galileo™
tactile stimulus system

User's Manual

For the latest updates, support documents & demos, FAQ, software and driver downloads, accessory options, and other information about the Galileo™, visit www.emci.co/galileo.

Additional resources can be found at www.emci.co/galileo

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Introduction

Thank you for your purchase of the Galileo™ Tactile Stimulus System. We are confident you will find it an invaluable research tool with unique and unparalleled capabilities. Galileo™ was designed to have broad compatibility with imaging systems and features that make it useful for all types of brain research.

Researchers told us they wanted a natural stimulus that could be used in fMRI and other magnetic imaging environments. This unique, patented design uses pneumatic pulses via lengthy PVC and silicon tubing, with the fast rise times that researchers need for clean, interference-free brain images.

This 8-channel, pneumatic tactile stimulator can be used to activate populations of low-threshold, rapidly conducting mechanoreceptive afferents in soft tissues overlying joints and muscles in the sensorimotor systems of the body. The stimulus uses patterned, programmable sequences of air pulses through flexible tubing for maximum compatibility and ease of use.

The wave forms used are fast rising and punctate, making them an ideal tool for mapping human and animal somatosensory (and other) systems through the use of functional neuroimaging techniques.

Safety Information

To prevent damage to your Galileo™ system or injury to yourself or others, please read the following safety precautions carefully before using this equipment. Keep these safety instructions where all those who use the product can read them.

The important consequences that could result from failure to observe the precautions listed in this section are indicated by the following symbol:

This icon denotes a warning. To prevent possible injury or damage, read all warnings and instructions before using your Galileo™ system.

Warnings

Do not disassemble
Touching the product's internal parts could result in injury or death. In the event of malfunction, the product should be repaired only by EMCI's repair center. Should the product break open as a result of a drop or other accident, remove the power cord immediately and contact EMCI.

Do not use in the presence of flammable gas
Do not use electronic equipment in the presence of flammable gas as this could result in explosion or fire.

Use appropriate cables
When connecting cables to the inputs and outputs on the Galileo™, use only the cables provided by EMCI or purchased from EMCI for the purpose of maintaining compliance with government regulations and assuring proper function.

Use EMCI hoses only

Eight-channel hose assemblies have been tested for compliance with imaging systems. Use only hose assemblies provided by EMCI or purchased from EMCI for the purpose of maintaining compliance with product regulations.

Use only EMCI adhesive collars

When attaching nodes to a subject, use only medical grade adhesive collars such as those provided by EMCI. For extra adherence, use only medical grade tincture of benzoin in conjuction with the adhesive collars.

Use EMCI TAC Cell nodes

TAC Cell nodes are volumetric chambers with a specific internal volume. These have been calibrated to work with the hose length and system tuning to optimize rise time and system responsiveness. Use of incorrect nodes may degrade system performance.

Replace damaged accessories

Before using the Galileo™ system, always check hoses, nodes, and collars for signs of wear, fatigue, or failure. Replace damaged accessories immediately.

Connect the Galileo™ to the correct power source

Be sure to connect the Galileo™ to the proper power source and voltage. Check the power requirements label next to the plug to ensure compatibility. Connection to improper voltage could result in damage to the system, shock, injury, or death.

Notices for Customers in the U.S.A.

Cables

At voltages over AC 125V (U.S.A only): The power cable must be rated for the voltage in use, be at least AWG no. 18 gauge, and have SVG insulation or better with a NEMA 6P-15 plug rated for AC 250V 15A. Use of interface cables other than those provided by EMCI may exceed the limits of Class A Part 15.

Federal Communications Commission (FCC) RF Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Modifications

The FCC requires that the user be notified that any changes or modifications made to this device that are not expressly approved by EMCI may void the user's authority to operate the equipment.

Compatibility Warnings

EMCI Brand Accessories

The Galileo™ Tactile Stimulus System has been designed to the highest standards and includes complex, proprietary circuitry and firmware. Only EMCI brand accessories (including cables, adapters, hose assemblies, etc.) certified by EMCI specifically for use with your Galileo™ system are engineered and proven to operate within the operational and safety requirements of this electronic circuitry and firmware.

The use of non-EMCI accessories could damage your Galileo™ system and may void your EMCI warranty, even extended warranty protection purchased seperately. The use of third-party cables could interfere with normal operation of the Galileo™ system or result in overheating, igniting, rupturing, leaking, or permanent damage to the internal electronics.

For more information about EMCI brand accessories, contact EMCI directly at www.emci.co or contact a local authorized EMCI distributor.

Software Control

The Galileo™ system ships with proprietary software designed to control every aspect of sequences, pressure waveform, and data management. Use of third party software may be necessary in certain research settings. The Galileo™ can accept certain serial triggers via USB to control aspects of the device. These serial triggers can be sent from any software package designed to send serial commands, including MatLab®, Scilab, FreeMat, and Octave.

> **i** EMCI does not guarantee compatibility with, nor support, third-party software and hardware packages.

System Setup

Package Contents
Please be sure all items listed below are included with your Galileo™ system before beginning setup.

Galileo™ System
Eight channel air hose assembly with nodes
24 pack of replacement nodes
96 pack of adhesive collars
Software installation USB drive
Power cord
USB cable

