

The next generation of 3D Brain Imaging and Neurotherapy

Discovery 24 and 20 Modules Hardware User Manual



BrainMaster Passkey Log

BrainMaster Serial Number_____

Passkey_____

Date Purchased_____

Date Affiliate Expires_____

BrainMaster Passkey Log

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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. The BrainMaster Discovery 24 also conforms to the requirements for Clinical EEG under the US FDA (Food and Drug Administration) under 510(K) 150498. 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." within the user's scope of practice.

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



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

***BMrMMP is an optional purchase*

Discovery Device Description

Executive Summary and Device Description

The Discovery 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 Discovery 20 is provided with 20 channels; the Discovery 24 – with 24 channels. When used with the supplied software, the system provides biofeedback monitoring, analysis, and reports using a Windows PC.

The Discovery 24 and the Discovery 20 are indicated for prescription use to acquire, record, transmit, and display physiological and data for electroencephalograph (EEG) studies of patients of all ages.

The Discovery 24 and the Discovery 20 are indicated for clinically proven Electroencephalographic (EEG) applications for patients of all ages. The devices can be used by healthcare professionals within their scope of practice 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 health care professional.

Notes and Safety Precautions

Symbols Used



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



Shock ProtectionType 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
GOhms	Gigaoohms
Hz	Hertz
LZT	Live Z-Score Training
m	meter
MMP	Multi Media Player
mV	millivolt
RMS	Root-Mean-Square
USB	Universal Serial Bus

General Care Instructions for your BrainMaster System

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 transmitters.**

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.**

General Care Instructions for your BrainMaster System

- However, users may choose to add personal information (e.g., codified patient identifier) to data file or folder 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 information 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.

General Care Instructions for your BrainMaster System

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.

General Care Instructions for your BrainMaster System

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 warrantees 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.

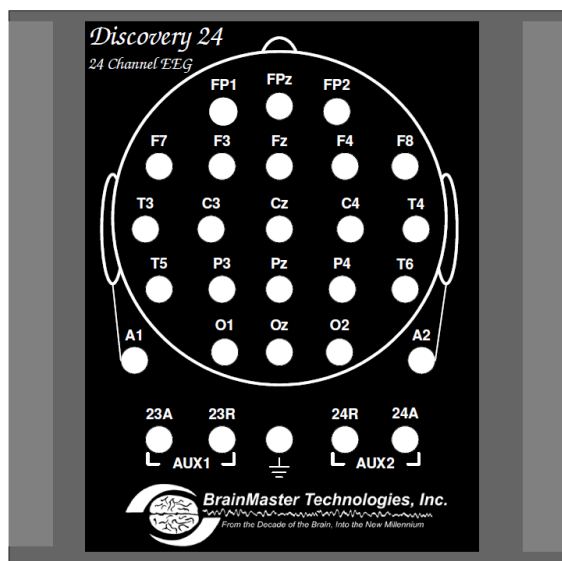
Please Note: These instructions apply to electrodes only they do not apply to the Electro-Cap products sold by BrainMaster. Consult the Electro-Cap manual and training video for proper cleaning and care. Contact Electro-Cap International at 800-527-2193 or view their website at <http://www.electro-cap.com/information.htm>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

