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# Minimal Standards for Digital/Quantitative Electroencephalography in Canada

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Digital electroencephalography (EEG) is rapidly replacing paper-based, analog EEG for a number of reasons, e.g., improved convenience, reduced cost (of paper and paper storage or microfilming records) and enhanced flexibility of recording and display. With increasingly widespread use of digital EEG technology from multiple manufacturers, there is a need for minimal standards for such equipment in patient care settings. This document represents a set of minimal standards for such technology and its utilization, as approved by the EEG Section of the Canadian Society of Clinical Neurophysiologists at its annual general meeting in June of 1998. The document meets Canadian standards and those recently developed by the International Federation of Clinical Neurophysiologists.<sup>1-3</sup> This document addresses some specific concerns relevant to digital technology. The aspects of patient documentation, length and principles of recording and charting are the same as those of previous Canadian documents and are not repeated in this paper.<sup>1,3</sup>

Optical disk or compact disk read-only-memory (CD-ROM) technology is an acceptable medium for storing digital EEG recordings. It is the user's responsibility to be aware of possible deteriorating legibility or impending technical obsolescence and make suitable arrangements for copying the information onto an updated storage medium or paper to meet storage requirements. Manufacturers should provide for a mechanism, e.g., the conversion of format, that allows electroencephalographers working with different equipment to interpret EEGs for clinical purposes.

To ensure the adequacy of waveform recording, a minimum sampling rate of 200 samples per second for each channel is used, but higher rates are recommended. The sampling rate should be even multiples of 50 or 64 Hz. When sampling at 200 Hz, an anti-aliasing filter of 70 Hz should be used, with a roll-off of at least 12dB/octave. Higher sampling rates require a proportionately higher anti-aliasing filter setting. A low frequency filter of 0.16 Hz should be available; as should a 60 Hz notch filter, for use when required. Digitization at voltage level of 12 bits or greater with the ability to resolve voltage to 0.5 $\mu$ V is recommended. Common mode rejection is 110 dB or greater at each

amplifier input. Interchannel cross-talk must be less than 1%, i.e., 40dB down or less.

The available technology is capable of displaying the recording on a video screen as well as on paper. With horizontal scaling, one second of time occupies 25-35 mm and contains at least 120 data points/channel; scaling at 0.5, 2 and 4 times should be feasible. On the vertical display, a minimum spacing of 10 mm between channels for a display of 16 or 18 channels is recommended. Adequate screen resolution is at least 4 pixel resolution per vertical millimetre. It is recommended that the screen have at least 1024 x 768 pixels, preferably 1280 x 1024 pixels. Playback systems should show the montage, filter and sensitivity settings, vertical voltage scale and horizontal time marking scale, technologist comments, event markers (e.g., for hyperventilation) and page number or time. The playback unit should also allow for montage selection changes and post-hoc alterations in sensitivity and filter settings.

Topographic mapping, frequency or power spectral analyses and other quantitative assessments of digital EEG data are not considered an alternative to traditional (standard) EEG display in either digital or analog systems. Interpretation of the quantitative EEG should involve analysis of the simultaneous standard EEG. When used in isolation, a quantitative EEG can yield misleading information.

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## REFERENCES

1. Canadian Association of Electroneurophysiology Technologists. Minimal Technical Standards, EEG/EMG. 1991-93.
2. Nuwer MR, Comi G, Emerson R, et al. IFCN standards for the clinical recording of digital EEG. *Electroencephalogr Clin Neurophysiol* 1998; 106: 259-261.
3. Young GB. Minimal standards for electroencephalographic laboratories. *Can Med Assoc J* 1991; 144: 865-867.