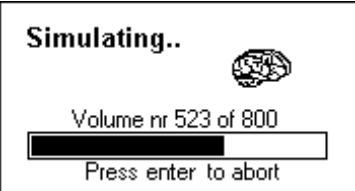
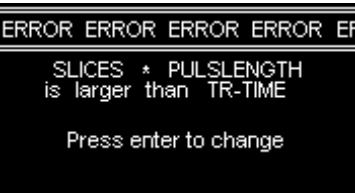
Pressing the right button when the value is set to 1 you can specify on which volume the SyncBox sends a signal to the PC.

Pressing the left button when the value is set to 1 you will find two more options, "each" and "rand". By selecting "each" the SyncBox will send a signal to the PC on each volume. By selecting "rand" the SyncBox will send a signal on an occasional volume.

Press START SESSION to start synchronization/simulation.

Press 'Send one pulse to PC' to check communication with the PC.

Press 'Go to options menu' to open the OPTIONS MENU.

	<p>OPTIONS MENU:</p> <p>In the OPTIONS MENU you can enter the same settings as in the MAIN MENU, with the difference that in the OPTIONS MENU the entered values will be stored as default values. If you want to remove a parameter from the MAIN MENU, you can do this simply by pressing ENTER on it in the OPTIONS MENU.</p> <p>The SyncBox can be operated in two different USB modes – HID and serial. This mode is chosen in OPTIONS MENU (for more details on SyncBox USB Interfacing, refer to section 3.3.1).</p> <p>If you are completely lost press ENTER on the 'Factory reset' line. All values will now be set back to standard factory values. Press 'Go to main menu' to return to the MAIN MENU.</p>
	<p>Press START SESSION to start simulation/synchronization.</p> <p>The chosen mode (synchronization, simulation) will be indicated in the upper left corner of the display.</p> <p>During the session the letters R and S will be displayed in the upper right corner of the display. R indicates that a pulse has been received from the scanner. S indicates that a pulse has been sent to the PC.</p> <p>Press ENTER to abort the simulation/synchronization session.</p>
	<p>If this text appears some of your settings are out of range. The text depends on the inaccurate value. Press ENTER to return to the MAIN MENU, where you can change your settings.</p>

Example: SyncBox in Synchronization mode

Volumes: 200

Slices: 25

Trigg on slice: 1

Trigg on volume: 5

The SyncBox will send a trigger signal to the PC on the first slice of volumes 1, 6, 11, 16, 21,..., 191, 196.

Example: SyncBox in Simulation mode

Volumes: 200

Slices: 25

Pulse length: 100

TR-time: 3000

Trigg on slice: 1

Trigg on volume: 5

The SyncBox will send a trigger signal to the PC on the first slice of volumes 1, 6, 11, 16, 21,..., 191, 196. Each slice will last for 100 ms and the time between acquisition of the first slice of each volume will be 3000 ms.

Computer Mode

The SyncBox can be completely controlled by the PC. By using a Serial Interface all settings, start, and stop can be executed from your stimulus presentation program. For further information please contact support@nordicneurolab.com.