Discovery 24/20 Specifications

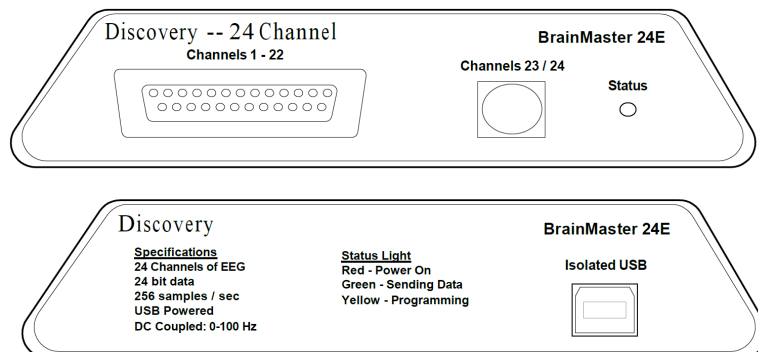
Device Overview

- Number of channels: 24 (**20 channels for the Discovery 20**)
 - Channels 1 – 19 are 10-20 sites.
 - Channel 20 is A2, referenced to A1. (A2-A1)
 - Channel 21 is Fpz (**Not available on Discovery 20**)
 - Channel 22 is Oz (**Not available on Discovery 20**)
 - Channels 23 and 24 are differential with separate active and reference inputs on external (**Not available on Discovery 20**)
- “Atlantis” style connector (cable & standard touch-proof leads)(**Not available on Discovery 20**).
- All channels acquired referenced to A1
- Amplifier type: DC, differential
- A/D accuracy: 24 bits; resolution 0.01microvolts EEG, 0.4 microvolts DC
- Input range: +/- 100 millivolts EEG, +/- 4 volts DC
- Input impedance > 1000GOhms
- Common-mode Rejection Ratio (CMRR) > 110 dB
- Amplifier bandwidth: 0.000 - 100 Hz
- EEG channel bandwidth: 0.43 - 80 Hz
- DC offset signal bandwidth: 0.000 - 2 Hz
- Input noise < 1.0 microvolt
- Sensor contact quality monitored via offset voltage
- Sampling Rate: 1024 samples/second
- Data rate to PC: 256 samples/second
- Line speed: 480600 baud
- Data rate: 19200 bytes / second
- Connection to PC: USB, optically and magnetically isolated

Discovery 24/20 Specifications



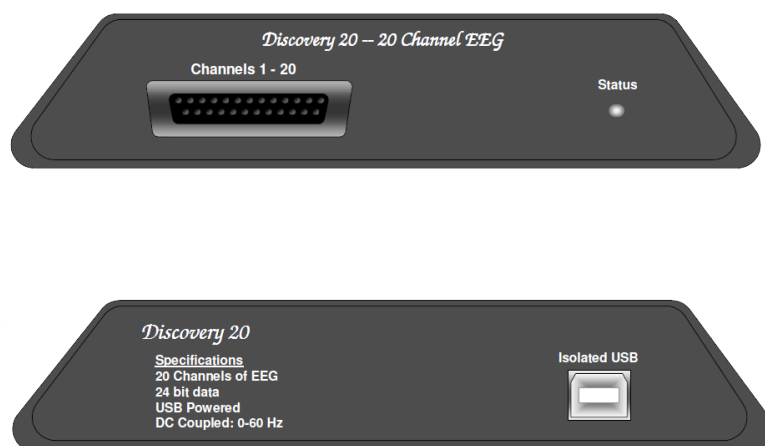
Discovery 24 Top Panel



Discovery 24 Front & Back Panel



Discovery 20 Top Panel



Discovery 20 Front & Back Panel

Discovery 24/20 Specifications

Electromagnetic Immunity Specifications

The Discovery 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 Discovery should ensure that it is used in a suitable electromagnetic environment.

Use of accessories, sensors, and cables other than those specified may result in increased emission and/or decreased immunity of the Discovery. See Discovery Accessories on Page 14

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

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

Discovery 24/20 Specifications

Discovery 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 2-Channel Cable
380-010	USB Cable (generic)

Discovery 24/20 Specifications

The Discovery 24 and Discovery 20 are suitable for the use in the specified electromagnetic environment. The customer and/or user of the Discovery should ensure that it is used in an electromagnetic environment as described below.

Guidance and manufacturers Declaration - Emissions		
The Discovery 24 or 20 is intended for use in the electromagnetic environment specified below. The customer or user of the Discovery should ensure that it is used in such an environment.		
Emissions Test	Compliance	Electromagnetic - Guidance
RF Emissions CISPR 11	Group 1	The Discovery 24 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.

Discovery 24/20 Specifications

Discovery 24 Immunity Tests

The Discovery 24 Immunity test levels were tested to Professional Health Care Facility Environments levels (Note: Discovery 20 is a variant model of Discovery 24, the same test levels apply).			
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

Discovery Basics

Connecting to the PC

The Discovery 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 Discovery module will not operate, , until it is recognized by a PC, and the PC provides the device with power.



Please see 531-379 for Hardware Installation instructions for more information.

Discovery Power on Sequence

After the Discovery 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 Status light on the front panel will turn on. This light will be red with-out any software running.

Connecting EEG Sensors through the Lid

The sensors are connected by using the lid of the device. Insert the respective sensor leads using the “touch proof” jacks into each site that you will be using.

Please Note: It is essential to first obtain a good ground connection and A1. If either of these connections is poor, all other signals will be compromised. For a secure ground, any suitable connection can be used. Connect this sensor first, and make sure the connection is secure.

Please Note: No matter what type of connection, please note that A1, A2 and GND must always be connected. If you do not connect these sites, you will not get a proper connection.

Connecting EEG Sensors through 25-Pin Connector

Make sure to properly connect all sites, per the manufacturer’s specifications. Once the device is fully connected, plug the male connector of the female connector of the Discovery.



Please see the manufacturer’s instructions for more information on connections.

