BrainMaster TECHNOLOGIES

The next generation of 3D Brain Imaging and Neurotherapy

Atlantis I & II and 2EB+ Modules Hardware User Manual

BrainMaster Passkey Log

BrainMaster Serial Number_____

Passkey_____

Date Purchased_____

Date Affiliate Expires_____

BrainMaster Passkey Log

BrainMaster Serial Number_____

Passkey_____

Date Purchased_____

Date Affiliate Expires_____

BrainMaster Passkey Log

BrainMaster Serial Number_____

Passkey_____

Date Purchased_____

Date Affiliate Expires_____

BrainMaster Passkey Log

BrainMaster Serial Number_____

Passkey_____

Date Purchased_____

Date Affiliate Expires_____

Table of Contents

Certificate Of Conformance 1
Minimum PC Computer Requirements 2
Discovery Device Description 3
Executive Summary and Device Description 3
BrainMaster Technologies Notes and Safety Precautions 5
General Care Instructions for your BrainMaster System 6
Symbols Used 6
Abbreviations Used 6
General Information 7
Hardware Care 9
Electrode Care 10
Other Considerations 11
Atlantis Specifications 12
Atlantis I Specifications 12
Atlantis I Front and Rear Panels 14
Atlantis II Specifications 15
Atlantis II Front and Rear Panels 17
Atlantis 2eb+ Specifications 18
Atlantis 2eb+ Front and Rear Panels 20
Electromagnetic Immunity Specifications 21
Atlantis Accessories 22
Environment Usage 23
Atlantis Immunity Tests 24
Atlantis Basics 25
Essential Performance 25
Connecting to the PC 26
Atlantis Power on Sequence 26
Connecting EEG Sensors 26
Front Panel Impedance Lights 27
Atlantis Firmware Field Programming 28

Certificate of Conformance

BrainMaster EEG devices including the 2E (390-001), 2EW (390-001W), 2EB (390-020), 2EA (390-040 Atlantis), 4EA (390-030 Atlantis), 2eb+ (390-025 Atlantis) and 24 / 20 (390-060 Discovery) are legally marketed worldwide. They conform to the requirements of the US FDA (Food and Drug Administration) under 510(K) 990538, and are covered abroad by a CE mark as Class I Biofeedback devices. BrainMaster EEG devices are indicated for biofeedback training using EEG. Our FDA registration includes classification 882.5050 (Biofeedback Device) and 882.1400 (Electroencephalograph). The stated functions in the FDA registration include "use EEG," "measure EEG," and "process [EEG] to produce frequency band energy."

The BrainMaster EEG line of biofeedback systems includes a series of models, all of which follow the same line of technology evolution, and all of which have the same level of safety and efficacy, and the same intended use. The differences between the devices consist solely of the specific circuits used in their construction, and the number of channels supported. Newer devices are more accurate, and offer more channels of EEG. There are no other pertinent differences in these devices.

Our internal record keeping is managed according to FDA GMP standards, and documents the required controls for design and testing. Devices are covered by the cited 510(K), in the form of internal Engineering Change Orders documenting and validating the design improvements. This fulfills the requirements to be legally marketed for their intended use in the US and abroad.

The CE mark information has been kept current by providing to our European agent the technical information to update their files as the technology has been improved. This fulfills the requirements for CE marking and sales in Europe.

All devices conform to all required testing and certification including IEC 60601, AAMI, and FCC, for safety and for electromagnetic emissions. Test reports are on file for all marketed devices.

Therefore, all current BrainMaster EEG devices may be legally marketed worldwide for the purpose of EEG biofeedback by using, measuring, and processing EEG.

Thomas F. Collura, Ph.D.
President
BrainMaster Technologies, Inc.

Minimum PC Requirements

BrainMaster 3.0 Software or Discovery 1.0 Software with up to 4-Channel LZT*

CPU:	Dual-Core 2.2GHz Processor
Operating System:	Windows XP, Windows Vista, Windows 7, Windows 8/8.1, Windows 10
Memory(RAM):	Windows XP - 1GB (Minimum) 2GB (Recommended)
	Windows Vista - 2GB (Minimum) 4GB (Recommended)
	Windows 7 - 2GB (Minimum) 4GB (Recommended)
	Windows 8 - 2GB (Minimum) 4GB (Recommended)
	Windows 10 - 4GB
Graphics Card:	512MB Dedicated OR 1GB Shared Graphics
Optical Drives:	DVD-ROM Drive: Required for BMrDVD
Input:	1 USB Port
Additional SW:	Microsoft Office: Required for Certain reports and EEGAudio
	Windows Media Player or 3rd Party DVD Decoder: Required for BMrDVD
	Adobe Acrobat Reader
	Adobe Flash Player: Required for BMrFlash Player
	Adobe Shockwave Player: Required for BMrFlash Player

Discovery 1.0 Software with BMrMMP** and up to 19-Channel LZT*

CPU:	Quad-core or above (Intel i7 or equivalent preferred)
Operating System:	Windows Vista, Windows 7, Windows 8/8.1, Windows 10
Memory (RAM):	4GB
Graphics Card:	Direct x 10 or above compatible graphics card 1GB Dedicated
Optical Drives:	DVD-ROM Drive: Required for BMrDVD**
Input:	1 USB Port
Additional SW:	Microsoft Office: Required for certain reports and EEGAudio**
	Windows Media Player or 3rd Party DVD Decoder: Required for BMrDVD**
	Adobe Acrobat Reader
	Adobe Flash Player: Required for BMrFlash Player
	Adobe Shockwave Player: Required for BMrFlash Player

BrainAvatar™ 4.0 Software

CPU:	Quad-core or above
Operating System:	Windows Vista, Windows 7, Windows 8/8.1, Windows 10
Memory (RAM):	4GB
Graphics Card:	Direct x 10 or above compatible graphics card 1GB Dedicated
Optical Drives:	DVD-ROM Drive: Required for BMrDVD**
Input:	1 USB Port
Additional SW:	Microsoft Office: Required for certain reports and EEGAudio**
	Windows Media Player or 3rd Party DVD Decoder: Required for BMrDVD**
	Adobe Acrobat Reader
	Adobe Flash Player: Required for BMrFlash Player
	Adobe Shockwave Player: Required for BMrFlash Player

CE 2195

**Live Z-Score Training is an optional purchase*
***BMrMMP is an optional purchase*

Executive Summary and Device Description

The Atlantis system is a physiological monitoring and feedback system that offers measurement, monitoring, and feedback of biological signals including the electroencephalogram (EEG recording), DC and slow cortical potentials (DC/SCP). All recordings are made noninvasively from the surface of the body using standard sensors of tin, gold, or silver chloride.

The system provides a visual or auditory signal corresponding to the status of one or more of a patient's EEG recordings (e.g., brain alpha wave activity) so that the patient can undergo operant learning. Signal processing and feedback are provided by the user's PC running the software provided by BrainMaster. Information is derived from spectral analysis of the EEG recording.

