Manufacturer
630 Komas Drive | Suite 200
Salt Lake City | UT 84108 | USA
P +1 (801) 582-5533 | F +1 (801) 582-1509
www.blackrockmicro.com

CereStim API

Instructions for Use

Revision 2.00 / LB-900 – CereStim API IFU – 2020/08

Table of Contents

What This Manual Covers

Inside this manual, you will find information on the CereStim API. This API is offered as a way to interface with the CereStim hardware using your own custom code so that it can be controlled programmatically within existing experimental designs or new custom applications. Since the Stim Manager software is built on top of this API, users can expect that every feature that the Graphical User Interface is capable of is also possible using the methods in this manual.

System Requirements

The specifications listed below are the minimum required for the software to run as intended.

- Microsoft Windows 7 (32-bit or 64-bit)
- AMD or Intel 2.0GHz Quad Core CPU
- 4 GB of RAM
- USB 2.0 or 3.0 Port

Installation

To use the CereStim API, it must first be downloaded from www.blackrockmicro.com. The downloaded file will include both the C++ and Matlab versions of the API.

MATLAB API (Stimmex) Installation

The MATLAB API requires one of the following files, depending on whether you are using a 32-bit or 64-bit MATLAB version, as well as the “cerestim96.m” file:

Stimmex.mexw32

Stimmex.mexw64

After placing the file, or the downloaded Stimmex API folder, in the location of your choice, add the file/folder to MATLAB’s search path to ensure that MATLAB can always find the file when called upon.

The exact method of adding to MATLAB’s search path may differ between versions of MATLAB – refer to your specific version’s documents.

C++ API Installation

We suggest using Microsoft Visual Studio for working with the C++ API. While the steps will differ significantly depending on how you plan to integrate the application, it is suggested to choose Empty Project as the project type and then follow along with example source files downloaded from www.blackrockmicro.com. The BStimAPI libraries should be loaded into your project as existing resources, and the “BStimulator.h” header as an existing header file.

Use Cases

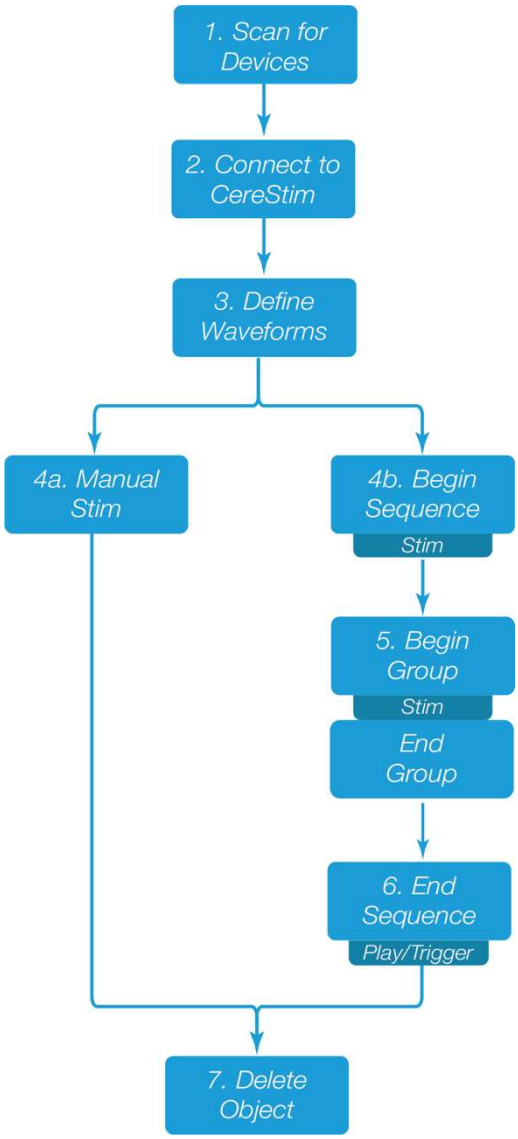
The CereStim API has the following typical use cases:

- Update stimulation waveforms or programs during the course of an experiment
- Integrate stimulation into an existing experimental control scheme
- Create custom applications that can control the CereStim hardware

Getting Started

Generally, it is easiest to start with an example file downloaded from www.blackrockmicro.com and modify it to suit your needs. An understanding of the basic paradigm of the API is useful. A generic description of API usage is shown below without language-specific examples. This can be used as a guide for the order in which API commands are used in your own programs.