Setup
1. Set the Galileo™ on a flat, solid, static surface and connect it to power
2. Connect the air hose assembly to each connector on the control plate. Start at the top connector and plug in the air hoses in the following order: red, orange, yellow, green, blue, purple, black, grey. These colors correspond to the colors in the software, as well as to the colors at the node end of the air hoses
3. Turn on the Windows® XP, 7, or 8 computer, connect to the Internet, and insert the installation USB drive
4. Double click the file called installer.exe and follow the on-screen prompts. Your system may need to download a USB driver, which it will do automatically
5. After installation, restart your computer. Do not attach the USB cable yet
6. After the reboot, double click the Galileo™ icon
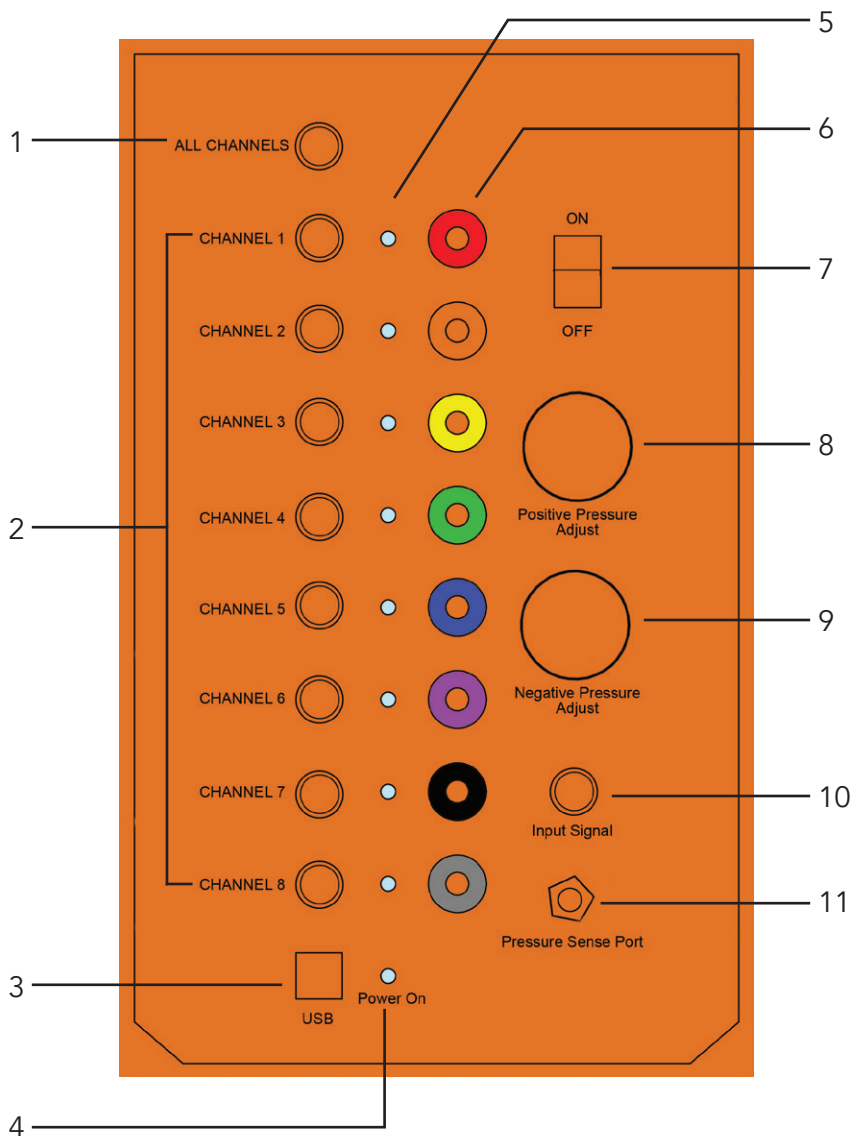7. Turn on the Galileo™ power then connect the USB cable

Hardware Controls

Front Controls

1. A single TTL output that sends the entire sequence to the imaging system — p23
2. Single per-channel TTL outputs for synchronization with imaging systems — p23
3. USB connection port — p9, 39, 45
4. Power on LED indicator — p41
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6. Color-coded air output connectors — p9
7. Power on/off toggle switch — p9, 41
8. Positive Pressure Adjust knob, used to increase the amplitude of the pressure waveform — p34
9. Negative Pressure Adjust knob, used to raise and lower the minimum negative pressure setting — p34
10. Input Signal connection used to trigger the start of a sequence from an exteral third-party hardware
11. Pressure sense port used to shape the waveform within the Tune tab of the Galileo system software (see Tuning on page 31) — p32, 34

> *For more information on controlling the Galileo using third party software or hardware, please visit us on the web at www.emci.co/galileo/control. Galileo Programs can be started via TTL input, and channel-level control is available via USB serial commands. Support for third-party configurations are limited in scope.*

1 — ALL CHANNELS

5

6

2 — CHANNEL 1
CHANNEL 2
CHANNEL 3
CHANNEL 4
CHANNEL 5
CHANNEL 6
CHANNEL 7
CHANNEL 8

ON
OFF
7

Positive Pressure
Adjust
8

Negative Pressure
Adjust
9

Input Signal
10

Pressure Sense Port
11

3 — USB

Power On

4

Designing Your Stimulus Set

Using the Galileo™ 1.0 Software

Initial View on Startup

Once the device is powered on and connected via USB, your software will now show a green "Unit Ready" status:
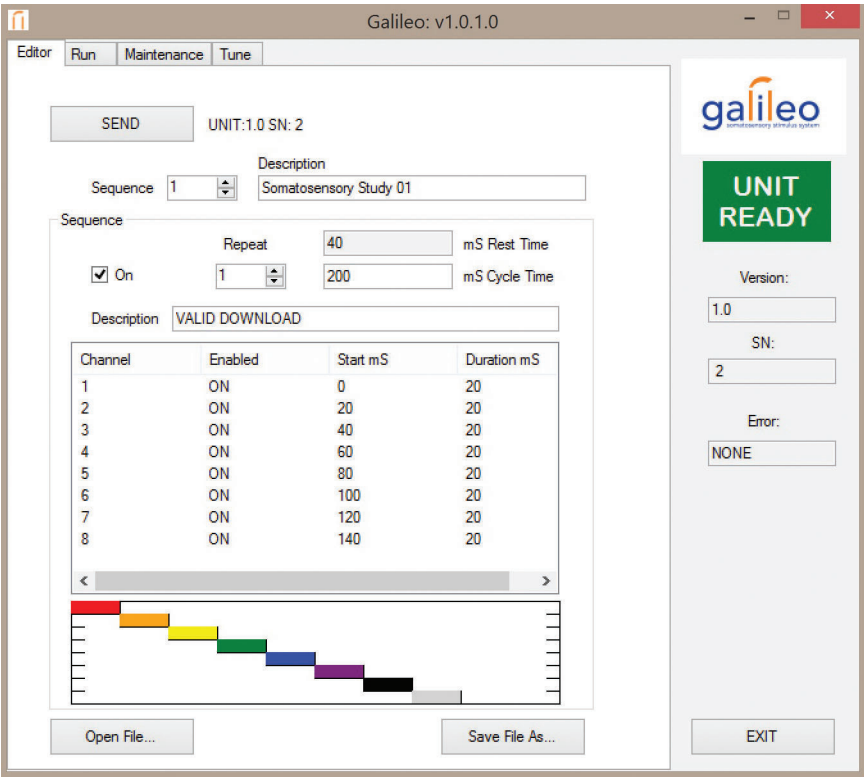
If your device says "Not Ready" please refer to the Troubleshooting section beginning on page 38.

Understanding Programs

The Size of a Program

Your Galileo™ system can save an unlimited number of programs (limited only by disk space on your computer). Each program can contain up to 25 sequences. Each sequence can be repeated from 1 to 32,000 times. Each sequence can use from 1 to 8 nodes.

Cycle Time

The Cycle Time for each sequence is determined by calculating the total of the pulse Duration ms and the ms Rest Time. The minimum cycle time is 200 ms. This is to prevent degradation of the waveform, which would directly affect imaging results. The Cycle Time must be at least 1 ms longer than the addition of all of the Duration ms times.

Rest Time

The ms Rest Time is determined by calculating the total run time for a sequence (Start ms times, durations, and pauses) and indicates the amount of time there will be no pulse activity before the next sequence begins.