The system incorporates optical and magnetic isolation/coupling technology to provide a safe and lownoise interface to the user's PC. The Atlantis is provided in three configurations, the "2x2", the "4x4", and 2eb+. These differ only in the number and type of channels available. When used with the supplied software, the system provides biofeedback monitoring, analysis, and reports using a Windows PC

The Atlantis devices are indicated for clinically proven Electroencephalographic (EEG) applications. The devices can be used by medical doctors in healthcare environments for use in monitoring and aiding diagnosis of a disease, injury, or handicap (Council Directive 93/42/EEC as amended by 2007/47/EC, Art1(2)(a)). The devices are also compatible with neurofeedback (EEG biofeedback) applications when prescribed by a healthcare professional.

Atlantis Device Description

Symbols Used

“Caution, consult accompanying documents” or “Attention, see instructions for use.”

Shock Protection Type BF -- for devices that have conductive contact with the patient.

On BrainMaster devices and cables, indicates Functional Earth Terminal. On BrainMaster devices and cables, the Functional Earth Terminal is not connected to the power line, or “mains” ground or neutral.

Abbreviations Used

A1, A2, Fp1, etc.	Standard “10-20” EEG sites
A/D	Analog-to-Digital
Aux	Auxiliary
BMr	BrainMaster Technologies, Inc
C	Celsius
CMRR	Common-mode Rejection Ratio
dB	Decibel
DC	Direct Current
EEG	Electroencephalograph
GB	Gigabyte
GHz	Gigahertz
G Ohms	Gigaohms
Hz	Hertz
LZT	Live Z-Score Training
m	meter
MMP	Multi Media Player
mV	millivolt
RMS	Root-Mean-Square
USB	Universal Serial Bus

General Information

All Cautions will be written in bold and underlined
All points will be written in bold
PLEASE NOTE: All notes will be written in red and bold

- **Read the user manual thoroughly prior to installing or using The BrainMaster System**
- **This User Manual should be kept near your BrainMaster System at all times for ease of reference**
- **The BrainMaster System is to be used under the supervision of a licensed practitioner at all times and is not intended to home use without supervision.**
- **Do not use The BrainMaster System for any purpose outside of its stated intended use**
- **The BrainMaster System is not to be used to monitor critical life functions**
- **Do not use the BrainMaster System in a flammable gas environment**
- **The BrainMaster System should never be submerged in water**
- **Do not use harsh solvents to clean The BrainMaster System as this can cause damage to the equipment**
- **Do not use the BrainMaster System in a high static environment as this can cause damage to the equipment**
- **The BrainMaster System is not designed for use in a sterile environment and should not be sterilized using any method as this would render the system inoperable**
- **The BrainMaster Device does not produce any electro-magnetic fields and should not interfere with the operability of other devices. To avoid electro-magnetic interference from other equipment, only use approved devices in conjunction with the BrainMaster device.**
- **The BrainMaster Device does not receive RF (radio frequency) energy and does not include RF transmiters.**

General Care Instructions for your BrainMaster System

- **BrainMaster modules are calibrated prior to delivery, and no additional calibration is required before use. An optional self-calibration unit is available for purchase to periodically check and verify calibration. If a unit fails self-calibration, please contact BrainMaster for further instructions.**
- **There are NO USER SERVICABLE PARTS within the BrainMaster System**
- **Never connect any equipment to The BrainMaster System that has not been approved by BrainMaster Technologies Inc. Only approved 3rd Party devices may be used in conjunction with the BrainMaster device.**
- **Always use the same type of electrodes (gold, silver, tin) when connecting a patient. Do not mix metals as this can degrade system performance and cause inaccurate readings**
- **Always visually inspect all electrodes prior to use as cracked or damaged leads can cause inaccurate readings.**
- **BrainMaster Recommends replacing your electrodes at minimum in 1 year cycles in order to maintain proper functioning equipment**
- **Ensure when connecting a Patient that your electrodes and Patient Cables do not come in contact with any other conductive parts including neutral or earth ground.**
- **When using the BrainMaster equipment at the same time with other instruments, it is necessary to remember that the sum of the dispersion currents determined by each instrument may exceed the value of the maximum leakage current.**
- **BrianMaster modules do not store any personally identifiable information on the device themselves. The BrainAvatar software allows users to record patient identification with the acquired EEG data files. To prevent unauthorized access, BrainMaster recommends teh use of standard PC data security measures and confidential identification codes.**
- **Any serious incident or adverse event involving usage of a BrainMaster device should be reported to BrainMaster and the local competent regulatory authority.**
- **We used as directed, BrainMaster devices and associated software do not acquire, store, or record any confidential, sensitive, or otherwise protected health information during usage.**

- **However, users may choose to add personal information (e.g., codified patient identifier) to data file or foler names to facilitate identification and data retrieval. In such cases, it is important that users practice "good security hygiene" (i.e., common best practices for information and network security) as necessary to prevent disclosure of confidential patient information.**
- **BrainMaster devices and software do not require a network connection during signal acquisition and recording. BrainMaster devices and software may be used without an internet connection to provide additional infomration security, if desired or necessary.**

Contraindications/Warnings

- **BrainMaster Devices are not for use in conjunction with High Frequency Surgical equipment.MRI equipment, or other electrical stimulators.**
- **The use of a cardiac pacemaker may cause undesirable artifacts within the EEG signal acquired by the BrainMaster Device. Care should be taken to ensure that your data is usable.**
- **Use of this equipment adjacent to, or stacked with, other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating normally.**
- **Use of accessories, transducers and cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.**
- **Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 15 cm (6 inches) to any part of the Discovery module, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result.**

Possible Side-Effects

- **A remote possibility of skin sensitivity to some substances, all sensor materials used, are ISO registered and have been duly tested for possible irritation or other concerns.**
- **Rarely, patients may experience a slight headache after EEG training.**

General Care Instructions for your BrainMaster System

These instructions apply to all products in the BrainMaster line such as the 2EB, Atlantis, Discovery, and all other peripherals that BrainMaster Technologies Inc. sells for use with the BrainMaster System.

Standard environmental conditions for indoor use are: Altitude: up to 2000m, Temperature: 5 to 40 deg C, maximum relative humidity is 80% for temperatures up to 31deg C decreasing linearly to 50% at 40 deg C.

There are NO USER SERVICEABLE PARTS within the devices.

Hardware Care

1. After every session wipe down your equipment with a damp cloth or paper towel in order to remove any paste or gel that has spilled onto the unit.

NEVER SUBMERGE YOUR EQUIPMENT IN WATER.

   a. The use of solvents such as Windex, glass cleaner, etc is not recommended as it could damage the equipment.

   b. If you have gel or paste that has dried to the unit we recommend using a small amount of rubbing alcohol on the affected area only and it should be wiped away as soon as possible.

   c. Removal of these substances will prevent them from possibly damaging the front end connectors and the USB port and switch on the rear of the unit.

2. Wipe all of your patient cables down with either a damp cloth or rubbing alcohol after each use in order to keep them clean and free of contaminants.

3. If the USB cable has become dirty it is also recommended that you wipe it down as well using either a damp cloth or rubbing alcohol.

Electrode Care

Please Note: BrainMaster sells multiple types of electrodes, gold, tin, and silver, these should never be mixed with use on patients. You must use the same metal type in all electrodes during a recording or your collected data will not be valid. Each metal type has its own properties and will cause an unstable recording environment if mixed.