DC Offsets Information

The Discovery does not monitor sensor impedance as the Atlantis does. Instead, it monitors the DC offset potential on all 24 or 20 channels, and uses them to assess sensor connection quality. While there does not seem to be an exact correspondence between sensor offset and sensor impedance, we have found that when sensor offsets below 25 millivolts are achieved, then good recordings can be expected. Below, is a recommended level for the different type of sensors:

Gold	below 50mV
Ag/AgCL	below 10mV
Tin	below 30mV

In the BrainMaster Discovery Software, we have built in the ability to monitor DC Offsets to assure the optimal connection. This has also been color-coded for you convenience:

White	below 25mV
Green	below 50mV
Yellow	below 75mV
Red	above 100mV



Please see 531-349 for for more information on the BrainMaster Discovery Software.

Discovery Basics

Essential Performance

Both the Discovery 24 and Discovery 20 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 of valid data. Alert messages include the following:

“No Response on Com” indicates that the Discovery 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/jell as needed. The type and condition of the sensors and cables should be checked. If necessary, a check of possible electromagnet (EM) interference sources should follow. The default threshold for signal artifacts is 255 mV.

PLEASE NOTE: that 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.

Discovery Basics

Impedance Lid Information (Optional Purchase)

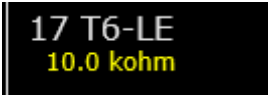
The Discovery Impedance Lid is intended to be used with the BrainAvatar* Software, and is to be used in place of the current two-step process of using a Checktrode and the connecting to the Discovery for recording of your QEEG. Below are a few steps to follow in order to achieve the best results.

1. Once you have logged into the BrainAvatar* software and started acquisition you will need to "Right Click" and select "show impedances" and your impedances will be shown on the right hand side of the screen.
 - a. The Impedances are color coded for your convenience.
 - i. Red indicates a poor connection that will require attention

A black rectangular box with a red border. Inside, the text "15 F8-LE" is in white, and "18.2 kohm" is in red.

15 F8-LE
18.2 kohm

- ii. Yellow indicates a marginal connection that requires attention

A black rectangular box with a yellow border. Inside, the text "17 T6-LE" is in white, and "10.0 kohm" is in yellow.

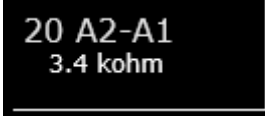
17 T6-LE
10.0 kohm

- iii. Green indicates a good connection

A black rectangular box with a green border. Inside, the text "19 Pz-LE" is in white, and "7.3 kohm" is in green.

19 Pz-LE
7.3 kohm

- iv. White indicates a very good connection

A black rectangular box with a white border. Inside, the text "20 A2-A1" is in white, and "3.4 kohm" is in white.

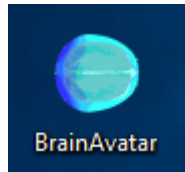
20 A2-A1
3.4 kohm

PLEASE NOTE: if you are not receiving impedance measurements once you have chosen to display them you will either need to press "Shift+ >" or select "impedance on" from the data drop down menu.

Discovery Basics

Steps for Impedance checking using the Impedance Lid

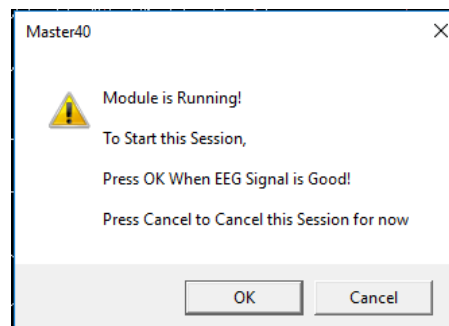
1. Start the BrainAvatar* Software.



2. Create a folder in the software using the protocol labeled "No Limit QEEG Assessment - Impedances"**. When the folder has been built, click the GO Button to begin.

No Limit QEEG Assessment - DC Offset	8/5/2016 12:54 PM	BDB2 File
No Limit QEEG Assessment - Impedances	8/5/2016 12:52 PM	BDB2 File
Peak	8/3/2016 11:23 AM	BDB2 File

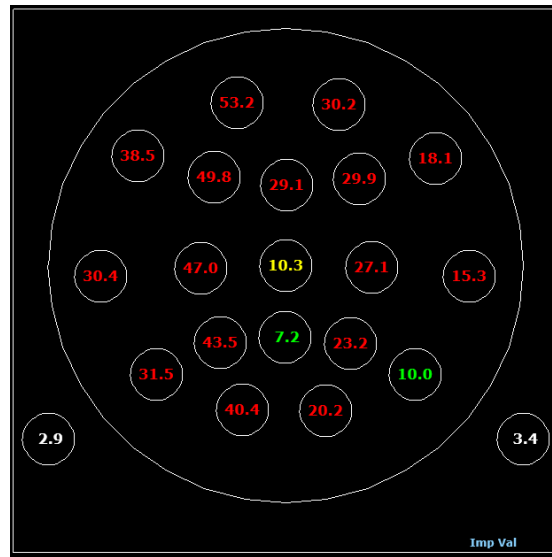
3. When you see the following message:



Do not click OK. You will now use the Impedance Head Map to check your impedances


Discovery Basics

4. In order for proper impedance measurements, it is necessary for the Ground Position to be properly applied. To properly check for a good ground connection, first connect A2, A1 and Ground. You will utilize the Impedance Head Map to validate these impedances



5. Once A2 and A1 are below 5 kohms proceed with all other electrodes. When all electrode positions are below 5 kohms, click OK to begin.

