# qEEG-Pro Manual

For use in the U.S.A.



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## 1. Indications for use

The qEEGpro system is to be used by qualified medical or qualified clinical professionals for the statistical evaluation of the human electroencephalogram (EEG). Federal law restricts this device to sale by or on the order of a licensed practitioner.

## 2. Potential adverse effects

Potential adverse effects of the use of the device are known if the qEEG-Pro is used as a standalone diagnostic system in the absence of other clinical data from more traditional means of patient evaluation. Relying only upon the use of a single index (such as relative power or the topological maps alone) without reviewing the traditional EEG, the epochs selected for analysis, or the complete set of statistical summary tables is also contraindicated and a source of potential error. Additional sources of error could arise from selecting EEG representative of other states, such as drowsiness or eyes-open EEG when comparing to an eyes closed database. Additionally, it is possible that errors will occur through the purposeful falsification of symptoms in the patient history and patient age.



## 3. FFT Absolute Power

The qEEG-Pro report contains topoplots of the absolute power (in microvolts squared), which are depicted for each 1 Hz frequency bin, starting with 1 Hz and ending with 40 Hz. Each frequency bin ranges from -.5 to =.5 Hz. For example: The 12 Hz bin ranges from 11.5 to 12.5 Hz.



**Figure 1.** Example of the FFT Absolute Power analysis.



## 4. Z-scored FFT Absolute Power

The qEEG-Pro report contains topoplots of the Z-scored absolute power for each 1 Hz frequency bin, starting with 1 Hz and ending with 40 Hz. The sample of the normative database consists of 200 subjects that have the lowest age difference compared with the age of the client, with an 'age resolution' of 6 months.



**Figure 2.** Example of the Z-scored FFT Absolute Power analysis.



## Appendix 1. qEEG-Pro calculation details

#### 12.1 qEEG-Pro normative database data collection

The qEEG-Pro normative database was constructed by using the resting-state EEG and questionnaire data of clients that visited the Neurofeedback Institute Netherlands (NIN) between 2004 and 2013 in one of the 10 different Dutch cities the NIN is located (Neurofeedback.nl). The EEG recording and questionnaire was done in order to guide subsequent Neurofeedback treatment. All clients signed an informed consent form, which stated that their anonymous EEG and questionnaire data may be used for research purposes. The questionnaire consisted of 292 questions (each rated from 0 to 8) that were directly based on the criteria of 46 DSM psychopathologies (CNC1020<sup>©</sup>; www.EEG-Professionals.nl/en/cnc-1020/). The recordings were done using the 19-channel Deymed TruScan<sup>tm</sup> EEG amplifier (www.deymed.com). The electrode sites were positioned according to the international 10-20 system (see figure 3).



**Figure 3.** Electrode positions and labels used for the resting-state EEG recordings of the qEEG-Pro database.

Sampling frequencies of 128 Hz and 256 Hz were used (8% and 92% of the subjects, respectively). The EEG recording session consisted of an 'Eyes Closed' condition (EC) and an 'Eyes Open' condition (EO). In the both conditions, the clients sat in an upright position for a total of 10 minutes. The clients were instructed to keep their neck and facial muscles relaxed and refrain from making an excess of eye movements or eye blinks in the EO condition. A total of 1696 clients completed the questionnaire and the EC EEG recording. A total of 1364 clients completed the questionnaire and the EO EEG recording. 88(EC) and 21(EO) clients showed epileptiform activity in their EEG and were excluded from the qEEG-Pro database. The duration of the de-artifacted EEG of 126 (EC) and 112 (EO) clients was less than 1 minute and were therefore excluded from the qEEG-Pro database. So to summarize, the EEGs of 1482 (EC) and 1231 clients were included in the qEEG-Pro. Clients ranged from 4 to 82 years of age. Figure 4 shows the age and gender distribution for both the EC and the EO condition.





Figure 4. Age and gender distribution of the qEEG-Pro normative database.

#### 12.2 qEEG-Pro EEG data analysis

All metrics that are described in detail above were applied to the qEEG-Pro database. A total of 150 subgroups (ages 1-75,5 years, 6 months resolution) were created by selecting 200 subjects that had a minimum age difference with the age bin of interest. A regression analysis was performed for all (log-transformed) metrics, using the log-transformed data from the 47 psychopathologies categories in the questionnaire. The residuals of the regression model represent the variance in the EEG data that cannot be explained by any of the 47 psychopathologies. These residuals are then used to calculate the means and standard deviations for all metrics.



## Appendix 2. Practical guide for uploading raw EEG

#### A3.1 Compatible devices

The qEEG-Pro report service can process .edf files from the following EEG amplifiers:

Deymed TruScan Brainmaster Discovery DSI24 / Freedom 24 MindMedia Nexus Mitsar

#### A3.2 Data export instructions

Follow the steps below to start using the qEEG-Pro report service.

Step 1. Locate the .edf file containing your client's EEG on your computer.

For **BrainMaster Discovery** users: The .edf file is automatically generated by the BrainMaster software.

For **Deymed TruScan** users: Generate an .edf file in **TruScan Explorer** by clicking on the 'export file' button.

An options dialog will pop up. Select EDF+ and use the same settings as depicted in the image below.