Start ms

Each channel can begin a pulse at any time during the sequence. For example, channel 1 can have a Start ms of 100 even if a later channel has a Start ms of 20. Multiple channels (up to eight) can fire simultaneously by entering the same start time for each.

Duration ms

The Duration ms is the measure of how long the pulse will last once the start trigger is given.

Enabling Sequences

Select a Sequence to Enable
There are 25 sequence spots available for any given program. By default all are turned off. Navigate to the sequence you desire to enable by using the up and down arrows or by typing in the sequence number. The enabled sequences do not have to be consecutive sequence numbers.

Check the "On" Box
Once the correct sequence number is displayed, check the "On" box to enable that sequence to run within the current program.

Select the Number of Repetitions
You can select the number of times you want a given sequence to repeat by using the up and down arrows under "Repeat" or by typing a number into the box. This setting can be used in several ways in the "Run" tab. The maximum number of repetitions is 32,000 per sequence.

Continue to Other Sequences
Once you have enabled the sequence and set the number of repetitions, you can navigate to the next sequence. Repeat steps 1-3 until you have enabled all of the sequences you need for the current program.

You can enable the number of sequences you plan to use for your program, then go back and program the channel, start, and duration settings, or you can program channel settings as you go. In this example, we are enabling sequences and will program as a second step.

Programming a Sequence

Enabling Channels

Under the Editor tab, navigate to the sequence you wish to program by typing the Sequence number into the box or by using the up and down buttons. To enable a channel, double click that channel under the "Enabled" label in the editing window. When you double click, the "On" check box will appear. To enable, check "On" and to disable, uncheck "On." You can enable any number of channels in each program.

Setting Start ms

The Start ms is the time you wish that channel to fire in milliseconds from start. Double click the number in the editor window under Start ms and type in the start value. They can be set to start in any order you wish. The allowed range of values for Start ms is 0 - 29,800 ms, assuming the cycle time is set high enough for the cycle to complete.

> **ℹ** *You must have ms Cycle Time set high enough to complete the duration of the latest-starting channel. For example, if your final channel is set to fire at 400 ms with a duration of 20 ms, your ms Cycle Time must be set to at least 421. Otherwise, the software will display an error.*

Setting Duration ms

To change the duration of the stimulus pulse, double click the number in the editor window under Duration ms and type in the duration value. The allowed range of values is 20-199 ms. If you input a number that is outside of the acceptable range, the software will display an error.

Program Editor Window

To change a value in the Editor Window, simply double click and type the value (or check the "On" box for enabling a channel).

View after double clicking channel 1 under "Enabled."

Adding Multiple Sequences

Enable Sequences
To edit subsequent sequences, simply navigate to the sequence you want to edit, make sure it is enabled by checking "On".

Adjust Settings
Each sequence can be programmed to do a specific pulse train with unique Start ms Times and Durations ms. Toggle each channel to "On" that you wish to use for the current sequence and adjust timing settings in the Editor Window. Set "Repeat" to the appropriate number of sequence repetitions.
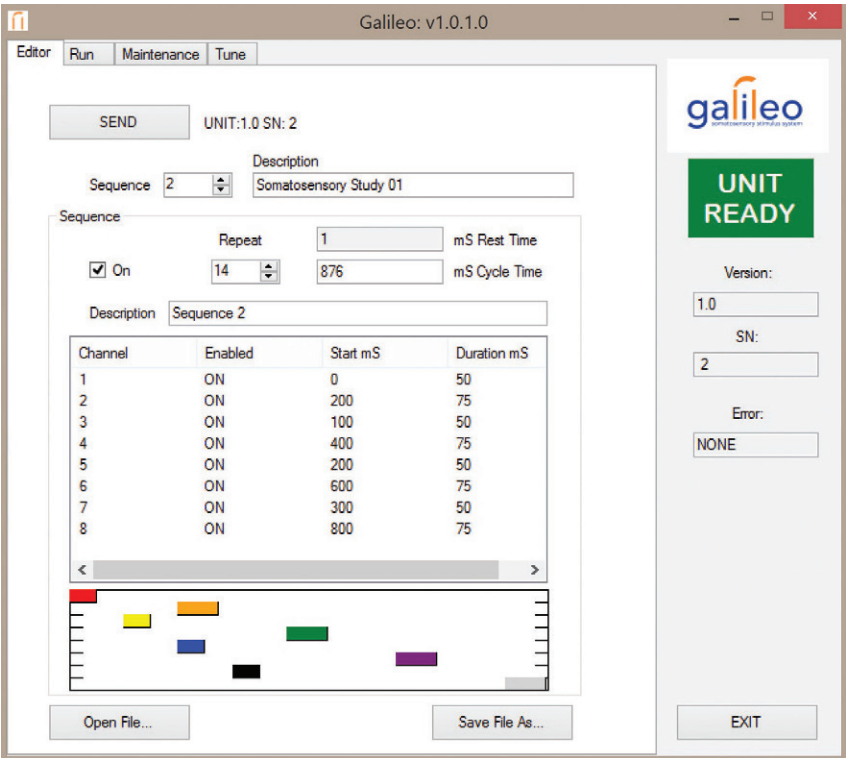
In the image on page 18, note that Sequence 2 is enabled, it is set to repeat 14 times, and that the Start ms times for each channel are staggered. This is to demonstrate how channels can be fired in any order.

Continue Sequencing

Continue adding sequences to your program until it is complete. You can program sequences in the Editor Window and leave them turned off for any particular Run by unchecking the "On" box for that sequence before sending the file to Run. Note that in the image below, channel 5 has been turned off, thus setting the Start ms and Duration ms to zero.
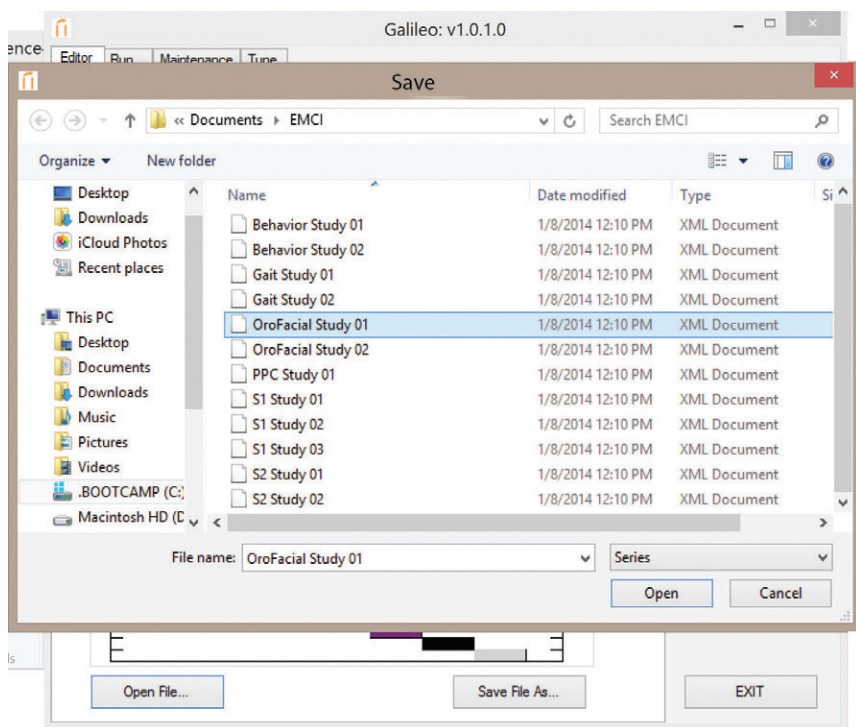
Saving a Program