PLEASE NOTE: When connecting your patient to the Discovery equipped with an impedance lid it is important to not place a jumper between A1 and A2 until such time as you have finished connecting your patient and ensured that all of your connections are good.

 *Please see 531-322 for more information on the BrainMaster BrainAvatar Software.
**If this protocol is not located in your protocol directory, instructions for downloading and proper placement can be found at www.brainm.com/kb/entry/531/

Discovery Self-Calibration Unit (Optional Purchase)

The Discovery Self Cal unit allows you to perform on-site calibrations without the need of expensive lab equipment. Running your own tests means you won't necessarily have to send your Discovery in to BrainMaster for troubleshooting. This can prevent loss of patient session time.



When running your device in calibration mode ensure that there is not a cap attached to the 25-pin connector.

Connecting The Discovery Self Cal

1. Plug the 25-Pin connector into the Channel 1-22 Plug on the front of the Discovery 24



2. Plug The Input connector into the Channel 23/24 Plug on the front of the Discovery 24. **PLEASE NOTE: The Discovery 20 does not use the 23/24 Plug. It is not needed and is not plugged in.**



The Discovery is now ready to begin Self-Calibration.

Process for Discovery Self-Calibration

- File | Settings | Run | Data | Help

Main | Login | Folder Settings | Settings | EDF Browser | Review | Global Settings |

Main | Read/Write | Channels | Bands | Protocol | Display | Feedback | Session | Event Wizard | Acquisition | Montage | Z Scores | Session Wizard | Atlants HW | Electrodes |

Read/Write Settings File
Name unknown

Data Channels

Frequency Bands

Training Protocol

Display Options

Feedback Control

Session Control

Auto Threshold

Current Training/Study:
 NCHANs: 22 SRATE: 25k LOWFREQ/OFF: OFF FILTER: 3
 ARTFACT: 240 uV COM: 4 - 50mVCHANs OFF - SAVEDSEG EDF -
 P-P/OWP1 LE P3-LE C3-LE P3-LE O1-LE F7-LE T3-LE T5-LE F7-LE
 Raw EEG: 0.0000-0.0000 Data: 1.0000-1.0000 Theta: 4.0000-7.0000
 Alpha: 8.0000-12.0000 Lbeta: 12.0000-15.0000
 Beta: 15.0000-20.0000 Hbeta: 20.0000-30.0000

GO: (none)
 STOP: (none) AUTO:OFF/50/20/10

Display:
 Sound: Reward Sound -

80 SESSIONS - NO BASELINES - 1 RUN OF LENGTH: 1.0 MIN- NO
 PAUSE BETWEEN RUNS-

PRINT SETTINGS Event Wizard USE THESE SETTINGS

Logged in, device Type Discovery

Use Settings and Close Use These Settings

- R1 Baseline Setup**

Main | Login | Folder | Settings | Review | Global Settings | Baseline | Event Wizard | Acquisition | Montage | Z Scores | Session Wizard | Atlantis HW | Electrodes |

Main | Read/Write | Channels | Bands | Protocol | Display | Feedback | Session | Event Wizard | Acquisition | Montage | Z Scores | Session Wizard | Atlantis HW | Electrodes |

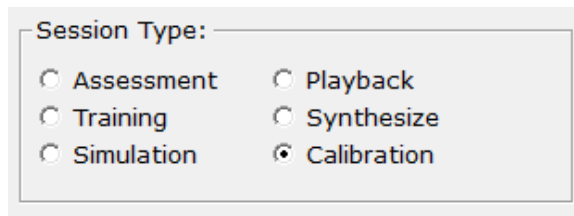
NOTE: Please enter all times as whole seconds (1, 2, 3, etc)

Baseline Length (pre and post) <input type="text" value="0"/> Seconds (before and after (Length of 0 means "no baseline")	Run Length: <input type="text" value="60"/> Seconds (0 means run indefinitely)
Number of Sessions: <input type="text" value="80"/> sessions (80 maximum) (0 allows repeated use of Test Session 1)	Number of Runs (Trials) <input type="text" value="1"/> Runs (Must have at least one Run)
Session Type: <input type="checkbox"/> Assessment <input type="checkbox"/> Playback <input type="checkbox"/> Training <input type="checkbox"/> Synthesize <input type="checkbox"/> Simulation <input checked="" type="checkbox"/> Calibration	<input type="checkbox"/> Pause Between Runs? <div>Session Wizard</div>