1. Every stimulation program always begins with opening connection to the stimulator(s). You must first scan for the available devices and select the one that you would like to connect to.
2. Connect to the available CereStim and make an object.
3. Every program or manual stimulus will require defining at least one waveform, also referred to as stim pattern. These get saved to the CereStim's internal memory to get used at the user's discretion.
4. At this point, you can either a) manually execute this Stim Pattern using the manualStim method, or b) you can create a more complex program for later execution. This is done using the beginSequence and endSequence methods.
5. Stimulation calls between the beginSequence and endSequence methods are executed in that order. If you want your saved waveforms to be delivered all at once, use the beginGroup and endGroup methods between the beginSequence and endSequence methods. Stimulation calls between the beginGroup and endGroup methods are executed simultaneously.
6. When you are ready to execute the program, you can use the play or trigger methods. The play method will execute your program, while the trigger method will enable trigger mode on the CereStim, causing the program to execute when the device receives a TTL pulse on its trigger input.
7. To properly end your stimulation program, always clear the stimulator object from memory using the API.



To learn more about the available methods, type 'help cerestim96' in MATLAB, or look through the header files in C++.

Conventions and Terminology

Stim Pattern	A biphasic pulse repeated a specified number of times. Sometimes referred to as a stim “waveform.”
Cerestim	This is the name of the CereStim object in the API workspace for this IFU. The name of this object is arbitrary and can be named to the user’s liking.
Program	A set of stim patterns executed in a specified order.
< >	Used to denote optional parameters.
<key, value>	Pairs are optional; some pairs do not require values. From left to right parameters will override previous ones or combine with them if possible.

Commands

cerestim96

This command is needed to create a stimulator object in the workspace.

USE

[CereStim_object] = cerestim96()

INPUTS

None	None

OUTPUTS

CereStim_object	A stimulator object to be used to control the stimulator through the API.

EXAMPLES

```
% Create a stimulator object named "cerestim." This naming
% convention is used throughout the document
cerestim = cerestim96();
```

scanForDevices

The scanForDevices method scans USB ports to look for attached stimulators and returns a list of devices. It must be called before selectDevice, and both methods must be called before connecting to the CereStim.

USE

[Serials] = cerestim.scanForDevices()

INPUTS

None None

OUTPUTS

Serials A list of serial numbers of stimulators plugged into the computer, or a single serial number if only one Cerestim is attached

EXAMPLES

```
% Return list of connected serials
SerialNumbers = cerestim.scanForDevices();
```

selectDevice

Selects a stimulator from the list obtained from scanForDevices. This selected device is associated with the stimulator object, and will be connected to when the connect method is executed.

USE

cerestim.selectDevice(SerialNumber)

INPUTS

Serial	A serial number from the list obtained by scanForDevices

OUTPUTS

None	None

EXAMPLES

MATLAB

```
% Connect to the first stimulator in the array 'Serials'
cerestim.selectDevice(Serials(1));
```

connect

Connects to the selected CereStim stimulator in selectDevice. This function has multiple optional parameters that, generally, do not need to be accessed. These are primarily used for debugging purposes by Blackrock Support and Engineering, so these can be left to their default values.

USE

cerestim.connect(<Interface>,<USBParams>)

INPUTS

<Interface>	0: USB (Default) 1: USB (Reserved)
<USBParams>	A three element array [pid timeout vid] where: pid = Product ID timeout = Time (ms) to connect before timeout vid = Vendor ID

OUTPUTS

None	None

EXAMPLES

MATLAB

```
% Connect through the default method
cerestim.connect(0);
```

isConnected

Tests whether the API is connected to a physical CereStim device. This can be used to ensure that there is no connection failures or disconnections that have occurred. Useful for ensuring that no commands are issued to the interface after a connection failure, to prevent program crashes.