Always use the same type of electrodes (gold, silver, tin) when connecting a patient. Do not mix metals as this can degrade system performance and cause inaccurate readings

Prior to hooking up a patient

1. Inspect all lead wires for cracks and kinks in the wiring.
    a. Pay close attention to the ends nearest the female connector and the connection closest to the electrode itself as these areas tend to crack and break the easiest.
2. Inspect the electrode itself for any corrosion, or loss of metal plating as this will affect your ability to acquire clean, low impedance, low dc offset (Discovery only) recordings.
3. If damage to an electrode is suspected do not use it.

Always visually inspect all electrodes prior to use as cracked or damaged leads can cause inaccurate readings

After your session

1. Immediately after your session remove excess material and then soak your electrodes (cup end only) in warm soapy water for approximately 20 minutes to loosen up the remaining paste.
    a. Avoid submerging the female connector jack in water if possible
2. Clean your electrodes using warm running water and a q-tip or other non-abrasive item to remove all remaining paste from the electrode.
3. Remove excess liquid by wiping the electrode down with a paper towel and hang them to dry.
    a. If they are needed immediately ensure that the electrode is completely dry using a paper towel or other non-abrasive cloth.

Other considerations

The cleaning instructions above can be used with the **Electro-Cap Ear-Clips only**. Consult the Electro-Cap manual for care and cleaning procedures for your Electro-Cap.

Electrodes **WILL** need to be replaced eventually they will not last forever, however proper care will ensure that your electrodes will last. The typical life of an electrode depends on several factors:

1. The type of metal (Gold, Tin, or Silver)
2. The amount of use they receive
    a. Once a week verses several times a day
3. How well they are cared for

How long will my Electrodes Last?

- Gold and Silver electrodes can last up to 2 years again depending on usage and care
- Tin electrodes can last from 6 month to a year

BrainMaster Recommends replacing your electrodes at minimum in 6 month cycles in order to maintain proper functioning equipment.

Please Note: BrainMaster only warranties your electrodes for 90-days from the time of purchase as they are considered a consumable item. Please inspect all electrodes upon receipt for damage. Consult your BrainMaster Warranty for further information or contact BrainMaster Support at 1-440-232-6000 M-F 9:30 to 6:00 PM EST or email support@brainm.com with any questions.

Please Note: These instructions apply to electrodes only they do not apply to the Electro-Cap products sold by BrainMaster. Consult the Electro-Cap manual and training video for proper cleaning and care. Contact Electro-Cap International at 800-527-2193 or view their website at http://www.electro-cap.com/information.htm for Electro-Cap related issues.

Atlantis I Specifications

- Configuration: 4 x 4:
  - 4 channels EEG AC/DC/Impedance
  - 4 channels biopotential AC/DC/Impedance
- Additional Inputs:
  - Event switch (stereo)
- Additional Outputs/Controls:
  - EEG-controlled Photic Stimulator
  - EEG-controlled Auditory Stimulator
  - EEG-controlled Vibrotactile Stimulator Relay switches input/output (stereo)
- Interface to PC: USB (optically isolated to 4500 volts)
- Power: Isolated power via USB port (magnetically isolated - no batteries)
- Standalone Power: None

EEG Information:

- Number of EEG channels: 4
- Amplifier type: BrainMaster Triamp^{tm} (simultaneous AC/DC/Impedance recording) Inputs: Bipolar: Separate Active and Reference per channel, shared isolated ground Connector: Proprietary 9-pin connector: signals/impedance sense/ground/power EEG A/D Resolution: 24 bits
- EEG A/D Accuracy: 0.023 microvolts
- EEG A/D Full Scale Range: +/- 190 millivolts
- Typical EEG internal sampling/operating rate (4 channels): 1024 samples/second (with continuous impedance monitoring)
- Maximum EEG sampling rate (4 channels): 4096 samples/second (without continuous impedance monitoring)
- Maximum EEG sampling rate (1 channel): 8192 samples/second (without continuous impedance monitoring)
- Common-mode Rejection Ratio: > 120dB
  Input Impedance: > 1000 G Ohm
- Input noise: < 1.0 microvolts
- Standard Operating Bandwidth: 0.0 (DC) – 120.0 Hz (1024 samples/second internal, 256 samples/second sent to PC)
- Maximum Operating Bandwidth (4 channels): DC – 2048 Hz. (4096 samples/second internal, 4096 samples/second sent to PC)
- Maximum Operating Bandwidth (1 channel): DC – 4096 Hz. (8192 samples/second internal, 8192 samples/second sent to PC)

Continuous sensor impedance monitoring for EEG:

- Resolution: 12 bits

Atlantis Specifications

- Impedance range: 0 – 1 Megohm
- Impedance accuracy: < 250 Ohm
- Front panel indicators: 8 tri-color (R/Y/G) LED's indicating impedance via color and flash rate
- Separate indicators for active and reference leads (total 8 indicators for 4 channels) Impedance Indicator Levels: <5K, <10K, <20K, <50K, <100K
    - Impedance data may be continually sent to PC and monitored using BrainMaster 3.0 software.

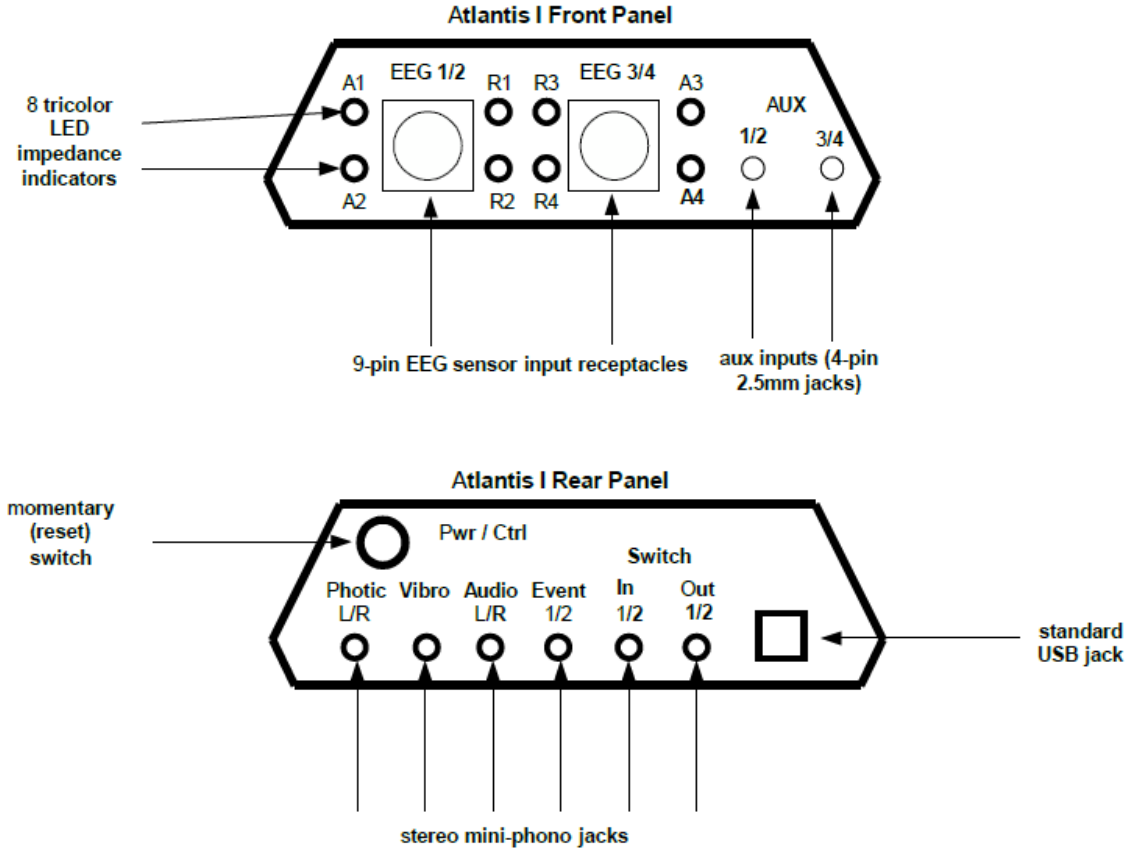
Aux Channel Information:

- Number of Aux channels: 4
- Amplifier type: BrainMaster Triamp^{tm} (simultaneous AC/DC/Impedance recording) Inputs: Single Ended: Single Active per channel, shared isolated ground
- Connector: 2.5mm 4-connector mini-phono jack: signals/gnd/power
- Aux A/D Resolution: 12 bits
- Aux A/D Accuracy: 0.2 millivolts
- Aux A/D Full Scale range: 0-2.5 volts
- Aux Typical sampling rate: 1024 samples/second (with continuous impedance monitoring)
- Aux Maximum sampling rate: 8192 samples/second (without continuous impedance monitoring)
- Aux impedance monitoring: 12-bit accuracy, range 10 Megohms
- Aux Standard Operating Bandwidth: 0.0 (DC) – 120.0 Hz. (1024 samples/second internal, 256 samples/second sent to PC)
- Aux Maximum Operating Bandwidth (4 channels): DC – 2048 Hz. (4096 samples/second internal, 4096 samples/second sent to PC)
- Aux Maximum Operating Bandwidth (1 channel): DC – 4096 Hz. (8192 samples/second internal, 8192 samples/second sent to PC)

Internal Autonomous Functions:

- Standard Operating rate: 1024 samples or events/second
- Modes: photic, vibrotactile, auditory feedback
- Photic: direct real-time EEG-controlled photic stimulation via built-in controller and optional LED glasses
- Auditory: direct real-time auditory feedback of EEG via. Built-in controller and optional earphones or speakers.
- Vibrotactile: direct real-time tactile feedback of EEG via. Built-in controller and optional vibrotactile cushion.
- Selectable modes: "split" (L and R separate) or "combine" (L+R to both eyes/ears/vibro).

Atlantis I Front and Rear Panels



Atlantis II Specifications

- Configuration: 2 x 2:
  - 2 channels EEG AC/DC/Impedance
  - 2 channels biopotential AC/DC/Impedance
- Additional Outputs/Controls:
  - EEG-controlled Photic Stimulator
  - EEG-controlled Auditory Stimulator
  - EEG-controlled Vibrotactile Stimulator Relay switches input/output (stereo)
- Interface to PC: USB (optically isolated to 4500 volts)
- Power: Isolated power via USB port (magnetically isolated - no batteries)
- Standalone Power: None

EEG Information:

- Number of EEG channels: 2
- Amplifier type: BrainMaster Triamp^{tm} (simultaneous AC/DC/Impedance recording) Inputs: Bipolar: Separate Active and Reference per channel, shared isolated ground Connector: Proprietary 9-pin connector: signals/impedance sense/ground/power EEG A/D Resolution: 24 bits
- EEG A/D Accuracy: 0.023 microvolts
- EEG A/D Full Scale Range: +/- 190 millivolts
- Typical EEG internal sampling/operating rate (4 channels): 1024 samples/second (with continuous impedance monitoring)
- Maximum EEG sampling rate (2 channels): 4096 samples/second (without continuous impedance monitoring)
- Maximum EEG sampling rate (1 channel): 8192 samples/second (without continuous impedance monitoring)
- Common-mode Rejection Ratio: > 120dB
  Input Impedance: > 1000 G Ohm
- Input noise: < 0.5 microvolts
- Standard Operating Bandwidth: 0.0 (DC) – 120.0 Hz (1024 samples/second internal, 256 samples/second sent to PC)
- Maximum Operating Bandwidth (2 channels): DC – 2048 Hz. (4096 samples/second internal, 4096 samples/second sent to PC)
- Maximum Operating Bandwidth (1 channel): DC – 4096 Hz. (8192 samples/second internal, 8192 samples/second sent to PC)

Continuous sensor impedance monitoring for EEG:

- Resolution: 12 bits
- Impedance range: 0 – 1 Megohm

- Impedance accuracy: < 250 Ohm
- Front panel indicators: 8 tri-color (R/Y/G) LED's indicating impedance via color and flash rate
- Separate indicators for active and reference leads (total 4 indicators for 2 channels) Impedance Indicator Levels: <5K, <10K, <20K, <50K, <100K
    - Impedance data may be continually sent to PC and monitored using BrainMaster 3.0 software.

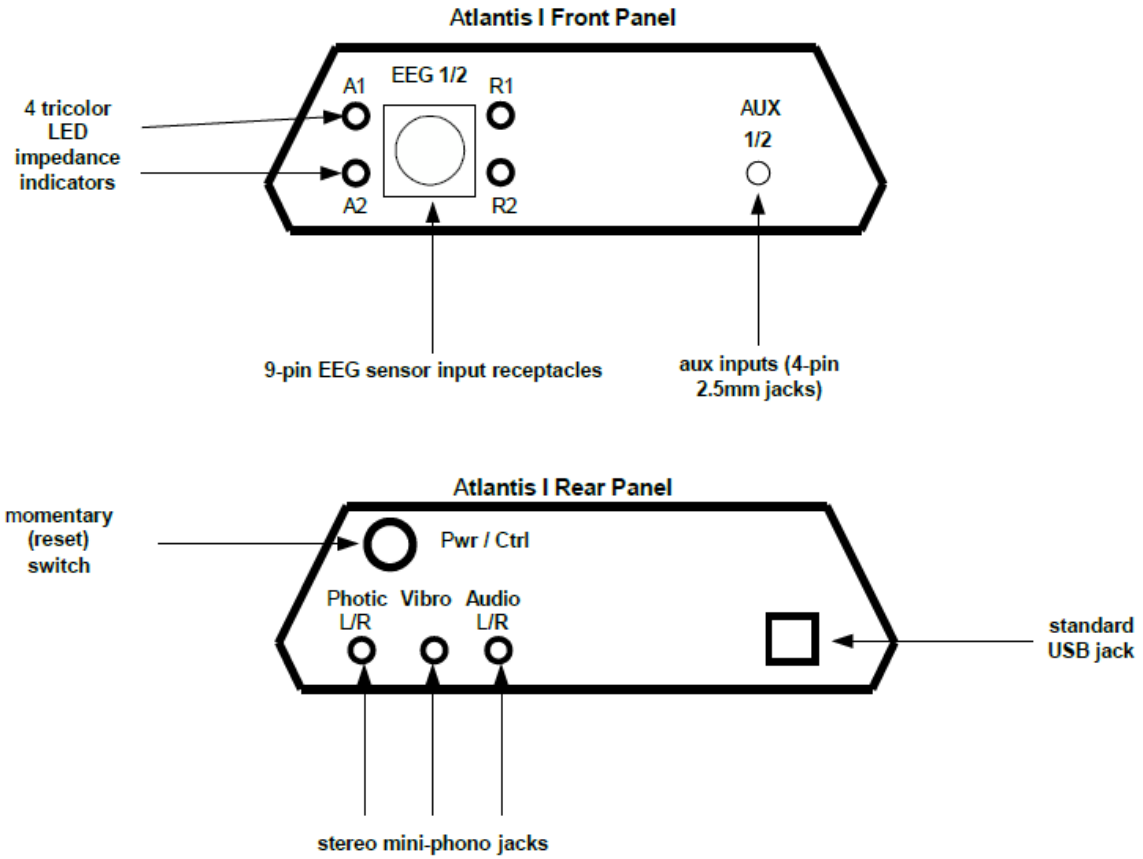
Aux Channel Information:

- Number of Aux channels: 2
- Amplifier type: BrainMaster Triamp^{tm} (simultaneous AC/DC/Impedance recording) Inputs: Single Ended: Single Active per channel, shared isolated ground
- Connector: 2.5mm 2-connector mini-phono jack: signals/gnd/power
- Aux A/D Resolution: 12 bits
- Aux A/D Accuracy: 0.2 millivolts
- Aux A/D Full Scale range: 0-2.5 volts
- Aux Typical sampling rate: 1024 samples/second (with continuous impedance monitoring)
- Aux Maximum sampling rate: 8192 samples/second (without continuous impedance monitoring)
- Aux impedance monitoring: 12-bit accuracy, range 10 Megohms
- Aux Standard Operating Bandwidth: 0.0 (DC) – 120.0 Hz. (1024 samples/second internal, 256 samples/second sent to PC)
- Aux Maximum Operating Bandwidth (2 channels): DC – 2048 Hz. (4096 samples/second internal, 4096 samples/second sent to PC)
- Aux Maximum Operating Bandwidth (1 channel): DC – 4096 Hz. (8192 samples/second internal, 8192 samples/second sent to PC)

Internal Autonomous Functions:

- Standard Operating rate: 1024 samples or events/second
- Modes: photic, vibrotactile, auditory feedback
- Photic: direct real-time EEG-controlled photic stimulation via built-in controller and optional LED glasses
- Auditory: direct real-time auditory feedback of EEG via. Built-in controller and optional earphones or speakers.
- Vibrotactile: direct real-time tactile feedback of EEG via. Built-in controller and optional vibrotactile cushion.
- Selectable modes: "split" (L and R separate) or "combine" (L+R to both eyes/ears/vibro).

Atlantis II Front and Rear Panels



Atlantis 2eb+ Specifications

- Configuration: 2 x 2:
  - 2 channels EEG AC/DC/Impedance
  - 2 channels biopotential AC/DC/Impedance
- Interface to PC: USB (optically isolated to 4500 volts)
- Power: Isolated power via USB port (magnetically isolated - no batteries)
- Standalone Power: None

EEG Information:

- Number of EEG channels: 2
- Amplifier type: BrainMaster Triamp^{tm} (simultaneous AC/DC/ recording) Inputs: Bipolar: Separate Active and Reference per channel, shared isolated ground Connector: Proprietary 9-pin connector: signals sense/ground/power EEG A/D Resolution: 24 bits
- EEG A/D Accuracy: 0.023 microvolts
- EEG A/D Full Scale Range: +/- 190 millivolts
- Typical EEG internal sampling/operating rate (4 channels): 1024 samples/second
- Maximum EEG sampling rate (2 channels): 4096 samples/second
- Maximum EEG sampling rate (1 channel): 8192 samples/second
- Common-mode Rejection Ratio: > 120dB
  Input Impedance: > 1000 G Ohm
- Input noise: < 0.5 microvolts
- Standard Operating Bandwidth: 0.0 (DC) – 120.0 Hz (1024 samples/second internal, 256 samples/second sent to PC)
- Maximum Operating Bandwidth (2 channels): DC – 2048 Hz. (4096 samples/second internal, 4096 samples/second sent to PC)
- Maximum Operating Bandwidth (1 channel): DC – 4096 Hz. (8192 samples/second internal, 8192 samples/second sent to PC)

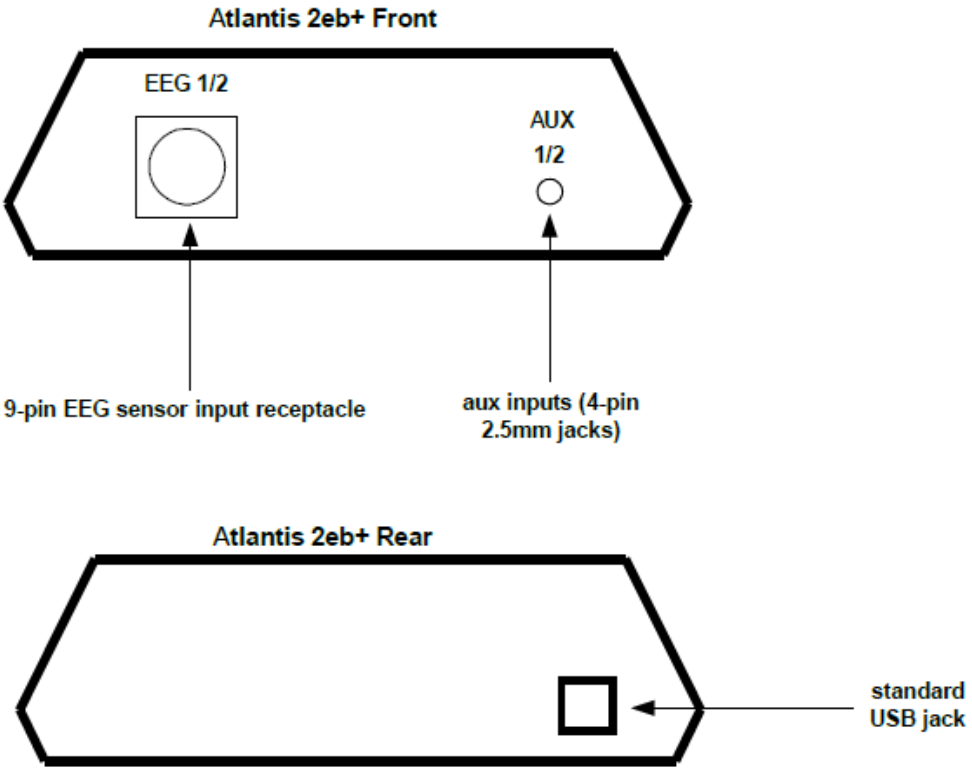
Continuous sensor impedance monitoring for EEG:

- No impedance monitoring on the 2eb+

Aux Channel Information:

- Number of Aux channels: 2
- Amplifier type: BrainMaster Triamp^{tm} (simultaneous AC/DC/ recording) Inputs: Single Ended: Single Active per channel, shared isolated ground
- Connector: 2.5mm 2-connector mini-phono jack: signals/gnd/power
- Aux A/D Resolution: 12 bits
- Aux A/D Accuracy: 0.2 millivolts
- Aux A/D Full Scale range: 0-2.5 volts
- Aux Typical sampling rate: 1024 samples/second
- Aux Maximum sampling rate: 8192 samples/second
- Aux Standard Operating Bandwidth: 0.0 (DC) – 120.0 Hz. (1024 samples/second internal, 256 samples/second sent to PC)
- Aux Maximum Operating Bandwidth (2 channels): DC – 2048 Hz. (4096 samples/second internal, 4096 samples/second sent to PC)
- Aux Maximum Operating Bandwidth (1 channel): DC – 4096 Hz. (8192 samples/second internal, 8192 samples/second sent to PC)

Atlantis 2eb+ Front and Rear Panels



Electromagnetic Immunity Specifications

The Atlantis is suitable for use in therapist offices or clinics except near active high-frequency surgical equipment, MRI devices or other sources of EM disturbances. The user of the Atlantis module should ensure that it is used in a suitable electromagnetic environment.

Medical electrical equipment requires special precautions regarding EMC and must be installed and operated according to the EMC information provided.

Also, note that portable and mobile RG communications equipment can affect medical electrical equipment.

Use of accessories, sensors, and cables other than those specified may result in increased emission and/or decreased immunity of the Atlantis. See Atlantis Accessories on Page 22.

The Atlantis should not be used adjacent to, or stacked with other equipment. If adjacent or stacked use is necessary, the Atlantis should be observed to verify normal operation in the configuration in which it is used.

There are minimum amplitudes for the Atlantis to measure physiological signals. Operation of the equipment below the minimum amplitudes may cause inaccurate results.

Atlantis Accessories

Part Number	Product Description
640-009	10/20 Paste 4oz.
640-010	10/20 Paste 8oz.
640-011	10/20 Paste (Weaver)
641-005	Nu-Prep (Weaver)
641-006	Nu-Prep (Weaver)
641-003	Electro Gel
630-007	18” Gold Cup Electrodes
630-005	48” Gold Cup Electrodes
630-040-18	18” Gold Flat Electrodes
630-040	48” Gold Flat Electrodes
630-016-24	24” Silver Chloride Electrodes
630-016-60	60” Silver Chloride Electrodes
630-011-18	18” Gold Cup Ear Clips
630-011	48” Gold Cup Ear Clips
630-012-18	18” Gold Flat Ear Clips
630-012	48” Gold Flat Ear Clips
621-200	3.5” Electro Cap Ear Clips
621-198	10” Electro Cap Ear Clips
621-199	48” Electro Cap Ear Clips
630-047	Quick Insert Electrodes
621-209	Electro Cap XL
621-210	Electro Cap L/XL
621-204	Electro Cap L
621-208	Electro Cap M/L
621-203	Electro Cap M
621-205	Electro Cap S/M
621-202	Electro Cap S
621-207	Electro Cap XS/S
621-201	Electro Cap XS
381-006	BrainMaster 47” 2-Channel Cable
380-010	10’(3M) USB Cable (generic)

Note That an Electrocap requires the use of a Mini-QII (390-050) Device.
Note all Electrocaps include their own 63” cable.

Atlantis Specifications

The Atlantis modules are suitable for the use in the specified electromagnetic environment. The customer and/or user of the Atlantis should ensure that it is used in an electromagnetic environment as described below.

Guidance and manufacturers Declaration - Emissions		
All Atlantis modules are intended for use in the electromagnetic environment specified below. The customer or user of the Atlantis should ensure that it is used in such an environment.		
Emissions Test	**Compliance**	**Electromagnetic - Guidance**
RF Emissions CISPR 11	Group 1	The Atlantis uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emissions CISPR 11	Class A	Physician and therapist offices, clinics, limited care facilities, freestanding surgical centers, freestanding birthing centers, multiple treatment facilities, hospitals (emergency rooms, patient rooms, intensive care, surgery rooms except near HF surgical equipment, and outside the RF shielded room of MRI equipment or other medical equipment where EM disturbances are high).
Harmonics IEC 61000-3-2	N/A	Mains power issues, such as harmonic distortion, voltage flicker, supply spikes and supply surge, do not apply to these tests as the ME equipment is USB-powered and the support equipment has its own safety features.
Harmonics IEC 61000-3-3	N/A	Mains power issues, such as harmonic distortion, voltage flicker, supply spikes and supply surge, do not apply to these tests as the ME equipment is USB-powered and the support equipment has its own safety features.

Atlantis Immunity Tests

The Atlantis Immunity test levels were tested to Professional Health Care Facility Environments levels			
Phenomenon	**Basic EMC or Test Method**	**Immunity Required Test Level**	**Tested level (see Note 1 below)**
Electrostatic Discharge	IEC 61000-4-2	± 8kV Contact ± 2kV, ± 4kV, ± 8kV, ± 15kV Air	± 8kV Contact ± 2kV, ± 4kV, ± 8kV, ± 15kV Air
Radiated RF Immunity	IEC 61000-4-3	3 V/m 80 MHz to 2.7 GHz 80% @ 2 Hz AM modulation	3V/m 80 MHz to 2.7 GHz 80% @ 2 Hz AM modulation
Proximity Fields from RF wireless communications equipment	IEC 61000-4-3	See Note 1 below	See Note 1 below
Electrical Fast Transient	IEC 61000-4-4	N/A	Mains power issues, such as harmonic distortion, voltage flicker, supply spikes and supply surge, do not apply to these tests as the ME equipment is USB-powered and the support equipment has its own safety features.
Surge Immunity	IEC 61000-4-5	N/A	Mains power issues, such as harmonic distortion, voltage flicker, supply spikes and supply surge, do not apply to these tests as the ME equipment is USB-powered and the support equipment has its own safety features.
Conducted Disturbances Immunity	IEC 61000-4-6	3 V/m 150 kHz to 80 MHz Per professional health care facility test standards	3 V/m 150 kHz to 80 MHz Per professional health care facility test standards
Rated Power Frequency Magnetic Fields	IEC 61000-4-8	30 A/m 50Hz or 60Hz	30 A/m 50Hz or 60Hz
Voltage Dips/Short Interruptions	IEC 61000-4-11	30 s Interruption of mains power tested using a battery-powered laptop. Performance not affected.	30 s Interruption of mains power tested using a battery-powered laptop. Performance not affected.

Note 1: Standard electro-magnetic immunity levels were utilized for these tests and therefore a separation distance between the Discovery and EM source must be at least 15cm (6 inches) or greater.