☐ Use Session Wizard to control session (use with MINI-Q)

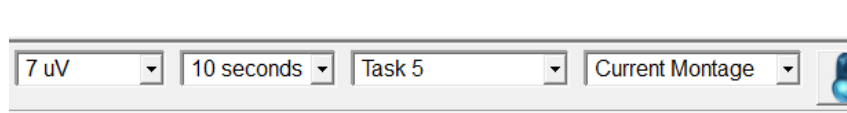
Discovery Self-Calibration Unit (Optional Purchase)

6. Verify Session type is set to Calibration.



7. Close the settings tab.

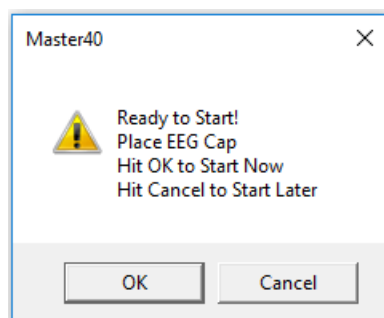
8. Verify that BrainAvatar is set to 'Task 5.' Set to 'Task 5' if it is not.



9. Hit "Go" on the main BrainAvatar screen.

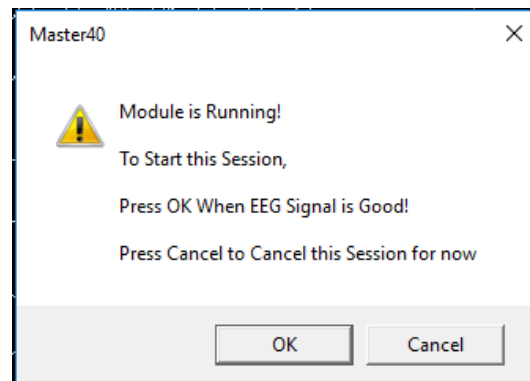


10. A popup will appear on the screen. Ensure that the Self-Cal is properly connected to the Discovery unit.

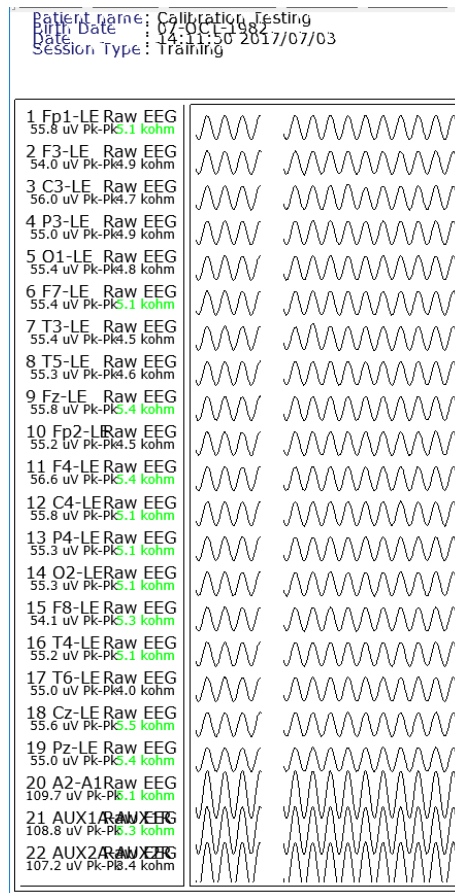


Discovery Self-Calibration Unit (Optional Purchase)

11. Hit "OK" and the software will begin running. Select "OK" on the next popup once the calibration signal begins running.



The Self-Calibration is now running on your Discovery 24 / 20. It will produce Sine Waves across all channels. The values will be 50uV on all channels referenced to LE. A2 referenced to A1 and Aux1/Aux2 will have a value of 100uV. If you have an impedance lid on your Discovery you will be able to see impedances at 4 k ohm (+/-10%)



Discovery Self-Calibration Unit (Optional Purchase)