USE

Status = cerestim.isConnected()

INPUTS

None	None

OUTPUTS

Status	0: Not Connected
	1: Connected

EXAMPLES

```
% Check the connection status of the CereStim
status = cerestim.isConnected();
```

disconnect

Disconnects the connected stimulator. This function should be called whenever you are finished using the stimulator and should be called before connecting to the stimulator. Failing to disconnect and then creating a new a stimulator object will prevent the new stimulator object from being able to connect to the stimulator.

USE

cerestim.disconnect()

INPUTS

None	None

OUTPUTS

None	None

EXAMPLES

```
% Disconnects the CereStim
cerestim.disconnect();
```

libraryVersion

Prints the current version of the API that is being used. This is useful for ensuring that libraries are up to date and knowing which version of the library the code is depending on. Since this device prints the libraryVersion, it does not require an output.

USE

cerestim.libraryVersion()

INPUTS

None	None

OUTPUTS

None	None

EXAMPLES

```
% Print the current library version
cerestim.libraryVersion();
```

deviceInfo

Returns information about the connected device. Will return a structure containing the serial number, firmware version of the motherboard, protocol version that the motherboard is using with the current modules, the status of the modules, and firmware version of the current modules.

USE

DeviceInfo = cerestim.deviceInfo()

INPUTS

None	None

OUTPUTS

DeviceInfo	A struct containing the serial number, firmware version of the motherboard, protocol version that the motherboard is using with the current modules, module status, and current module firmware version

EXAMPLES

```
% Get information about the device
DeviceInfo = cerestim.DeviceInfo();
```

getHardwareValues

Reads the hardware values that are set in the stimulator. For safety and reliability reasons, values are stored in the CereStim.

USE

Values = cerestim.getHardwareValues()

INPUTS

None	None

OUTPUTS

Values	A structure containing max phase amplitude (uA), max charge (pC), max interphase(uS), max compliance voltage (V), max frequency (Hz), minimum compliance voltage (V), minimum frequency (Hz), number of modules installed, and max phase width (uS)

EXAMPLES

```
% Get information about current hardware and limits
Values = cerestim.getHardwareValues();
```

getInterface

Checks what interface type is being used for the connection to the CereStim96. Currently USB is the only available interface.

USE

Type = cerestim.getInterface()

INPUTS

None	None

OUTPUTS

Type	0: Default
	1: USB

EXAMPLES

```
% Check which interface type the CereStim is using
Type = cerestim.getInterface();
```

usbAddress

Returns the USB address of the connected device.

USE

Address = cerestim.usbAddress()

INPUTS

None	None

OUTPUTS

Address	The USB address that the stimulator is attached to.

EXAMPLES

```
% Check which interface type the CereStim is using
Type = cerestim.usbAddress();
```

isSafetyDisabled

Reports whether safety limits in the CereStim firmware are disabled. Safety limits can only be disabled by Blackrock personnel. If you have a device with disabled safety limits, please contact support@blackrockmicro.com.

USE

SafetyStatus = cerestim.isSafetyDisabled()

INPUTS

None	None

OUTPUTS

SafetyStatus	0: Safety limits are enabled.
	1: Safety limits are disabled.

EXAMPLES

```
% Check to see if the device has safety limits enabled
SafetyStatus = cerestim.isSafetyDisabled();
```

isLocked

Reports the lock status of the device. The device may be locked down for two reasons: if the number of detected current modules doesn't match the hardware configuration or if the hardware has not been configured. The first situation can occur if the device was programmed incorrectly or if a board in the device has become loose. The second situation can occur if the device was reprogrammed, but programming was not finished. If your device is locked down, please contact support@blackrockmicro.com.