Essential Performance

All Atlantis modules, including the Atlantis I 4x4, the Atlantis II 2x2, and the Atlantis 2EB+, will provide physiological monitoring and recording of brain signals. Software used with the device enables patient neurofeedback. During a "session", data will be recorded and the PC software will display brainwave signals on-screen. Auditory and visual neurofeedback can be enabled and protocols for the feedback can be set prior to the session. If these essential performances are not met, the software provides warning or alert messages to notify the operator or clinician of possible errors. These basic safety measures ensure proper use of the equipment and recording valid data. Alert Messages include the following:

- **No Response on COM** - Indicates that the Atlantis is not communicating with the USB-attached computer (PC). The user should check the USB connection and communication port settings used on the PC.
- **Artifact Warning** - Indicates possible electromagnetic disturbances or improper use of EEG sensors. For basic safety, the user should check impedance levels and re-apply sensors or sensor paste/gel as needed. The type of condition of the sensors and cables should be checked. If necessary, a check of possible electromagnetic (EM) interference sources should follow. The default threshold for signal artifacts is 255 mV.

PLEASE NOTE: While these conditions may affect a patient's neurofeedback session and result in invalid data, there is no impact on the service life of the device.

Connecting to the PC

The Atlantis module is connected to the PC using a standard USB cable. This both powers the unit, and also provides a communication channel to and from the PC. When the module is first connected, it will be necessary to install the "driver" software, by following the instructions provided. The Atlantis module will not operate, even in local autonomous mode, until it is recognized by a PC, and the PC provides the device with power.

 Please see 531-319 for Hardware Installation instructions for more information.

Atlantis Power on Sequence

After the Atlantis is properly installed on the PC, the PC will be providing power to the module. Each time the module is connected to the PC and the PC is powered, the module will go through a startup sequence indicated by the front panel LEDs -- note that the 2eb+ does not include these LEDs. They will first glow red, then flash red, yellow, and green, and finally go into the impedance indication mode. When nothing is connected to the inputs, the impedance lights should flash slow orange.

Connecting EEG Sensors

The sensors are connected by using the input cable (381-006 or 381-009). Insert the cable connector into the front panel socket on the module. Then insert the respective sensor leads using the "touch proof" jacks on the other end of the cable.

 Please see 531-239 or 531-240 for more information on the BrainMaster Input cables.

Please Note: It is essential to first obtain a good ground connection. All of the other connections, and the impedance sensing circuit, depend on a good ground. If the ground connection is poor, all other signals, including the impedance sensing, will be compromised. For a secure ground, either an ear clip, mastoid connection, or any other suitable connection can be used. Connect this sensor first, and make sure the connection is secure.

Front Panel Impedance Lights

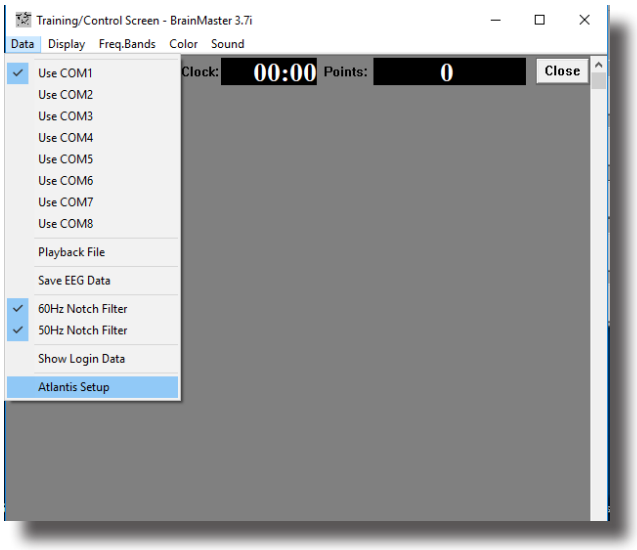
The impedance of each sensor lead is represented by its respective LED, which will flash with a color and frequency indicating the impedance. Note that these lights are not included in the 2eb+ module. The interpretation is as follows:

Slow green:	< 5K ohms
Fast green:	< 20K ohms
Fast yellow:	< 50K ohms
Slow yellow:	> 50K ohms

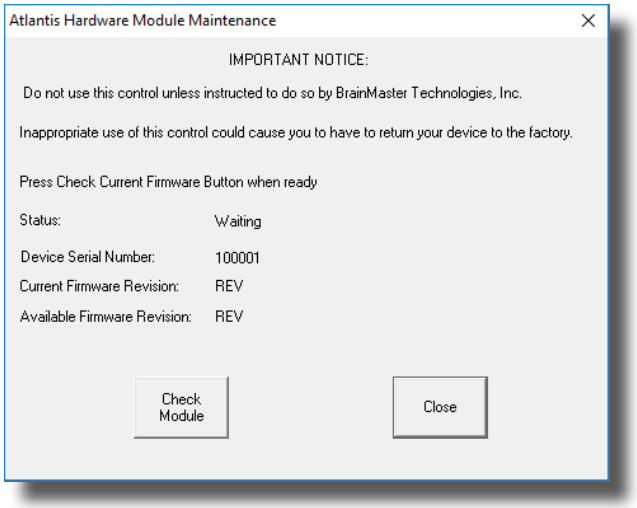
Once the ground is secured, attach the active and reference leads. The LED indicators should indicate the state of each lead. Note that if one lead falls off completely, its "companion" lead may show up in the LED's. For example, if the channel 1 reference lead is entirely disconnected, either the channel 1 reference, the channel 1 active, or perhaps both, will indicate a failure. This is because if a lead is entirely floating, its respective amplifier may "float", causing both leads to indicate the failure.

Atlantis Firmware Field Programming

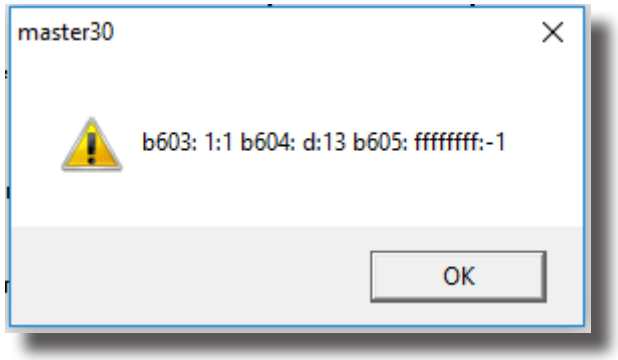
1. Firmware Field programming is performed in the Training/Control Screen. Begin by clicking the "Data" tab, then choosing "Atlantis Setup" **PLEASE NOTE:** You must be running the latest updated version of the BrainMaster software, as well as be utilizing the proper COM that the device is assigned to in order to update to the latest version of the Atlantis Firmware.