12. On the "Calibration" tab, you will see the values on each channel as below. The values will be between 48.5 and 51.5

VALUE A	RULE	VALUE B	THEN: VAL A	VAL B	% TIME
x=C1AA; GT	x=C2AA; nothing	48.81	46.29	100.0	
x=C3AA; GT	x=C4AA; nothing	48.35	47.98	100.0	
x=C5AA; GT	x=C6AA; nothing	48.21	48.28	33.8	
x=C7AA; GT	x=C8AA; nothing	48.27	47.76	100.0	
x=C9AA; GT	x=C10AA; nothing	48.34	48.04	100.0	
x=C11AA; GT	x=C12AA; nothing	48.48	48.42	100.0	
x=C13AA; GT	x=C14AA; nothing	48.04	48.15	0.0	
x=C15AA; GT	x=C16AA; nothing	47.56	48.32	0.0	
x=C17AA; GT	x=C18AA; nothing	48.43	48.36	99.4	
x=C19AA; GT	x=C20AA; nothing	48.17	95.58	0.0	
x=C21AA; GT	x=C22AA; nothing	95.53	95.44	74.4	
x=C23AA; GT	x=C24AA; nothing	0.00	0.00	0.0	

13. Allow the Calibration to run for 60 seconds. After 60 seconds stop the software.

14. Change 'Task 5' to either 'Eyes Open' or 'Eyes Closed.' Go back to the settings menu as illustrated above and change 'Calibration' to 'Assessment', and Run Length to 0.

7 uV 10 seconds Eyes Open Current Montage

BrainAvatar Setup

Main | Login | Folder | Settings | EDF Browser | Review | Global Settings

Main | Read/Write | Channels | Bands | Protocol | Display | Feedback | Session | Event Wizard | Acquisition | Montage | Z Scores | Session Wizard | Atlantis HW | Electrodes

NOTE: Please enter all times as whole seconds (1, 2, 3, etc)

Baseline Length (pre and post):
 Seconds (before and after)
 (Length of 0 means "no baselines")

Run Length:
 Seconds
 (0 means run indefinitely)

Number of Sessions:
 sessions (80 maximum)
 (0 allows repeated use of Test Session 1)

Number of Runs (Trials):
 Runs
 (Must have at least one Run)

Session Type:
☒ Assessment ☐ Playback
☐ Training ☐ Synthesize
☐ Simulation ☐ Calibration

☐ Pause Between Runs?

Session Wizard

☐ Use Session Wizard to control session (use with MINI-Q)

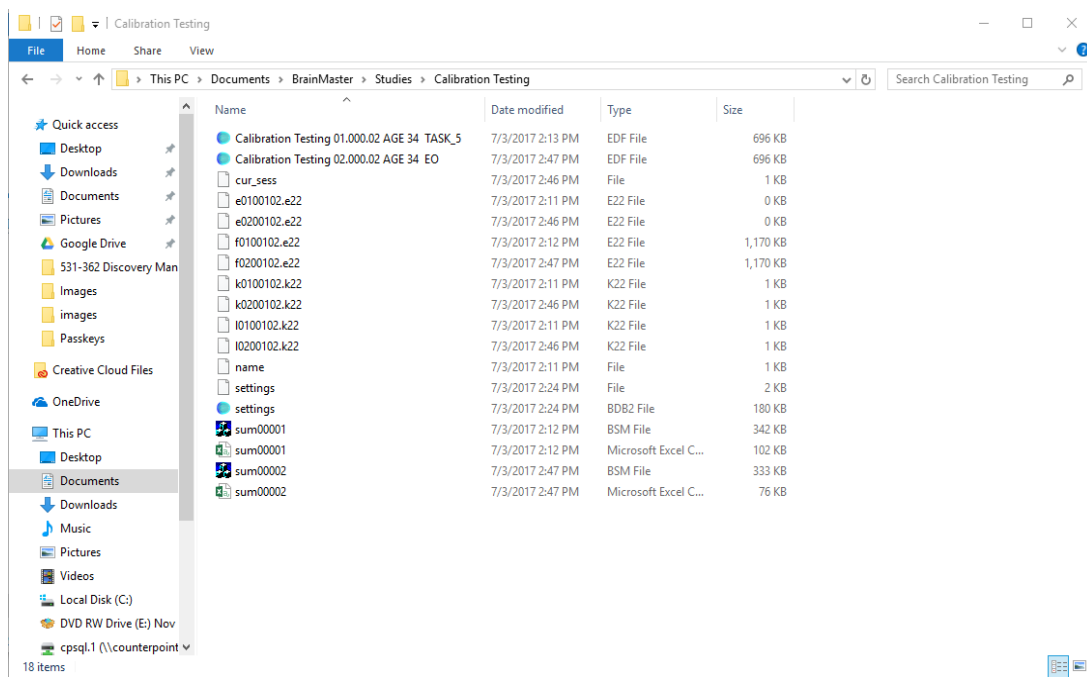
Logged in, device type Discovery

Use Settings and Close Use These Settings

Discovery Self-Calibration Unit (Optional Purchase)

The software will now function as it normally would. Your calibration data will be saved as the first session in the client's folder. To view the EDF file of the calibration data, on the BrainAvatar main screen select the 'file' tab and then 'open current study.'