USE

LockedStatus = cerestim.isLocked()

INPUTS

None	None

OUTPUTS

LockedStatus	0: The device is not locked
	1: The device is locked

EXAMPLES

```
% Check whether the CereStim hardware is locked
LockedStatus = cerestim.isLocked();
```

getMinMaxAmplitude

Returns the minimum and maximum amplitudes allowed for stimulation.

USE

[Minimum, Maximum] = cerestim.getMinMaxAmplitude()

INPUTS

None	None

OUTPUTS

Minimum	The minimum amplitude allowed for stimulation
Maximum	The maximum amplitude allowed for stimulation

EXAMPLES

```
% Check the allowed amplitude ranges for stimulation
[MinAmp MaxAmp] = cerestim.getMinMaxAmplitude();
```

testModules

Reports the status of each module and the voltage measured during a known stimulation. This serves as a diagnostic tool to identify bad output voltage levels of the stimulator. The voltage levels are taken during a biphasic waveform (config_0): before stimulus, during amplitude 1, during interphase, during amplitude 2, and during interpulse over an internal test circuit.

USE

ModuleStruct = cerestim.testModules()

INPUTS

None	None

OUTPUTS

ModuleStruct	A struct containing the status, according to the chart below, as well as a 2D array with 5 voltage measurements, in millivolts, for each module: 0: Unavailable 1: Enabled 2: Disabled 3: Normal Voltage Levels 4: Voltage Levels Below Normal

EXAMPLES

```
% Check module status
ModuleStatus = cerestim.testModules();
```

testElectrodes

Returns the impedance of each electrode at 1kHz. It also returns the voltage measured at five locations during a known stimulation. The voltage levels are taken during a biphasic waveform (config_0): before stimulus, during amplitude 1, during interphase, during amplitude 2, and during interpulse.

USE

ElectrodeStruct = cerestim.testElectrodes()

INPUTS

None	None

OUTPUTS

ElectrodeStruct	A struct containing the estimated impedance values as well as a 2D array containing the five voltage measurements, in millivolts, for each electrode

EXAMPLES

```
% Test electrode impedance
ElectrodeStruct = cerestim.testElectrodes();
```

measureOutputVoltage

Returns the voltage measured at five locations during a known stimulation. The voltage levels are taken during a biphasic waveform (config_0): before stimulus, during amplitude 1, during interphase, during amplitude 2, and during interpulse.

USE

Measurements = cerestim.measureOutputVoltage(Module, Electrode)

INPUTS

Module	The current module (0-15) that should send the stimulation
Electrode	The electrode to which the stimulation should be sent (1-96)

OUTPUTS

Measurements	A five member array of voltage measurements, in millivolts, at the five locations in the known stimulus waveform

EXAMPLES

```
% Check voltages on a given electrode
VoltageMeasures = cerestim.measureOutputVoltage();
```

disableModule

Disables the selected modules for stimulation. This can be used by Blackrock Support for troubleshooting, or it may be used to limit the possible number of simultaneous stimulations.

USE

cerestim.disableModule(ModuleList)

INPUTS

ModuleList	An array of module numbers (1-16) to be disabled

OUTPUTS

None	None

EXAMPLES

```
% Disable the first, fourth, and sixteenth modules
cerestim.disableModule([1 4 16]);
```

enableModule

Enables the selected modules for stimulation.

USE

cerestim.enableModule(ModuleList)

INPUTS

ModuleList	An array of module numbers (1-16) to be enabled

OUTPUTS

None	None

EXAMPLES

```
% Enable the first, fourth, and sixteenth modules
cerestim.enableModule([1 4 16]);
```

maxOutputVoltage

Limits the maximum output voltage that can be delivered during stimulation. Reads the specified maximum output voltage if no inputs are used.