For **Mitsar** users: Go to the main drop-down menu in **EEGStudio** and select 'Export to'-> 'EDF (+) file' (see below).

•	Main Analysis	View	Add-on	
IF	Open File Storage		WinEEG file	
×	Application Options		WinHRV file	
2	Exam Information	Edf	EDF(+) file	
Ŵ	Create Exam		BrainLoc file	
Ĩ	Open Exam	Tat 🕅	Text file (ASCII)	
->>	Import Exam	Bin	Binary file	
Ì	Close Exam			
	Create Exam Copy			
<u>ل</u>	Export to			
2	Reject Changes			
$\widehat{}$	Contact Us			
0ļ	Check For Updates			
x	Exit			

For **MindMedia Nexus** users: Go to 'File' -> 'Export Session Data' in **Polyman Viewer** with the 'Output Format' set to 'EDF+ format'.

Time Settings:			Select (mu	Itiple) DATA channels for expor	t:		
Time START:	00:00:00	(format hh:mm:ss)	17: 256 18: 256	SPS - A:Gamma Wave SPS - B:Theta Wave	1		
Time END:	00:01:17	(format hh:mm:ss)	19: 256	SPS - B:Alpha Wave SPS - B:SMR Wave			
	Export SE	LECTED area only.	21: 256 SPS - B:Beta Wave 22: 256 SPS - B:Gamma wave 22: 256 SPS - B:Gamma wave				
Export SEGMENTS only. (entire session)			24: 32 SPS - A: Ineta amplitude	n			
			25: 32 S 26: 32 S	SPS - A:SMR amplitude SPS - A:Beta amplitude			
	Exclude data in ARTIFACT segments!			SPS - A:Gamma amplitude SPS - B:Theta amplitude			
Output options:			29: 32 5	SPS - B:Alpha amplitude	E		
Type of DATA:	All Data Samples. 👻		31: 32 SPS - B:Beta amplitude				
Output Rate:	32 SPS	•	32: 32 5	PS - B:Gamma amplitude PS - HR (BVP)			
Output Format:	EDF + forma	t 👻	34: 2048	_			
	REPEAT d	ata in slower channels.	30: 32 SPS - EMG1 ampl. 37: 32 SPS - EMG2 ampl.				
	EDF: Use	Maximum range	38: 32 5	38: 32 SPS - EMG1/EMG2 39: 32 SPS - EMG1-EMG2			
Additional options:			40: 32 5	PS - BVP amplitude			
	V Include T	ME (as "hh:mm:ss")	42: 32.5	SPS - SCP			
	Include T	ME (as sample intervals)	43: 32 5	PS - C:EMG Mean Freq.			
	Indude E	/ENT markers	44: 32 5	PS - D:EMG Mean Freq. PS - A:Median Freq.			
	Indude SEGMENT markers			46: 32 SPS - B:Median Freq.			

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2. After you have logged into the user environment, click on the 'Clients' tab and fill out the form.

- 3. Click on the 'EEG' tab and then on 'Add EEG'.
- 4. Select the appropriate client, fill out the form and upload the raw EEG.



The age of the client can easily be selected by using the calendar tool. Left click on the upper panel in the calendar tool to switch from 'days' to 'months' and 'years' (see below).



5. After the upload is complete, you can safely log out of the system by clicking on the 'Logout' tab. The estimated processing time for QEEG-Pro reports is 60 minutes, after which the QEEG-Pro reports can be downloaded to your computer.

#### A3.3 Client sensitive information and Data security

- The qEEG-Pro report service assures that no client sensitive information that may accompany your uploaded EEG files will be accessible to third parties.

- The raw and processed EEG files and the QEEG reports will be stored on the qEEG-Pro report service servers but the qEEG-Pro report service cannot be held responsible for situations in which the raw data or the reports are no longer accessible for the user. The user is recommended to back up their EEG files and qEEG reports on a (hard)disk or backup server/webservice.

#### A3.4 Instructional Videos, Expert Coaching and Support

For the qEEG-Pro instructional videos library, go to: http://qeegpro.eegprofessionals.nl/support/video/

If you need support for the use of the qEEG-Pro Report Service, got to:



http://qeegpro.eegprofessionals.nl/support/

We also offer qEEG-Pro Expert Coaching if you want to discuss specific patients or when you want to go into more detail about specific qEEG-Pro analyses. Dr. Keizer is the creator of the qEEG-Pro Report Service and is available for expert coaching on the following topics:

- 1. EEG recording quality
- 2. Interpretation of qEEG-Pro analyses
- 3. Protocol recommendation
- 4. Setting up a scientific neurofeedback experiment
- 5. Analyzing EEG data using Matlab

If you would like to make use of Expert Coaching, go to: http://qeegpro.eegprofessionals.nl/support/expert-coaching/



## References

Delorme, A., & Makeig, S. (2004). EEGLAB: an open source toolbox for analysis of single-trial EEG dynamics including independent component analysis. *Journal of Neuroscience Methods, 134*(1), 9-21

Manufactured by: BrainMaster Technologies, Inc. 195 Willis Street, Suite 3 Bedford, OH 44146 United States Phone: 440-232-6000 Support@brainm.com