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g.CSP recoveriX extension

USER MANUAL V1.16.00

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TO THE READER

Welcome to the medical and electrical engineering world of g.tec!
Discover the only professional biomedical signal processing platform under MATLAB and Simulink. Your ingenuity finds the appropriate tools in the g.tec elements and systems.
Choose and combine flexibly the elements for biosignal amplification, signal processing and stimulation to perform even real-time feedback.

Our team is prepared to find the better solution for your needs.

Take advantage of our experience!

Dr. Christoph Guger

Dr. Guenter Edlinger

Researcher and Developer

Reduce development time for sophisticated real-time applications from month to hours.
Integrate g.tec's open platform seamlessly into your processing system.
g.tec's rapid prototyping environment encourages your creativity.

Scientist

Open new research fields with amazing feedback experiments.
Process your EEG/ECG/EMG/EOG data with g.tec's biosignal analyzing tools.
Concentrate on your core problems when relying on g.tec's new software features like ICA, AAR or online Hjorth's source derivation.

Study design and data analysis

You are planning an experimental study in the field of brain or life sciences? We can offer consultation in experimental planning, hardware and software selection and can even do the measurements for you. If you have already collected EEG/ECG/EMG/EOG, g.tec can analyze the data starting from artifact control, do feature extraction and prepare the results ready for publication.

Related Products

g.tec provides several biosignal analysis elements that are especially relevant to the kinds of tasks you perform with g.tec Highspeed.

For more detailed information on any of our elements, up-dates or new extensions please visit our homepage www.gtec.at or just send us an email to office@gtec.at

Conventions

| Item | Format | Example |
|------------------|------------------------|----------------------------------------------|
| MATLAB code | Courier | to start Simulink, type simulink |
| String variables | <i>Courier italics</i> | set(P_C, 'PropertyName', ...) |
| Menu items | Boldface | Select Save from the File menu |



ATTENTION



NOTE

Installation and Configuration

This chapter includes the following sections:

[Hardware and Software Requirements](#)

[Installation from a CD](#)

[Files on your Computer](#)

Hardware and Software Requirements

Hardware Requirements

g.CSP recoveriX extension requires a PC compatible desktop or a notebook workstation running Microsoft Windows.

The table below lists optimal settings:

| Hardware | Properties |
|-------------------------|---------------------------------------------------------------------------------|
| CPU | Pentium working at 3000 MHz |
| Harddisk | 100 gigabyte |
| RAM | 8 gigabyte |
| USB 2.0 high speed port | One free USB port for the g.EstimFES stimulator and one for the Hardlock Dongle |
| g.Estim FES RESEARCH | |

Software Requirements

g.CSP recoveriX extension requires g.tec Highspeed On-line Processing, MATLAB, Simulink and Signal Processing Toolbox. Make sure that the g.CSP installation works correctly before installing the g.CSP recoveriX extension software. Depending on your Windows operating system, administrator rights might be necessary for the installation.

| Software | Version |
|-------------------------------|-------------------------------------|
| g.CSP | 2.16.00 |
| g.EstimFES Simulink Interface | 1.16.00 |
| MATLAB | 2015a |
| Simulink | 2015a |
| Signal Processing Blockset | 2015a |
| Windows | Windows 10 Professional Threshold 2 |
| Acrobat Reader | 11.0.04 |
| Microsoft .NET Framework | 4.6.1 |



ATTENTION

It is essential to use the correct MATLAB and Simulink versions! The package will not work correctly if other versions are used.

Installation

Please read Install.pdf for detailed installation information.

Files on your Computer

g.CSP recoveriX extension files - are stored under (it is assumed that the default path setting is used)

```
C:\Users\<username>\Documents\gttec\gCSP\  
recoveriX extension
```

Extension Toolboxes - are stored under (it is assumed that the default path setting is used)

```
C:\Users\<username>\Documents\gttec\gCSP\  
recoveriX extension\Extension Toolboxes
```