Export Your Program File
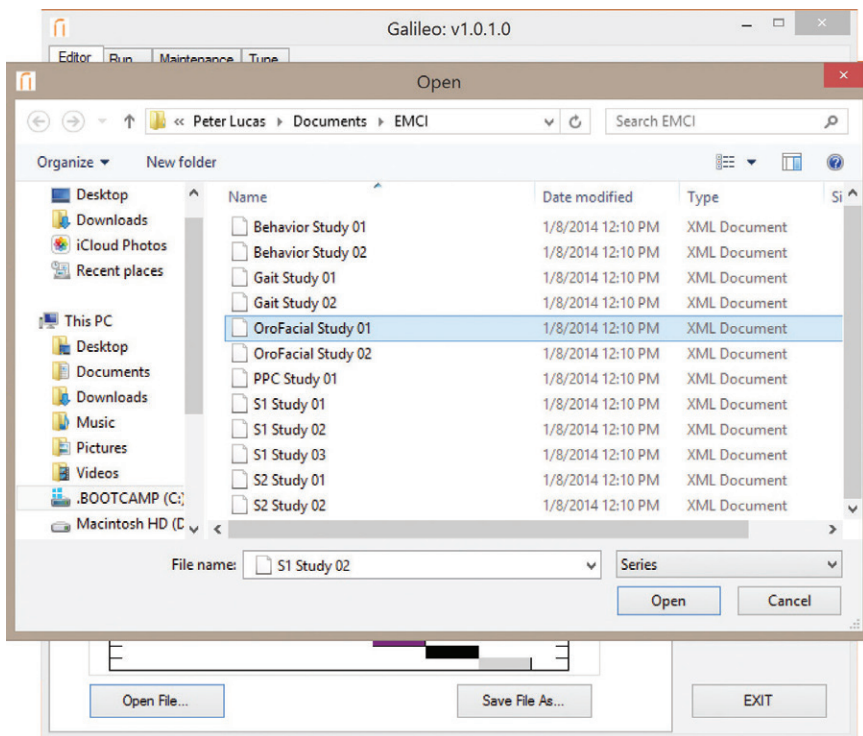
To save your Program, click "Save File As" on the Editor tab and choose a location and a filename for the Program. You can still edit the Program later by editing and resaving with the same file name.

Opening a Saved Program

Open a Program File to Edit or Run

To open your Program, click "Open File" on the Editor tab and choose the file you want to use.

Running Your Program

Preparing to Run the Program

Overview:
Once your program is completely written and ready to be used, you will need to make final connections to your imaging equipment and the test subject.

Connecting to fMRI/MEG/PET/EMG/CT Via TTL
The Galileo™ is equipped with multiple options for synchronization with a wide variety of imaging systems. Each channel can be connected to a TTL input on the imaging system directly. If the imaging system does not have eight TTL inputs, the "All Channels" TTL output on the Galileo™ can be connected to a single input on the imaging system. Specifics for setting up imaging systems vary widely, but the simple digital pulse generated by the Galileo™ is compatible with the majority of systems.

Connecting TAC Cell Nodes to the Subject
Using the provided adhesive collars (and tincture of benzoin when needed), attach the nodes to the subject on the glabrous regions of the face, hands, or other mechanoreceptive areas of the body. With the Galileo™ powered on, there is a slight negative pressure when the system is at rest that helps to hold nodes in place. If the subject has particularly oily or wet skin from excessive sweating, use tincture of benzoin on the site before attaching the nodes with adhesive collars.

> **i** *Make sure you are using the appropriate TAC Cell nodes for your test subject. Nodes vary for human, large animal, small animal, and specialty applications (i.e. gait studies). Node packs and specialty adhesive collars should be obtained directly from EMCI.*

Sending a Sequence to Run

Sending Your Program to Run
The final step on the Editor tab is to click "Send" to send the finished program to the Galileo™ in preparation for running.

Introduction to the Run Tab
The Run tab has three modes available for executing your program on the Galileo™ system; Run, Random Balanced, and Random. Each mode can be set to run as many times as you select, and Run and Random modes can be set to continuously cycle until the stop button is clicked. The Description field can be used to input a unique Subject Identifier.

Run Modes

Run

The Run mode will run through every enabled sequence in the program, in order. If a sequence is set to run more than once, it will run through the same sequence until it has completed all repetitions, and then move to the next sequence.

The program can be set to run from 1 - 32,000 times. It will repeat the program in the same order each time it runs. If the "Continuous" box is checked, the program will continue to run until interrupted by clicking "Stop" (available only when a program is running).

Random Balanced

Random Balanced mode adds an element of randomization while still allowing the programmer a degree of control. In Random Balanced mode, each sequence will run the number of times prescribed in the Editor, but will run the sequences in random order. For example, in a two-sequence set where sequence 1 repeats 4 times and sequence 2 repeats 3 times, the random balanced cycle may run sequences 1,1,2,1,2,2,1, or 2,2,1,1,1,2,1, or any other random balanced order.

Random

The Random mode is designed with double-blind research in mind. In this mode, each sequence will be run one time (or the number of times chosen in the Run tab between 1 - 32,000) but the sequences will run in a completely random order. By checking "Continuous" the system will randomly select an enabled sequence and run until interrupted by clicking "Stop" (available only when a progam is running).

