NIC

Neuroelectrics Instrument Controller

MatNIC2

Matlab Interface for the remote NIC control
Version 1.3

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Contents

What is the MatNIC?

> MatNIC is a set of Matlab functions to control NE devices through NIC

> The NIC software includes a TCP/IP server which clients might connect to in order to remotely control the Enobio/StarStim device. For Starstim you should purchase MatNIC; for Enobio we provide a free version of MatNIC
> To use MatNIC2 you need NIC2
> This server is running on the TCP port 1235 of the machine where the NIC software is executed.

> In order to remotely control the Enobio/StarStim device a protocol is defined between the server and the client.
> We provide a set of matlab functions along with a demo client that implements this protocol. Extract from those codes are provided herafter.

Controlling ENOBIO

> When controlling an Enobio device only two commands might be issued from MatNIC: start and stop the EEG streaming. In order to do so the client needs to successfully connect to the NIC port:

  • [ret, status, socket] = MatNICConnect(host);

> The host parameter corresponds to the host name (or ip address) of the machine where the NIC software is running. The ret variable is set to a negative number if the connection was not succesful.
> The socket variable is an identification of the connection that shall be passed to the other Matlab functions in order to perform the desired actions.

> To load a protocol, you need first to manually create the desired templates in NIC. See the NIC manual if needed and finally call the load Protocol function:

  • ret = MatNICLoadProtocol (ProtocolName, socket);

> The function returns a negative value when it is not possible to send the command to the TCP/IP server.
> The NIC TCP/IP server reports when the device effectively starts sending the EEG streaming by sending a status command. This command shall be read using the following funtion:

  • [ret, status] = MatNICQueryStatus(socket);

Controlling ENOBIO

> The ret variable is set to a negative value when it is not possible to read any status from the provided socket. The function sets the status variable with the read value. The status value corresponding to the start of the EEG is 0xF2. Refer to the documentation of the function for further information about all the possible status that the server might send. When the EEG streaming is ON the data can be captured through a separated server which runs on the port 1234. The 8/20/32 channel samples are sent in 4 bytes in two's complement. The MSB byte of each sample is sent first.

> When EEG streaming is ON the data can be captured through a separated server which runs on the port 1234.

> In order to stop the streaming of EEG the following function might be used:

- [ret] = MatNICUnloadProtocol (socket)

Controlling STARSTIM

> To start a Stimulation protocol or Stimulation and EEG protocol simultaneously,you need first to manually create the desired templates in NIC. See the NIC manual if needed.

> To remotely control a stimulation session you need first to connect to the TCP/IP server port:

  • [ret, socket] = MatNICConnect(host);

> The host parameter corresponds to the host name (or ip address) of the machine where the NIC software is running. The ret variable is set to a negative number if the connection was not succesful. The socket variable is an identification of the connection that shall be passed to the other Matlab functions in order to perform the desired actions.

> Once connected the name of a stimulation template shall be specified through the following function:

  • ret = MatNICLoadTemplate(templateName, socket);

> The templateName parameter shall specify the name of the template to be loaded. If this template does not exist on NIC, then the function will return a negative value. A negative value might be returned as well if the authorization to perform the remote control of the stimulation session is not given. The NIC user gives this authorization by accepting the dialog that the NIC software presents when the request to load a template is received. If the NIC user accepts the remote control session, the template is loaded so the function returns succesfully with a non-negative value.

Controlling STARSTIM

> When all the parameters that are specified on the template are configured on the StarStim device the server sends the stimulation ready status whose value is 0xFC. This status might be read with the following function:

- [ret, status] = MatNICQueryStatus(socket);

Controlling STARSTIM

> Once this status is received the client might either start the stimulation or abort the process. For starting the stimulation use the following function:

- ret] = MatNICStartProtocol (socket)

> As it has already mentioned the socket variable passed as parameter shall be the value that is returned by the MatNICConnect function. The function returns a negative value when it is not possible to send the command to the NIC.

> The TCP/IP reports when the device effectively starts the stimulation by sending a status command (0xFD) that might be read with the MatNICQueryStatus function. If the loaded template configures some of the channels to perform EEG recording then the status corresponding to the starting of the EEG streaming will be received too.

> Once the programmed stimulation finishes the corresponding status value (0xFE) is sent by the TCP/IP server. After finishing the stimulation the system prepares to receive a new stimulation command. The MatNIC client can find out when the system is ready for a new stimulation request by quering the device status (which should be 0xFC) which migh be read with the MatNICQueryStatus funtion.

# Controlling STARSTIM

> While stimulation is ongoing, the tDCS amplitude can be modified online:

  • ret = MaTNICOnlineAtdcsChange(amplitudeArray, channelArray, transition, socket);

> When the new value of amplitude is set, the amplitude is modified at the selected stimulation channel and it takes the transition time entered (in ms) to change from the current amplitude to the new one
> To be able to use this function, NIC version 1.2.12 and MatNIC 1.7 or higher should be used

> During the Stimulation session, the tACs amplitude can be modified online:

  • ret = MatNICOnlineAtacsChange(amplitudeArray, channelArray, transition, socket);

> When the new value of amplitude is set, the amplitude is modified at the selected stimulation channel and it takes the transition time entered (in ms) to change from the current amplitude to the new one
> To be able to use this function, NIC version 1.2.12 and MatNIC 1.7 or higher should be used

> During the Stimulation session, the tACs frequency can be modified online:

  • ret = MatNICFtacsChange(frequencyArray,channelArray, socket);

> When the new value of frequency is set, the stimulation frequency is modified at all the stimulation channels
> To be able to use this function, NIC version 1.2.12 and MatNIC 1.7 or higher should be used

Controlling STARSTIM

> During the Stimulation session, the tACS phase can be modified online:

- ret = MatNICOnlinePtacsChange(phaseArray,channelArray, socket);

> The socket parameters is the value obtained on the MatNICConnect function. The function returns a negative value when it is not possible to send the command to the TCP/IP server.

> During the Stimulation session, the tRNS amplitude can be modified online:

- ret = MatNICOnlineAtrnsChange(amplitudeArray,channelArray, socket);

> The socket parameters is the value obtained on the MatNICConnect function. The function returns a negative value when it is not possible to send the command to the TCP/IP server.

> At any moment the stimulation might be aborted. To do so the following function is available:

- [ret] = MatNICAbortProtocol (socket)

> The socket parameters is the value obtained on the MatNICConnect function. The function returns a negative value when it is not possible to send the command to the NIC.

> As a result of requesting to abort the stimulation session the TCP/IP disconnects the client so if the clients might want to start a new session it shall connect again by the MatNICConnect function and use the new socket value.

> For further information refer to the MatNIC code and the files with the Matlab functions that have been mentioned above.

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http://www.neuroelectrics.com
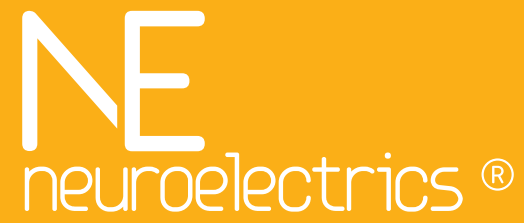
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