USE

<MaxOutput> = cerestim.maxOutputVoltage(<VoltageIndex>)

INPUTS

VoltageIndex	Voltage level selection index, based on the following list:
	7: 4.7 V
	8: 5.3 V
	9: 5.9 V
	10: 6.5 V
	11: 7.1 V
	12: 7.7 V
	13: 8.3 V
	14: 8.9 V
	15: 9.5 V

OUTPUTS

<MaxOutput>	The currently set maximum output voltage in millivolts

EXAMPLES

```
% Limit the maximum output voltage to 7.1V
cerestim.maxOutputVoltage(11);

% Check the maximum output voltage
MaxOutputVoltage = cerestim.maxOutputVoltage();
```

stimulusMaxValue

Sets upper limits for stimulation parameters and reads current limits. If no inputs are provided, the current limits are read and returned as an output.

USE

<LimitsStructure> =
cerestim.stimulusMaxValue(<Voltage,Amplitude,PhaseCharge,Frequency>)

INPUTS

<Voltage>	The maximum voltage, using the index in maxOutputVoltage, allowed during stimulation
<Amplitude>	The maximum current, in microamps, allowed during stimulation
<PhaseCharge>	The maximum charge, in picocoulombs, allowed per phase
<Frequency>	The maximum allowed stimulation frequency, in hertz

OUTPUTS

<LimitsStructure>	A structure containing the information described under inputs

EXAMPLES

```
% Limit the maximum outputs to 9.5V, 9000 uA, 1000000
% pC, and 1000 Hz
cerestim.stimulusMaxValue(15,9000,1000000,1000);

% Check the maximum outputs
MaxOutputVoltage = cerestim.stimulusMaxValue();
```

updateMap

Maps the connection of each channel to its corresponding electrode number.

USE

cerestim.updateMap(BankA, BankB, BankC)

INPUTS

BankA	Array of 32 elements where the index represents the channel (1-32), and the value at each position is the electrode number
BankB	Array of 32 elements where the index represents the channel (33-64), and the value at each position is the electrode number
BankC	Array of 32 elements where the index represents the channel (65-96), and the value at each position is the electrode number

OUTPUTS

None	None

EXAMPLES

```
% Odd and even channel electrode pairings on BankA
BankA = [2 1 4 3 6 5 8 7 10 9 12 11 14 13 16 15 18 17 20 19
22 21 24 23 26 25 28 27 30 29 32 31];
BankB = [33:64];
BankC = [65:96];
cerestim.updateMap(BankA, BankB, BankC);
```

setStimPattern

Creates a custom biphasic stimulation waveform. Up to 15 waveforms can be defined, even if the CereStim has less current modules. Current modules limit the number of electrodes that can be stimulated simultaneously, not the number of defined waveforms.

USE

cerestim.setStimPattern(WaveformID, Polarity, Pulses, Amp1, Amp2, Width1, Width2, Interphase, Frequency)

INPUTS

WaveformID	The stimulation waveform (1-15) that is being configured
Polarity	The polarity of the first phase of the biphasic waveform: 0: Anodic 1: Cathodic
Pulses	The number of times to play the biphasic pulse (1-255)
Amp1	The amplitude of the first phase, in microamps. The values this can take depend on the stimulator model Microstimulator: 1-215 uA Macrostimulator: 100-10000 uA
Amp2	The amplitude of the second phase, in microamps.
Width1	The width of the first phase in microseconds (44-65535)
Width2	The width of the second phase in microseconds (44-65535)
Interphase	Period of time between the first and second phases in microseconds (53-65535)
Frequency	Rate at which biphasic pulses will be repeated in Hz (4-5000); could also be called interpulse, as it defines the tail end of the waveform

OUTPUTS

None	None

EXAMPLES

```
% Set waveform 3 to a waveform with an anodic first
% phase, 100 repeating pulses, 45 uA amplitude, with
% 100 us phases, a 55 us interphase, at 100 hz. Since
% this is 100 pulses at 1000 hz, it will take
% approximately 0.11 second
cerestim.setStimPattern(3,0,100,45,45,100,100,55,1000)
```

getStimPattern

Returns the configuration of a specific stimulation waveform.

USE

WaveformStruct = cerestim.getStimPattern(Waveform ID)

INPUTS

Waveform ID	The stimulation waveform to read (1-15)

OUTPUTS

WaveformStruct	A structure containing the information specified in the input of setStimPattern

EXAMPLES

```
% Obtain the parameters for stim pattern 4
WaveformStruct = cerestim.getStimPattern(4)
```

disableStimulus

Disables a stimulation waveform that was configured with setStimPattern.