Running the Program

Start the System

Click the button for the Run mode you wish to use. Once the system begins to run, a Run display becomes visible.
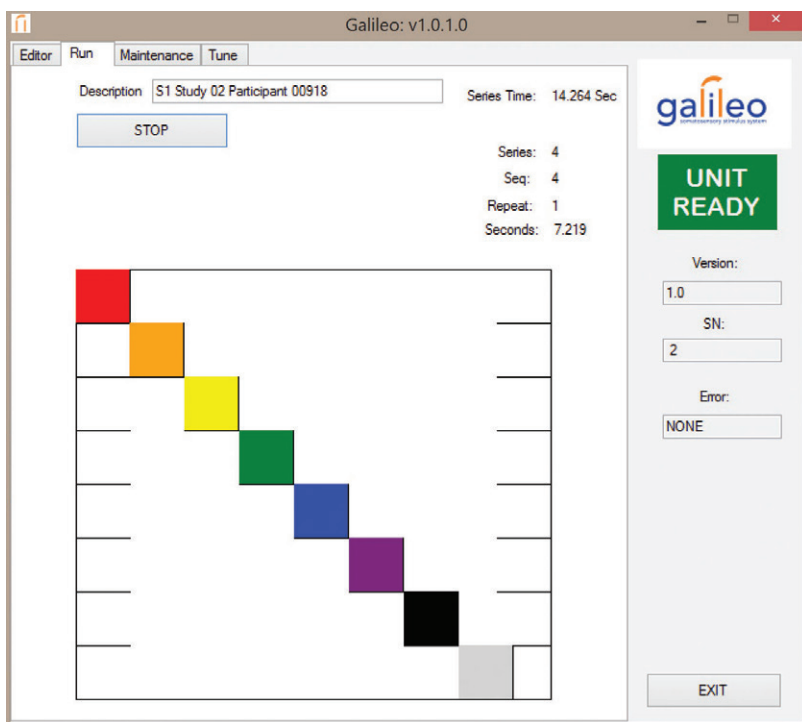
At this time, the stimulus is running to the nodes attached to the test subject and the TTL outputs are sending sync data to the imaging system. You can interrupt the program at any time by pressing "Stop". If you stop during a partially executed program, Galileo™ will remember where it stopped. You can either resume the program or cancel. In either case, a data file will be created that details the Run.

Information Display

The Run display provides several pieces of information in real time as the program runs. The Series Time shows the total time required to execute the program. The Series, Sequence number, and the number of program repeats are all listed as well. The Seconds display shows the elapsed time.

The graphical view shows the eight channels in a color-coded chart that gives a visual representation of both the pulse order and their durations.

Stopping the Program
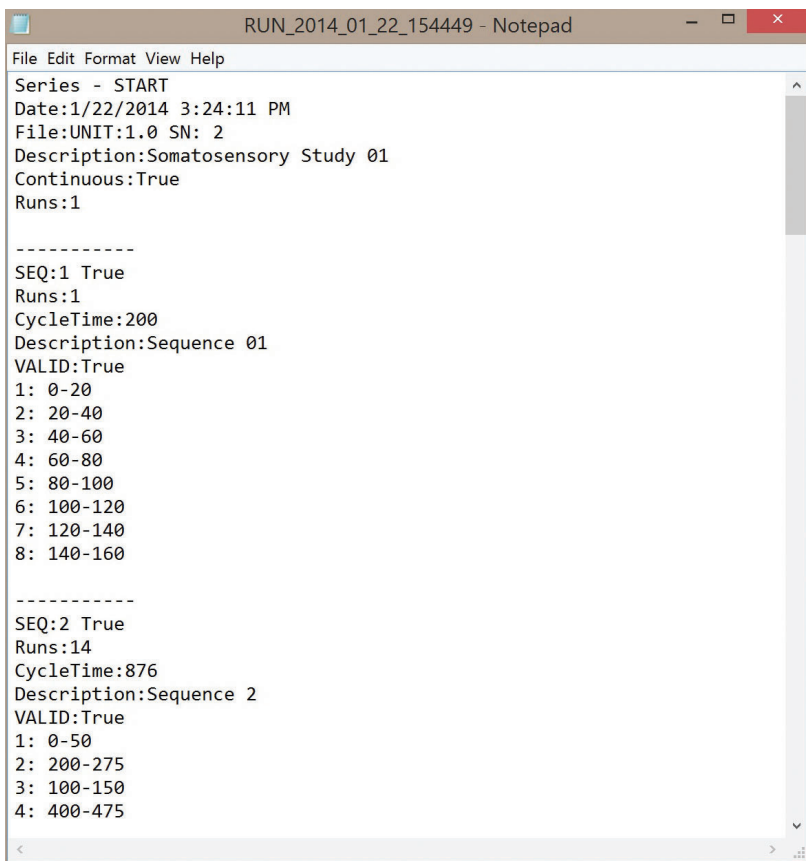
There are two ways to stop the program. The program will automatically stop and return to the Run screen after it completes the program. The program can also be stopped at any time by pressing Stop within the Run display.
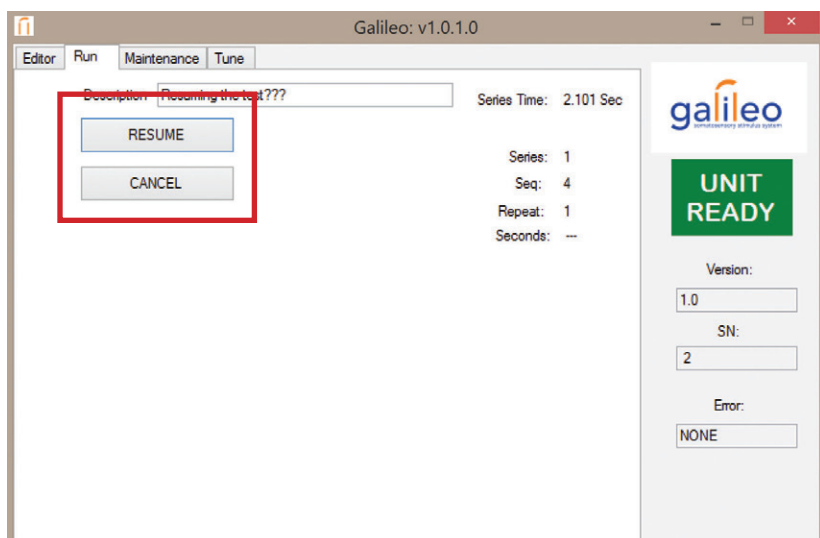
Data Output Files

Run Data

Each time the Galileo™ runs a program (or part of a program), it creates a data output file. The file stores important information about the run that can be used in data analysis. A sample data file is seen below.

```
RUN_2014_01_22_154449 - Notepad          –  □   ×

File  Edit  Format  View  Help

Series - START
Date:1/22/2014 3:24:11 PM
File:UNIT:1.0 SN: 2
Description:Somatosensory Study 01
Continuous:True
Runs:1

-----------
SEQ:1 True
Runs:1
CycleTime:200
Description:Sequence 01
VALID:True
1: 0-20
2: 20-40
3: 40-60
4: 60-80
5: 80-100
6: 100-120
7: 120-140
8: 140-160

-----------
SEQ:2 True
Runs:14
CycleTime:876
Description:Sequence 2
VALID:True
1: 0-50
2: 200-275
3: 100-150
4: 400-475
```