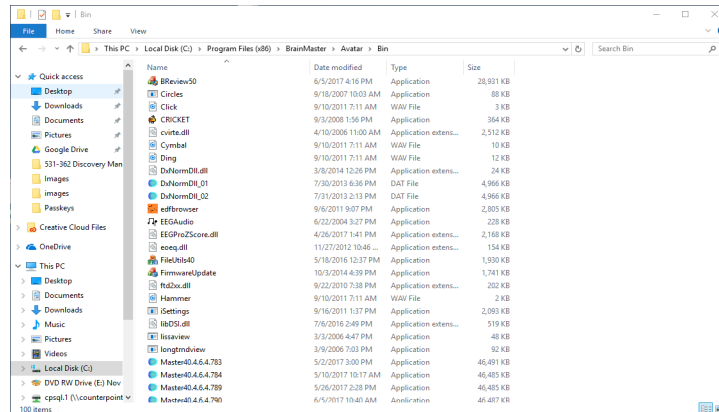
To retrieve calibration data at a later time, the .EDF file will be stored to your pc under C:\Program-Data\BrainMaster\Studies\ (study name). It will be listed as the client's name followed their age and TASK_5.



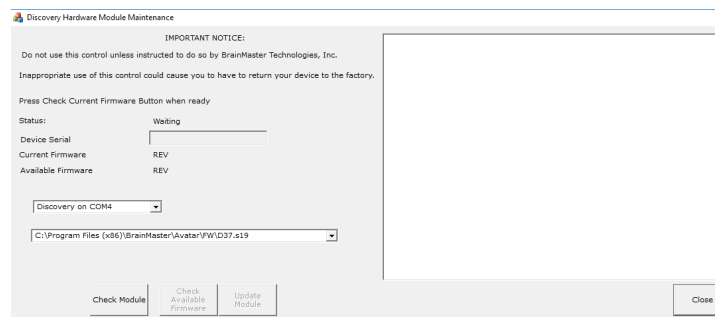
 *Please see 531-322 for more information on the BrainMaster BrainAvatar Software.

Discovery Firmware Field Programming

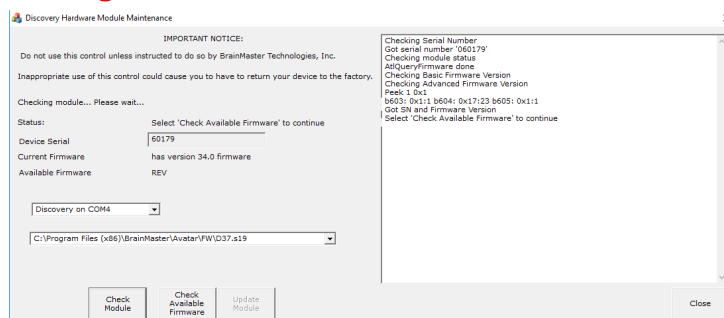
1. Firmware Field programming is performed in the application called "Firmware Update". Begin by Double-clicking the application. **PLEASE NOTE:** You must be running the latest updated version of the BrainAvatar software in order to update the Discovery Firmware.



2. Use the Drop-Down-List to choose the proper COM Port for your Discovery. When this has been selected, click the "Check Module" Button.

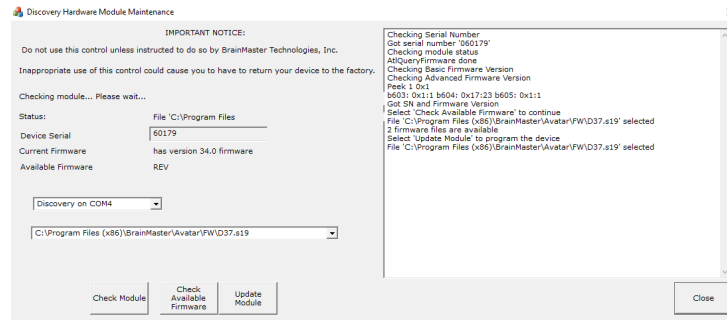


3. After the Device has been checked, it will let you know its Serial Number and Firmware Revision. It will also make the Check Available Firmware Button accessible. Please click to continue. **PLEASE NOTE:** The Firmware Revision needs to be Firmware 30 or above to remotely update. If this is an earlier version, please call BrainMaster Technologies for more information.