USE

cerestim.disableStimulus(Waveform ID)

INPUTS

<Waveform ID>	The stimulation waveform that is being disabled (1-15)

OUTPUTS

None	None

EXAMPLES

```
% Clear stimPattern 2
cerestim.disableStimulus(2)
```

manualStim

Sends a previously configured stim pattern to one electrode.

USE

cerestim.manualStim(Electrode, Waveform ID)

INPUTS

Electrode	The electrode that should be stimulated (1-96)
Waveform ID	The stimulation waveform to be used (1-15)

OUTPUTS

None	None

EXAMPLES

```
% Send stimulus 3 on channel 2
cerestim.manualStim(2,3);
```

beginSequence

Defines the beginning of a stimulation sequence (also known as a stimulation program). A stimulation sequence is a set of stimulation patterns to be executed. These can be setup to be done sequentially, simultaneously, or as a combination of both. Every stimulation program begins with the beginSequence command and is defined in the lines between the beginSequence and endSequence commands. Valid stimulation program lines are 'wait', 'autoStim', 'begofgroup', and 'endofgroup' commands. A stimulation script can have up to 128 commands in between its beginSequence and endSequence lines.

USE

cerestim.beginSequence()

INPUTS

None	None

OUTPUTS

None	None

EXAMPLES

```
% Small stim pattern
cerestim.beginSequence();
cerestim.autoStim(2,2);
cerestim.endSequence();
```

endSequence

The end of a stimulation sequence (also known as a program). See beginSequence for more information about this pair of commands.

USE

cerestim.endSequence()

INPUTS

None	None

OUTPUTS

None	None

EXAMPLES

```
% Small stim pattern
cerestim.beginSequence();
cerestim.autoStim(2,2);
cerestim.endSequence();
```

autoStim

Defines a stimulus to an electrode in a stimulation script.

USE

cerestim.autoStim(Electrode, Waveform ID)

INPUTS

Electrode	The electrode that should be stimuluated (1-96).
Waveform ID	The stimulation waveform that should be used for stimulation (1-15)

OUTPUTS

None	None

EXAMPLES

```
% Small stim program
cerestim.beginSequence();
cerestim.autoStim(2,2);
cerestim.endSequence();
```

wait

Tells the CereStim to wait a specified amount of time before executing the next command in a stimulation sequence (program). The maximum wait time is 65535 ms.

USE

cerestim.wait(Milliseconds)

INPUTS

Milliseconds	The amount of time to wait (ms)

OUTPUTS

None	None

EXAMPLES

```
% Small stim program
cerestim.beginSequence();
cerestim.autoStim(2,2);
wait(10);
cerestim.autoStim(2,2);
cerestim.endSequence();
```

beginGroup

Defines the beginning of a set of stimulations to occur simultaneously in a stim sequence (also called a stim program). Only autoStim commands may be used between beginGroup and endGroup commands. The number of simultaneous stimulations is determined by the number of modules installed and enabled in the stimulator.

USE

cerestim.beginGroup()

INPUTS

None	None

OUTPUTS

None	None

EXAMPLES

```
% Small stim program
cerestim.beginSequence();
cerestim.autoStim(3,3);
cerestim.beginGroup();
cerestim.autoStim(2,2);
cerestim.autoStim(3,3);
cerestim.endGroup();
cerestim.autoStim(4,4);
cerestim.endSequence();
```

endGroup

Defines the end of a set of stimulations to occur simultaneously in a stim sequence (also known as stim program). Refer to the beginGroup command for more information.

Use

cerestim.endGroup()

Inputs

None None

Outputs

None None

Examples

```
% Small stim program
cerestim.beginSequence();
cerestim.autoStim(3,3);
cerestim.beginGroup();
cerestim.autoStim(2,2);
cerestim.autoStim(3,3);
cerestim.endGroup();
cerestim.autoStim(4,4);
cerestim.endSequence();
```

play

Run a stimulation sequence (stim program) a specified number of times. Using this command requires having created a program using beginSequence and endSequence previous to this.