Run Data Information

Series - Indicates the start, stop, or pause of a Run
Date - Indicates the exact start time of a Run
File - The unique ID of the Galileo system
Description - The name of the Program
Continuous - Indicates continuous operation or fixed repeats
Runs - Indicates how many times the Program ran

Seq: Indicates that the Sequence is enabled (True/False)
Runs: Indicates the user specified number of repeats
CycleTime: Shows the total cycle time of the Sequence in ms
Description: Shows the description of the Sequence
Valid: Indicates that the Sequence can be executed (True/False)
1: Start Time - End Time for channel 1
2: Start Time - End Time for channel 2
3: Start Time - End Time for channel 3
4: Start Time - End Time for channel 4
5: Start Time - End Time for channel 5
6: Start Time - End Time for channel 6
7: Start Time - End Time for channel 7
8: Start Time - End Time for channel 8

> *Every Sequence is shown in the data file even if it is not enabled. Disabled Sequences are listed numerically and say "False" after SEQ:#.*

Data Output Files - Cont'd

Sequence Order

After the Sequence data in the data file, the mode, order, and repeat information is output. In the sample file below, the mode displays as RUN, which means there is no randomization. Under Seq, Repeat, the order stays the same (1,4,5,6,7 - all of the enabled sequences) and each repeats only one time (as set on the sequence editor).

```
RUN_2014_01_22_154449 - Notepad
File  Edit  Format  View  Help

OPENED:1/22/2014 3:44:49 PM
DESCRIPTION:S1 Study 02 Participant 00918
RUN
-------------------------------------------------
Seq, Repeat
1, 1
4, 1
5, 1
6, 1
7, 1
1, 1
4, 1
5, 1
6, 1
7, 1
1, 1
4, 1
5, 1
6, 1
7, 1
1, 1
4, 1
5, 1
6, 1
7, 1
1, 1
4, 1
5, 1
6, 1
7, 1
1, 1
```

Tuning the Pulse Wave

⚠️ *Advanced Settings*
Tuning of the pulse wave form is an advanced technique and requires knowledge of appropriate stimulus wave forms. Improper tuning adjustments could create imaging interference or reduce the effectiveness of the stimulus provided by the Galileo™ system.

Software Tuning

Preparing to Tune

With the Galileo™ powered on, select the Tune tab in the software interface. On the dropdown, select a channel to use as your tuning reference (1=red, 2=orange, etc.).

> **ⓘ** *Only one channel is needed to tune the Galileo™ system, but all channels will be affected by tuning. The amplitude and frequency of the pulse wave will be the same for all eight channels. Channels cannot be independently tuned.*

Hold the selected node firmly against the front panel tuning port and click "Start" on the Tune tab.
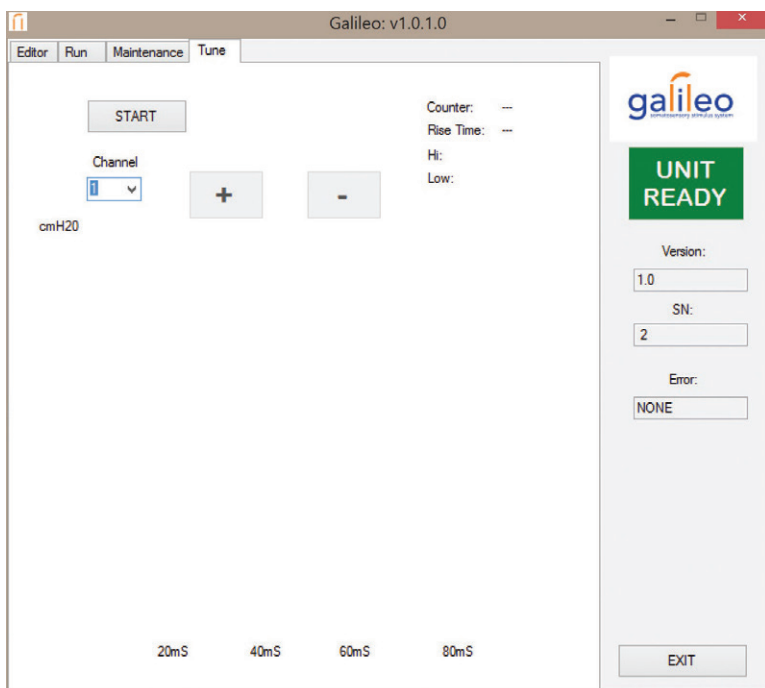
Making Adjustments

Once the node is pressed to the tuning port and the Start button has been clicked, the real-time waveform display will show the wave. Use the + and - buttons increase the delay between switching from high pressure to low pressure, which adjusts the amplitude of the initial stimulus rise.
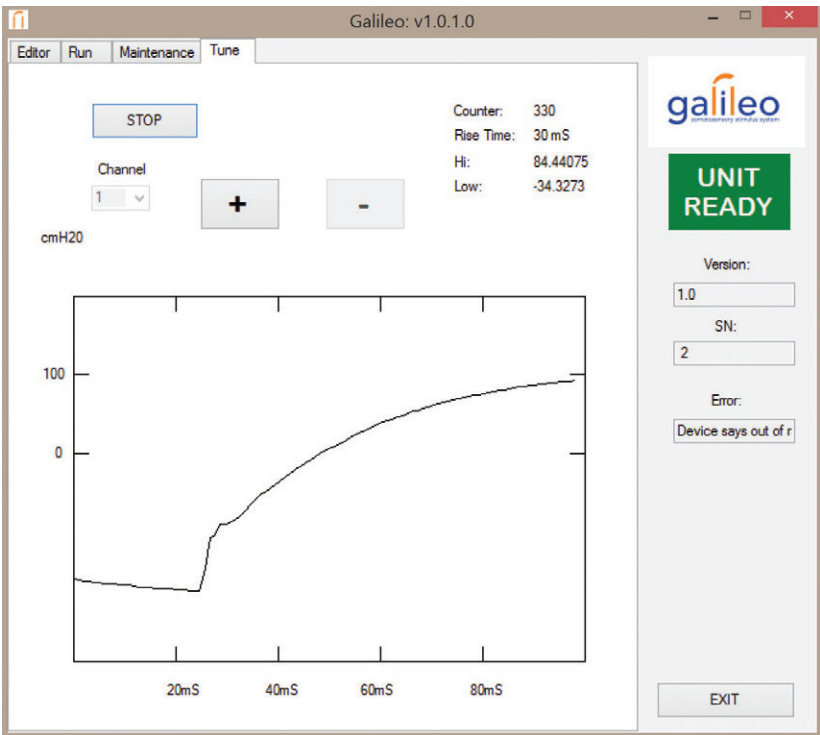
The information display will show a Counter which displays the number of pulses since tuning began, the Rise Time in ms (the recommended rise time is 8 - 16 ms for somatosensory work), and the high and low pressure readings (normally 150 cm/H_2O and -50 cm/H_2O respectively).