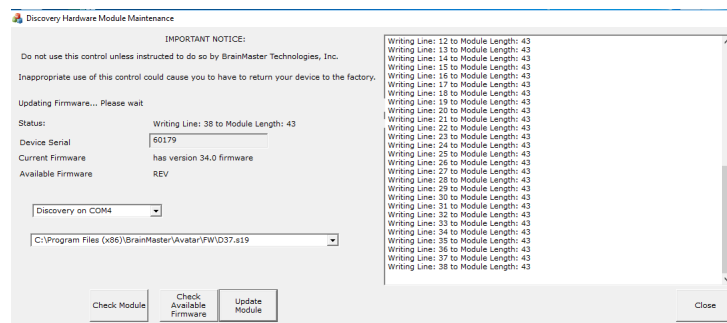


Discovery Firmware Field Programming

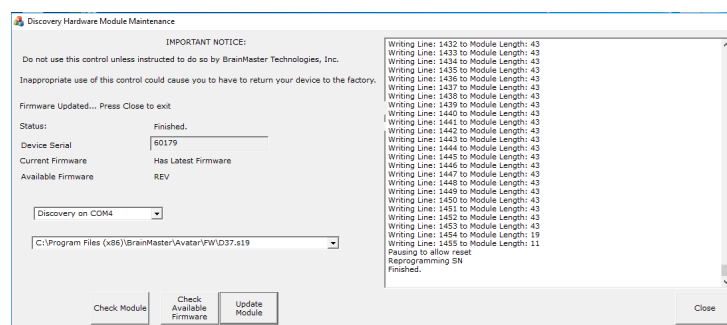
- Utilize the Drop-Down-List to choose the proper firmware revisiont. Click Update Module To contnue.



- The Firmware will now begin to update. **PLEASE NOTE:** During this process, make sure that nothing else is to be occurring as this can cause problems in writing the Discovery Firmware. You can tell that this is occurring, because, the Status line number will be changing.

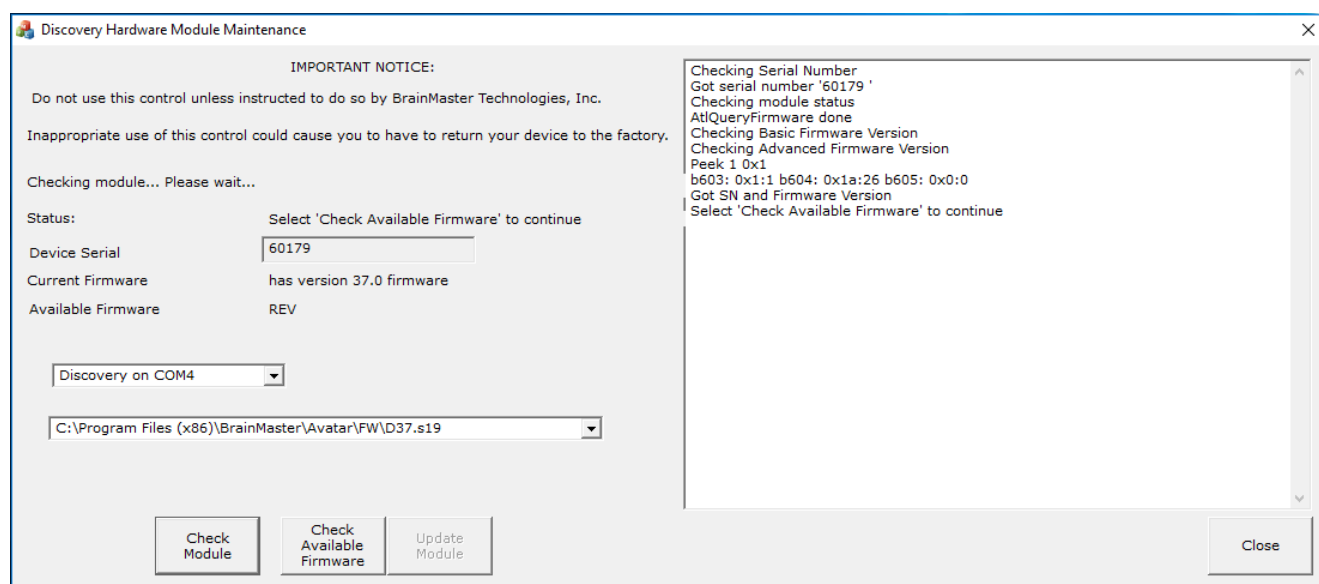


- When completed, the software will produce a Pop-Up stating that this has been successful. Click OK to this. **PLEASE NOTE:** After clicking OK, the system will reset itself. You will need to allow the system to finalize this. You will know that it is complete, when the Message box states "Finished". Click Close when completed.



Discovery Firmware Field Programming

Your Discovery is now using the most up-to-date Firmware. You can validate this, by running the application, and see that the current Revision matches the number to the version that was installed.



Please see 531-322 for for more information on the BrainMaster BrainAvatar Software.





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