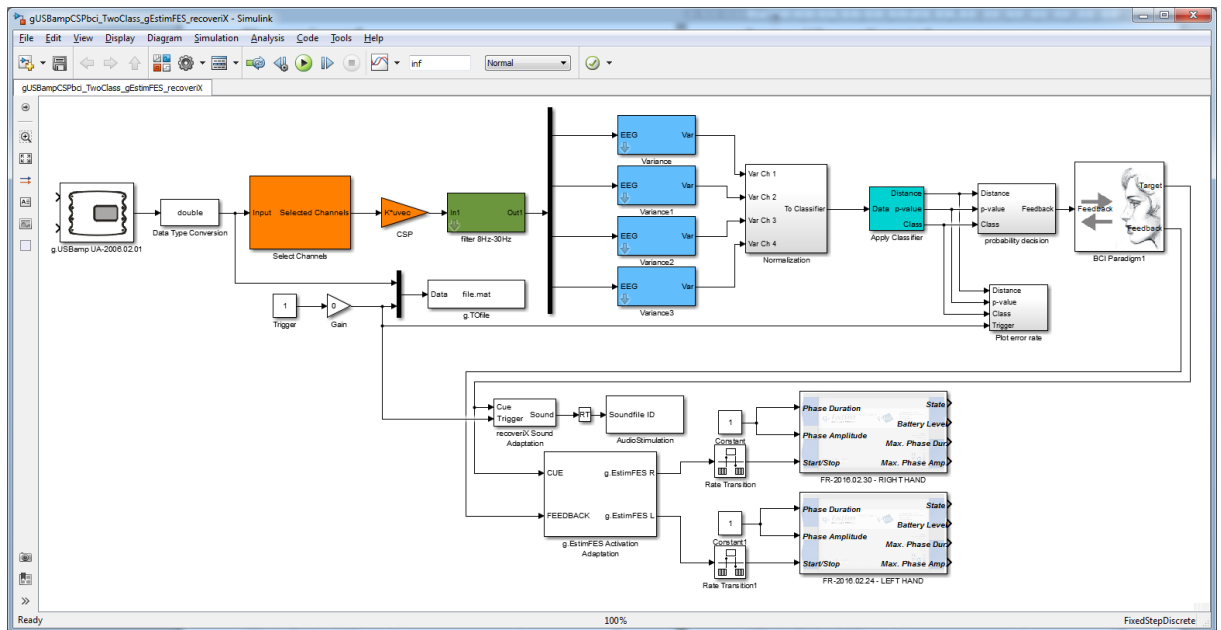
Audio command files - are stored under (it is assumed that the default path setting is used)

```
C:\Users\<username>\Documents\gttec\gCSP\  
recoveriX extension\AudioFiles
```

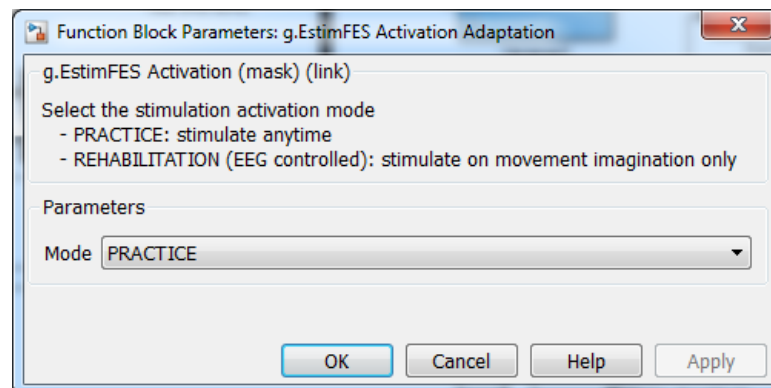
Running g.CSP recoveriX extension

To run the g.CSP recoveriX extension on your system, please perform the following example:

1. Start the MATLAB command window. See your MATLAB documentation if you are not sure how to do this.
2. Open the Simulink model by typing `gUSBampCSPbci_TwoClass_gEstimFES_recoveriX` into the MATLAB command window. This command starts up Simulink and creates the following window:

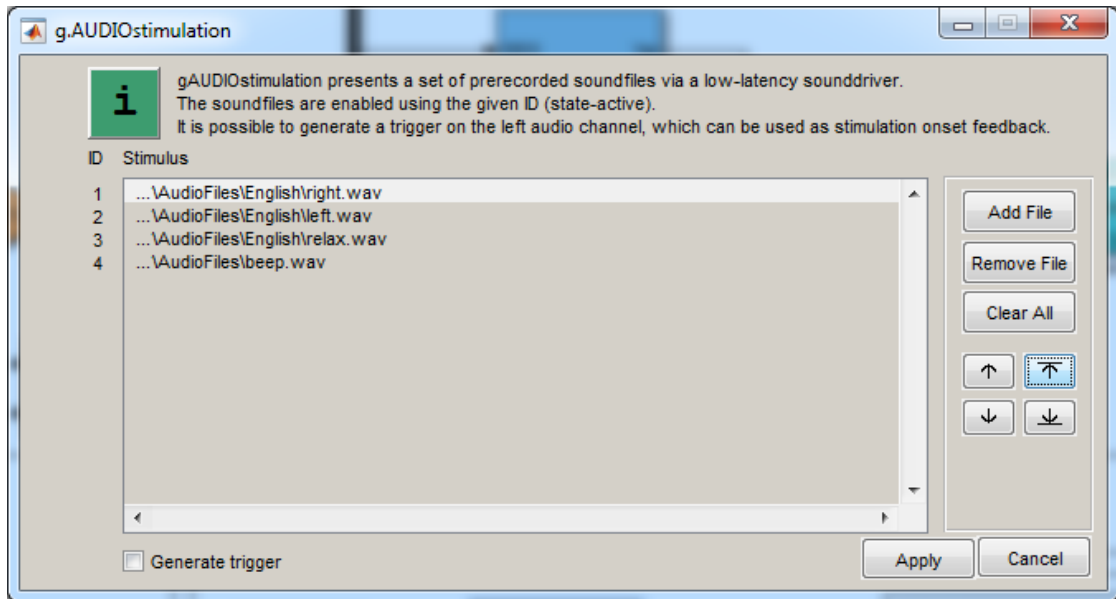


This model extends the g.CSP Simulink model by the activation of g.Estim FES in the desired mode PRACTICE or REHABILITATION (EEG controlled).