Hardware Tuning

Fine Tuning with Hardware Controls

The Galileo™ is equipped with positive and negative pressure adjust controls on the front panel of the system. With the Tune display open in the software and the pressure wave displayed, use the negative pressure adjust knob to raise and lower the entirety of the pressure stimulus wave. Use the positive pressure adjust knob to increase or decrease the pressure plateau.

> *The positive and negative pressure adjust knobs are highly precise and may require many rotations in either direction to affect the pressure wave.*

Do Not Override Pressure Safety Mechanisms

Positive and negative pressure settings are adjustable within a range determined to be safe for most types of somatosensory research. Safety mechanisms are in place to prevent injury to test subjects. Modifying, tampering, or removing safety mechanisms may cause injury or death, and will void warranties. For certain study applications, higher pressures may be warranted. EMCI can provide a factory-calibrated system for your research on a case-by-case basis. Do not attempt to modify these internal settings yourself.

Use the Built-In Pressure Port As Reference Only

The tuning port is intended to be used for reference only. For precise adjustments, EMCI recommends using calibrated external pressure and vacuum sensors.

Maintaining Your Galileo System

General Hardware Maintenance

Hoses & TAC Cell Nodes

In most cases, the eight-channel air hose assembly will last for many uses. Before conducting critical studies, please check the entire length of tubing for cracks, kinks, and holes. Damaged hose assemblies should be replaced immediately. Do not attempt to repair or seal a damaged hose. The pressures in use and the fast rise time required are critical and can be affected by even a slight unaddressed leak.

The TAC Cell nodes require more regular replacement. They adhere to the test subject with adhesive collars, and over time these can become worn and damaged. The dimensions of the nodes are critical to the pressure wave's speed and accuracy (as they are a volumetric chamber), and should be replaced no less often than every 6 months or 120 uses, whichever is sooner.

Air hose assemblies and TAC Cell nodes can be cleaned using alcohol or dish soap, and should be air dried.

⚠️ **Do Not Use Tubes with Residual Water Inside**
Water droplets within the air hose assembly will cause improper waveforms and reduce wave rise time. Do not use tubes that have not fully dried after cleaning.

Galileo™ Housing

The Galileo's beautiful design will be the envy of every other lab in your facility. The external housing can be cleaned using a damp washcloth, with the system unplugged. If necessary, use a small amount of dish soap on the cloth. Be sure to dry the housing well.

Software /Firmware Updates

From time to time, EMCI will release software and firmware up-dates for the Galileo™ system. These updates will be available directly from www.emci.co/galileo. Firmware updates may require a return of the Galileo™ to the factory service center, but will be done free of charge for the first two years. Extended warranty pro-grams are available.

For certain complex or mission-critical installations, EMCI may opt to send a technician to service your Galileo™ rather than having it disconnected and shipped to the factory repair center. At EMCI's discretion, firmware updates may be user-applied under the super-vision of EMCI technicians via telephony.

Do Not Modify or Alter Software Code
This software has been designed to function within proper safety and efficacy parameters, and have been tested for compliance to applicable regulations. Alter-ing source code may cause malfunction, injury, or death and will void your warranty.

Troubleshooting

Software Errors

"Not Ready" is displayed on the software interface
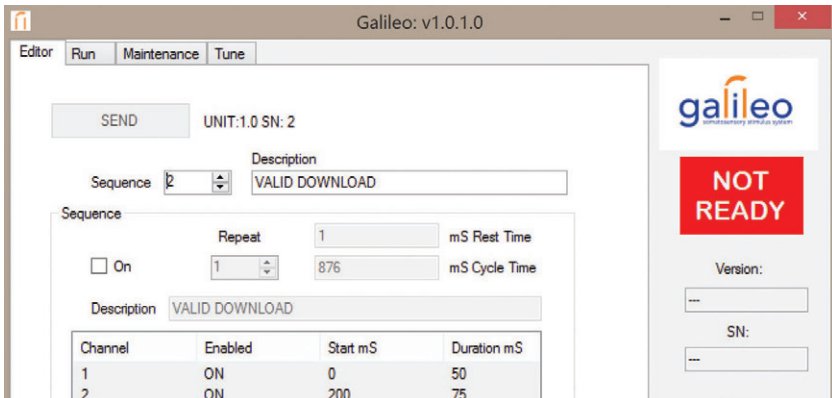
The "Not Ready" message is displayed when the connection between the software and the device has not be established. There are several common reasons this may occur. To resolve this error, follow the steps below:

• Unplug the USB cable and relaunch the software. Reconnect the USB cable. This will often resolve the error
• Power off the Galileo™ and unplug the USB cable. Power the Galileo back on and reconnect the USB cable
• Disconnect the USB cable and reboot your computer. Relaunch the Galileo™ software and reconnect the USB cable
• Check to make sure that the drivers are installed. Under Computer Management (in Windows®), select Device Manager. Make sure that under Ports (COM & LPT) the Silicon Labs CP210x USB to UART Bridge controller is installed and working properly. See the graphic on page 40.

Software Errors - Cont'd

The Silicon Labs CP210x USB to UART Bridge controller can be obtained through Windows® Update when the Galileo™ is plugged in and powered on.
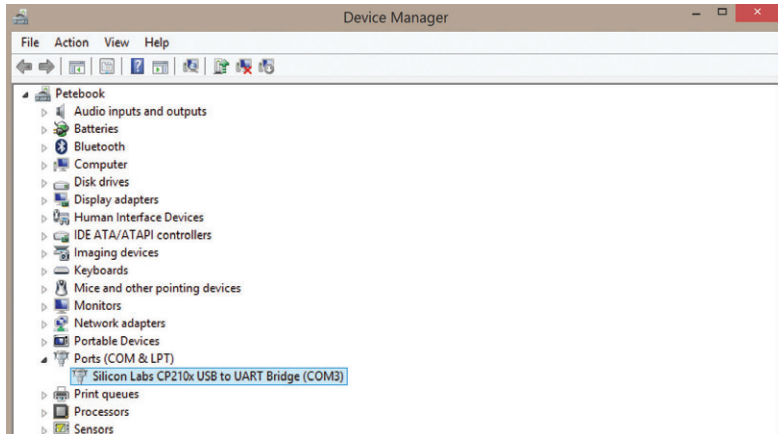
There is a .NET Framework error upon software launch

Certain installations of Windows will be unable to successfully load the Galileo™ software if the .NET Framework is out of date. To correct this error, visit www.microsoft.com/net/downloads, then download and install the latest .NET Framework. After installation, reboot your computer, then relaunch.