USE

cerestim.play(Repetitions)

INPUTS

Repetitions	The number of times to execute the stimulation sequence. Passing a zero will repeat the stimulation indefinitely until stopped

OUTPUTS

None	None

EXAMPLES

```
% Play a program 3 times
cerestim.play(3);
```

trigger

Sets the stimulator to trigger mode. When in trigger mode, the stimulator is waiting for signal on the hardware trigger port. When triggered, the CereStim will play the stim sequence that was previously defined using beginSequence and endSequence commands. Latency between edge and program start is approximately 3 microseconds.

USE

cerestim.trigger(Mode)

INPUTS

Mode	The type of event to trigger stimulation: 0: Disable Trigger Mode 1: Rising (low to high) 2: Falling (high to low) 3: Either rising or falling edges

OUTPUTS

None	None

EXAMPLES

```
% Wait for a rising edge TTL on the trigger port
cerestim.trigger(1);
```

disableTrigger

Takes the stimulator out of trigger mode. Refer to trigger for more information about this mode.

USE

cerestim.disableTrigger()

INPUTS

None	None

OUTPUTS

None	None

EXAMPLES

```
% Disable the waiting trigger
cerestim.disableTrigger();
```

getSequenceStatus

Reads the current state of the stimulator. The stimulator can only receive certain commands in certain states, so this function is useful for identifying which state it is in. Generally, the stimulator can only receive most commands while it is stopped, but some commands are made to interact with a given state (stop, for example, interacts with the playing state). This command is important in ensuring that commands are not issued to the CereStim when it is busy.

USE

Status = cerestim.getSequenceStatus()

INPUTS

None	None

OUTPUTS

Status	The stimulator's status: 0: Stopped 1: Paused 2: Playing 3: Writing 4: Waiting for Trigger

EXAMPLES

```
% Check the current status of the stimulator
Status = cerestim.getSequenceStatus();
```

groupStimulus

Performs simultaneous stimulations on different electrodes with different waveforms. This command can be used in place of creating a stimulation sequence to improve latency times for creating and executing simple simultaneous stimulations.

USE

cerestim.groupStimulus(BeginSeq, Play, Times, Number, Electrodes, Patterns)

INPUTS

BeginSeq	Boolean expression to signal whether this is the beginning of a sequence
Play	Boolean expression to indicate whether to play the waveforms immediately or to wait for another command
Times	Number of times to play stimulation
Number	Number of stimuli that will occur simultaneously
Electrodes	Array (with length equal to number of modules) with each entry containing an electrode to be stimulated. Use zero to avoid module
Patterns	Array (with length equal to number of modules) with each entry containing the Waveform ID to be used for stimulation on the corresponding electrode set in the previous parameter

OUTPUTS

None	None

EXAMPLES

```
% Send a stimulus to play three times on channels 33-48
% immediately with stim patterns 1 and 2
cerestim.groupStimulus(0, 1, 3,16,[33 34 35 36 37 38 39 40
41 42 43 44 45 46 47 48],[1 2 1 2 1 2 1 2 1 2 1 2 1 2 1
2]);
```

stop

Stops the currently running stimulation sequence (stim pattern) and resets it. When played again, it will begin from the first command. It can only be called while the stimulator has a status of ‘stimulating’ or ‘paused’.

USE

cerestim.stop()

INPUTS

None	None

OUTPUTS

None	None

EXAMPLES

```
% Stop the stimulator from executing the current stim.
Cerestim.stop();
```

pause

Pauses the currently running stimulation sequence (program). Will begin at the next command in the sequence when the stimulator is set to play again.

USE

cerestim.pause()

INPUTS

None	None

OUTPUTS

None	None

EXAMPLES

```
% Pause the current stimulus, then continue again.
cerestim.pause();
wait(3);
cerestim.play(1);
```

Troubleshooting

Because the CereStim API relies on a programming language, such as MATLAB or C++, there are many issues that can be encountered that may be related to use of the language itself and not of the CereStim API; these types of errors, for the most part, are not described below.