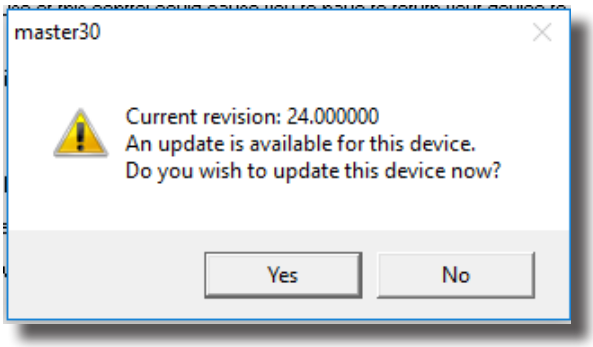
2. When the "Atlantis Hardware Module Maintenance" appears, click "Check Module"



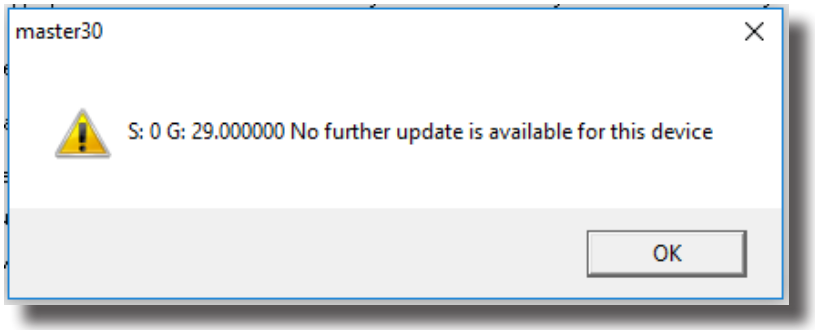
3. When the following box appears, click "OK" to continue. **PLEASE NOTE:** The text that appears might be different to the text that appears on your screen.



4. The Following screen will let you know your current Firmware Revision. Click "Yes" to continue. **PLEASE NOTE:** If the current revision of Firmware is version 19.000000 or below, please contact BrainMaster Technologies before continuing on your own!

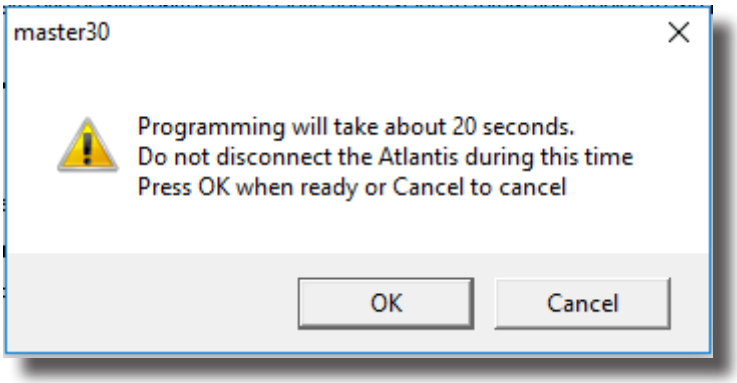


Example of Firmware that can be updated

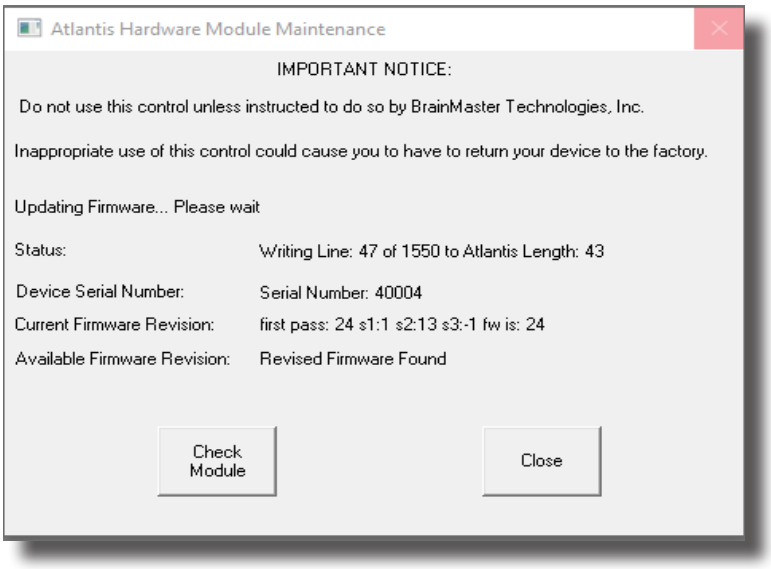


Example of the most up-to-date Firmware

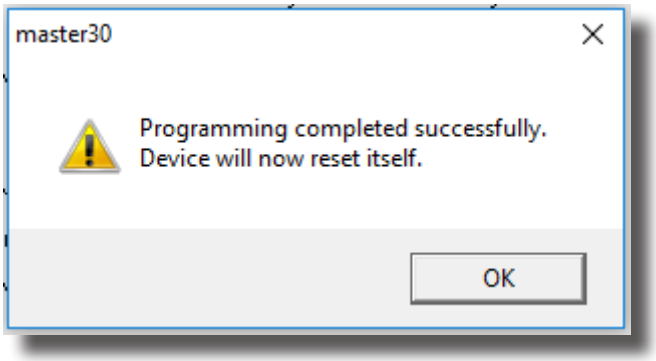
5. The following window will give you instructions. Be sure to follow these instructions, and click "OK" to continue.



6. The "Atlantis Hardware Module Maintenance" Menu will now begin to update the firmware. **PLEASE NOTE: It is important that while this is happening, that nothing else is to be occurring, as this can cause problems in writing the Atlantis Firmware. You can tell that this is occurring, because, the Status line number will be increasing.**

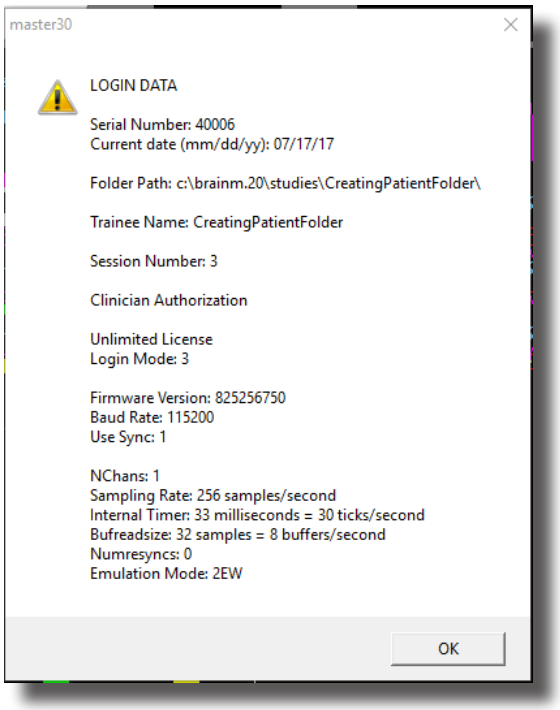


7. When the following screen appears, click "OK" to continue. On the "Atlantis Hardware Module Maintenance" menu, click "Close".



Atlantis Firmware Field Programming

Your Atlantis is now using the most up-to-date Firmware. You will be able to that you are using the latest version of firmware during a session by click the File Button and then clicking on the Show Login Data Option while the system is running.



Please see 531-320 for more information on the BrainMaster 3.0 Software.

BrainMaster Products are manufactured by:

BrainMaster Technologies Inc.
195 Willis St.
Bedford, OH 44146
United States
Phone: 1-440-232-6000
E-Mail: support@brainm.com
Internet: www.brainm.com

EC REP

European Representative:

mdi Europa GmbH
Langenhagener Straße 71
D-30855 Langenhagen

Phone: +49-511-39 08 95 30
Fax: +49-511-39 08 95 39
Email: info@mdi-europa.com
Internet: www.mdi-europa.com

REF 531-326 v5.7 1/23/2023