During tuning, "Device says out of range" error occurs

The "Device says out of range" error is the result of improper application of the active node to the pressure sense port. This can occur when the wrong node is pressed to the port, or when the node is not being held securely enough to the port. Check to make sure you are using the active node and pressing it firmly to the pressure sense port.

Hardware Errors

The Galileo™ system will not power on
If the Galileo™ system fails to power on (the power light does not come on or the system is completely silent), check the following to correct the problem:

- Ensure that the Galileo™ is connected directly to wall power. Do not plug the Galileo™ into a power strip or extension cord and do not use three-prong-to-two-prong adaptors
- Ensure that the power voltage matches the rating indicated on the back of the Galileo™
- Ensure that the wall outlet has power by plugging in another device that is known to be working
- Check the power switch. It should be firmly seated in the control panel. If the switch is loose, the Galileo™ will need to be serviced by the factory
- Check the airflow vents around the body of the Galileo™ for debris or other items that may be blocking proper ventilation of the system. The Galileo™ has been designed to shut down to prevent overheating
- Check the factory-issued power cord for damage. If available, try replacing the power cord with another EMCI power cord or equivalent

If the issue persists, contact EMCI for maintenance.

No User Serviceable Parts
There are no user serviceable parts inside the Galileo™ system. Opening the Galileo™ and tampering with internal components will void your warranty and may create dangerous conditions including electrical shock and rapid pressure discharge, which could result in serious injury or death.

Factory Service

If your Galileo™ system stops working or displays a persistent error, the unit should be returned for factory maintenance. For maintenance, contact EMCI at returns@emci.co or call 913-432-5321. You will be provided with an RMA number. Please include your RMA number with your shipment.

If the device is in warranty, EMCI will perform repairs and maintenance at no charge. If the device warranty has expired, or has been voided by tampering, abuse, etc., EMCI will generate a quote for necessary repairs and request authorization to proceed.

Adverse Events
In the unlikely event that there is an injury related to the use of the Galileo™, such incident must be reported to EMCI within 7 business days. All adverse events will be investigated by EMCI and may be reportable to regulatory agencies by EMCI.

Factory Hardware Customization
Your Galileo system is highly user customizable using the proprietary software and hardware controls. However, for certain research projects additional customization may be required.

EMCI's factory customization center will work with your research team to make hardware modifcations to meet your requirements. By having customizations done by EMCI, you ensure that the system remains safe, effective, and compliant with applicable regulatory agencies. Costs for this customization will be quoted to you in advance of any work being done, and will require your written approval.

Warranty

This warranty is given in place of all other warranties, expressed or implied. No statement or claim about the product by an employee, agent, or dealer of EMCI shall constitute a warranty by EMCI or give rise to any liability for, or obligation of, EMCI.

EMCI warranties its equipment to be free of defects in materials and workmanship under normal use and with appropriate maintenance for a term of one (1) year. For plastic, silicon or other expendable items, EMCI warrants only that such parts will be free of defects in materials and workmanship at the time of purchase.

EMCI will repair or replace any defective item or parts covered under the warranty that are returned to us within the warranty period. The following information is required: RMA number (call EMCI to obtain), a letter stating the perceived problem, serial number, and copy of invoice (or, in lieu of invoice, the purchaser's name, date of purchase, phone number and address).

Equipment that has been damaged by mishandling, intentional misuse, submersion, or unauthorized repair is excluded from this warranty and will be repaired for a fee. Please contact your freight company directly to submit any claims for shipping damage, which is not the responsibility of EMCI.

Limit of Liability
EMCI's liability is limited to the total cost of the product, service or software. In no event will EMCI be liable for any consequential, indirect, special, incidental or punitive damages, regardless of the form of action, whether in an agreement, tort, strict product liability or otherwise, even if advised of the possibility of such damages and even if the damages were foreseeable.

Technical Specifications

General

Power Consumption:	120VAC 6A nominal
	120VAC 7.5A max
	Optional 220VAC 50Hz
Operating Temperature:	50° - 122° F (10° - 50° C)
Dimensions:	20" x 20" x 20"
	50cm x 50cm x 50cm
Weight:	38lbs (17.2kg)
Pressure Output Range:	-200 to 200 cmH_2O
Wave Rise Time:	12ms for 10-90% @ 16'

Hardware Controls

• Vacuum Pressure Regulator (manual knob)
• Pressure Regulator (manual knob)
• BNC TTL output - 1 input and one output per channel
• BNC TTL output - 1 input transmitting full signal chain
• Serial Control via USB 2.0

Computer Requirements

PC running Windows® XP, 7, or 8 with one open USB 2.0 port, or Intel Macintosh using OSX and Bootcamp running Windows® XP, 7, or 8 with one open USB 2.0 port

> **i** *Windows® virtual machines for Macintosh® OSX such as Parallels® and VMWare® may not supply the required driver support for communication with the Galileo™*

Useable Environments

fMRI, MEG, PET, EIT, EEG, CT

Glossary

Channel
One of the eight pneumatic stimulators, its respective TTL output, and LED active indicator

cmH_2O
Centimeters of water

Cycle Time
The amount of time for all channels to fire through one repetition of a Sequence

Duration ms
The time between the switch between positive pressure and negative pressure

fMRI
Functional Magnetic Resonance Imaging

ms
Milliseconds

Program
A set of sequences designed for a specific test protocol

Rest Time
The time from the end of the last channel to fire's pulse duration to the start of the next Sequence

Rise Time
The time for the pressure wave to go from maximum negative cmH_2O to maximum positive cmH_2O

Glossary Cont'd

RMA
Return Merchandise Authorization

Run Data
A text file generated automatically be each Run or partial Run that details all aspects of the sequences, Run order, repetitions, and time stamp

Run
The execution of a Program (or partial execution) resulting in stimulus and the output of a Run Data file

Sequence
The instructions for a specific order, start, and duration of between one and eight channels

Start ms
The time at which a channel will fire relative to the start of the current Sequence

TAC Cell Node (Node)
The plastic connector that is adhered to the subject's skin during a Run. Nodes have a calibrated internal volume of displacement to allow for exact rise times.

TTL
Transistor-transistor Logic or TTL logic levels is a widely accepted standard multiple-emmitter transistors

Contacting EMCI

Replacement Accessories
913-432-5321
www.emci.co/store
orders@emci.co

Return Authorizations
913-432-5321
returns@emci.co

Adverse Events
913-904-2270
complaints@emci.co

Technical Support
913-904-2270
www.emci.co/galileo/support
galileotech@emci.co

Software Updates
www.emci.co/galileo/downloads

Epic Medical Concepts & Innovations

Engineering & Sales
6950 Squibb Road, STE 300
Mission, KS 66202

Service & Support
1111 Valley Ridge Drive
Grain Valley, MO 64029

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