Problem	Symptom	Failure	Potential fix
API cannot detect a CereStim	The scanForDevices Method Returns Empty	CereStim is not powered on, not connected by USB, or is already connected to by another object instance or by Stim Manager	Turn the CereStim off and back on again. Close Stim Manager if it is open and connected to the CereStim
API cannot execute programmed sequence	You get an error stating there is a “Sequence Error”	Stimulator is busy with another sequence	See if there are other sequences running by calling getSequenceStatus(). If this does not return 0, you may need to wait or disable the trigger to get it to run again.
		Sequence commands were programmed in the wrong order, like if an endSequence comes before its prerequisite beginSequence	Change code to properly program your sequence, and rerun the script
Code stops mid script even though all arguments are valid	You get an error stating “Incorrect Number of Output Parameters”	Many functions in the CereStim API require output arguments. Failing to include a variable to receive these outputs will result in this error	Change code at point where it breaks to have API commands fill output variables, even if these output variables are never used later in your script
Desired number of stimuli are not generated in the timeframe you expect	You get an error stating “Insufficient Number of Modules”	Your system does not have enough functioning modules to create the desired stimulation	Check to make sure your modules are activated and properly connected using testModules(). Activate inactive ones with enableModules(). Your stimulation protocol has too many active inputs for the module limit of your CereStim. Simplify your protocol Your modules are malfunctioning. Contact Blackrock Support

Return Merchandise Authorization

In the event of a returned material authorization (RMA) or complaint, please provide the product description, product number, lot number, person requesting the RMA or complaint and address, and the nature of the RMA and complaint.

In the unlikely event that your device needs to be returned to Blackrock for repair or maintenance, do not send any equipment back without a Return Merchandise Authorization Number (RMA). An RMA number will be issued to you by a Blackrock representative. If you need to obtain an RMA number, you may contact a product support representative at +1 (801) 582 5533 or by emailing support@blackrockmicro.com.

Once an RMA number has been issued, it is important to safely pack the returned item for shipping back to Blackrock. It is preferred that you save the original boxes and packing materials that your system arrived in for return shipment. Please address the package as follows:

Blackrock Microsystems, LLC
ATTN: RMA#
630 S. Komas Dr., Suite 200
Salt Lake City, UT 84108 USA
Tel: +1 (801) 582-5533

Warranty

Blackrock Microsystems (“Blackrock”) warrants its products are free from defects in materials and manufacturing for a period of one-year from the date of shipment. At its option, Blackrock will repair or replace any product that does not comply with this warranty. This warranty is voided by: (1) any modification or attempted modification to the product done by anyone other than an authorized Blackrock employee; (2) any abuse, negligent handling or misapplication of the product; or (3) any sale or other transfer of the product by the original purchaser.

Except for the warranty set forth in the preceding paragraph, Blackrock provides no warranties of any kind, either express or implied, by fact or law, and hereby disclaims all other warranties, including without limitation the implied warranties of merchantability, fitness for a particular purpose, and non-infringement of third-party patent or other intellectual property rights.

Blackrock shall not be liable for special, indirect, incidental, punitive, exemplary or consequential damages (including without limitation, damages resulting from loss of use, loss of profits, interruption or loss of business or other economic loss) arising out of non-compliance with any warranty. Blackrock’s entire liability shall be limited to providing the remedy set forth in the previous paragraph.

Support

Blackrock prides itself in its customer support. For additional information on this product or any of our products, you can contact our Support team through the contact information below:

Manuals, Software Downloads, and Application Notes
www.blackrockmicro.com/technical-support

Complaints

When filing a complaint, please provide the product description, product number, software version, lot number, complainant's name and address, and the nature of the complaint.

Issues or Questions
www.blackrockmicro.com/technical-support
support@blackrockmicro.com
U.S.: +1 (801) 582-5533