In PRACTICE mode the hand of the current trial will be stimulated anytime. For EEG controlled stimulation use the REHABILITATION mode where the hand of the current trial will be stimulation only if a movement imagination was detected.

Double click the *AudioSimulation* block to set the commands for the experimental paradigm.



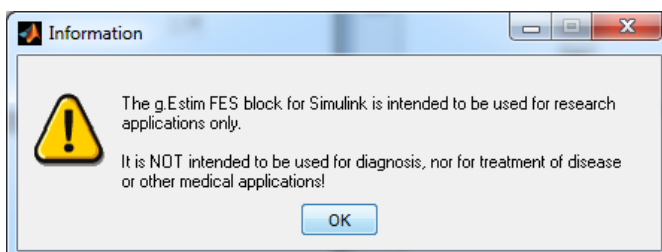
The audio files are located in the AudioFiles subfolder of the g.CSP recoveriX extension folder. It is essential to add the files in the order shown in the dialog above (right – left – relax – beep).

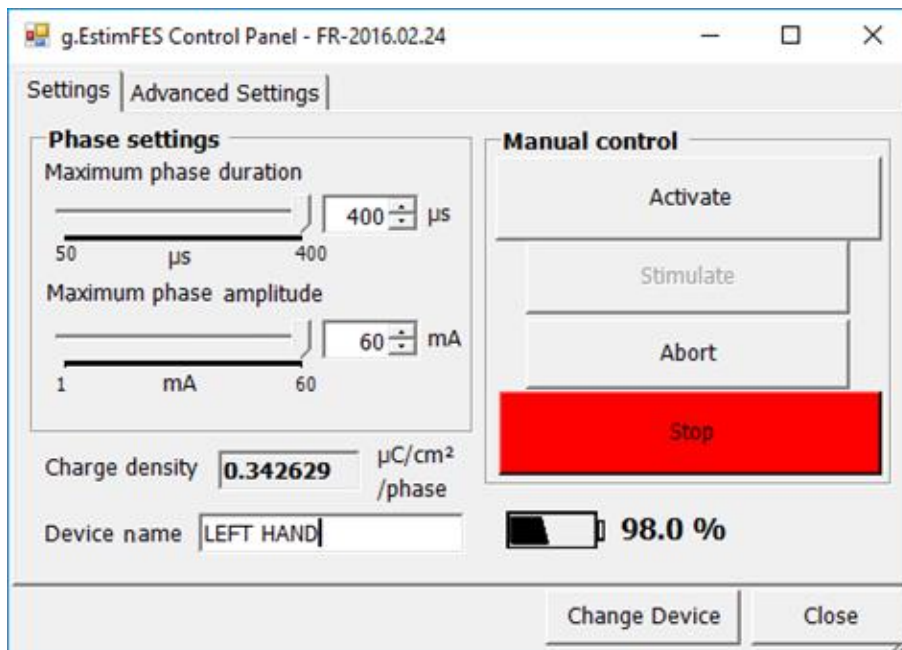
It is essential to rename the beepTone.mat file of the g.CSP installation. Otherwise the sound card output will be occupied by the MATLAB figure and you will not hear any commands.

To disable the command output, either comment out the block (by right click the block and select Comment Out) or use the gUSBampCSPbci_TwoClass_gEstimFES Simulink model.

3. Before configuring g.EstimFES block and starting the model, make sure that g.EstimFES electrical stimulator is set up correctly according to the Instructions for Use. The power LED on the electrical stimulator must be on.
4. Double click on the **g.EstimFES** block.

The message box informs you about the intended use of the software product.





The configuration shown above sets the maximum phase duration to 400 μs and the maximum phase amplitude to 60 mA.

If more g.EstimFES are used within a Simulink model, set a Device name to make identification of the device easier.

5. Apply changes by clicking **CLOSE**.
6. Start the model by pressing the **Start** button in the Simulink model



7. To view the signals double click on the **g.SCOPE** block. Please see the g.tec Highspeed Library Description for more information on g.SCOPE block.
8. Stop the model with the **Stop** button and close it



Help

g.CSP recoveriX extension provides a printable documentation.

The printable documentation is stored under

```
C:\Users\<username>\Documents\gttec\gCSP\  
recoveriX extension\
```

named gCSP_recoveriX_extension.pdf.

Use Acrobat Reader to view the documentation.

Product Page

Please visit our homepage www.gtec.at for

- Update announcements
- Downloads
- Troubleshooting
- Additional demonstrations



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