Standard for EDA Signal Processing

(for APA BoD considerations - posted 08.18.23)

1. Statement of purpose

This consensus standard was developed by a committee of persons involved in the development, validation, and manufacture of instrumentation and technology for polygraph field practice, which is related to, though distinct from, basic science and research activities in psychophysiology. Standardization of the electrodermal activity (EDA) data acquisition involves a combination of factors including hardware, software, and field practice. The goals of this standard are to achieve a consistent utilization and display of EDA data across different polygraph field testing instruments produced by different manufacturers, and to provide the information and capabilities for interested parties to evaluate compliance with this standard.

2. Data acquisition

2.1 Measurement Circuit

2.1.1 The EDA measurement shall be made using the direct current exosomatic method.

2.1.2. The measurement circuit may be configured as a constant current circuit which produces output that is directly proportional to skin resistance or as a constant voltage circuit which produces output that is directly proportional to skin conductance.

2.1.3 EDA values may be expressed in resistance, conductance, or dimensionless units.

2.1.4 Endosomatic recordings, including skin potential measurements, and alternating current exosomatic recordings have not been widely validated for the polygraph application and shall not be used for field examinations unless supported by published validation studies.

2.2 Circuit limits

2.2.1 Constant current circuits shall be limited to 10µA of excitation current per square centimeter of electrode area.

2.2.1.1 This current limit shall not apply to the design of constant voltage circuits.

2.2.2 Fixed constant voltage circuits shall be limited to 0.5V of excitation voltage.

2.2.2.1 This voltage limit shall not apply to the design of constant current circuits.

2.2.3 Variable or adjustable constant voltage circuits that adapt to the subject's baseline resistance may be used, but the current shall be limited to 10µA per square centimeter of electrode area across the entire measurement range, and the applied voltage shall never exceed 5V.

2.3. Electrodes

2.3.1 Manufacturers should make known any recommendations of electrode type or size that will give optimum performance with their system.

2.3.2 Electrodes shall provide a means to be secured to the recording surface of the skin, typically by Velcro straps or adhesive.

2.3.3. Individual pairs of electrodes shall be the same size and shape and shall be made of the same material.

2.3.4 Polygraph field instruments used for EDA recording for the purpose of basic science or academic research into the nature of EDA should conform to the guidelines published by the Society for Psychophysiological Research (Boucsein et al., 2012).

2.4 Recording sites

2.4.1 Standard recording sites shall be the volar surface of distal or medial phalanges, thenar and hypothenar surfaces of the palm, and two sites at the inner aspect of the foot, over the abductor hallucis muscle adjacent to the sole of the foot and midway between the proximal phalanx of the big toe and a point directly beneath the ankle.

2.4.1.1 If alternate recording sites are recommended by a manufacturer, the manufacturer shall publish a justification for using alternate sites and shall provide a means to document the use of alternate sites in the permanent record for each exam and any accompanying reports.

2.5 Site preparation

2.5.1 Manufacturers should recommend standard site preparation in published training and instructional materials or tutorials.

2.5.2 Sufficient time should be allowed, after site preparation and attachment of the recording sensors, prior to recording onset, to allow for adequate hydration of the skin and stabilization of the EDA baseline level.

2.6 Sampling Rates

2.6.1 Data shall be acquired and stored at a minimum sample rate of 25 samples per second.

2.6.2 Data used for scoring, whether displayed on-screen for manual scoring or passed to a computerized algorithm shall be maintained at a minimum sample rate of 25 samples per second.

2.6.2.1 Data used solely for on-screen display during the live exam may maintain a minimum display rate of 8 samples per second provided the data stream maintains a minimum of 25 samples per second for scoring and storage.

3. Signal processing

To achieve the goals of consistent display of EDA data and independent validation, polygraph field instruments shall comply with the following:

3.1 Instrument manufacturers shall standardize automatic mode high pass EDA filters to use a time constant of 10 seconds.

3.2 Automatic mode (high pass filtered) should be the preferred mode for displaying data and scoring for field examinations.

3.3 Instruments and any accompanying software should default to the automatic mode when taking EDA measurements. Manual mode should only be selected by user intervention.

3.4 EDA data shall be stored so that it can be reviewed and output in both manual mode and automatic mode.

3.5 Instrument manufacturers shall publish all filtering conducted on the signal whether in hardware, software, or firmware.

4. General Parameter Reporting

4.1 Instrument manufacturers shall publish all parameters used to acquire the EDA signal. This shall include but is not limited to: type of circuit used (constant current or constant voltage), measurement units, excitation current or voltage level, recommended electrode type, type of electrodes used, electrode location or placement, number and types of filters used along with corner frequencies and other necessary parameters.

4.2 In instances where testing parameters (e.g., electrode type, location, site preparation, etc.) are a matter of field practice and not instrument design, the reporting requirement for the manufacturers may be fulfilled by providing a means to enter and permanently store the specified parameters with the exam data and attach said parameters to any reports for the exam. The examiner will then assume responsibility for the entry of these parameters.

5. Time series import and export

Instrument manufacturers shall provide for the import and export of recorded time series EDA data using the NCCA ASCII Standard format published by the APA (2019).

6. Documentation of compliance with this standard

Instrument manufacturers shall be afforded an opportunity to publish in an official APA publication that they comply with these standards and if compliance has been confirmed by an independent technology testing service.

6.1 Instrument manufacturers who wish to market or disseminate assertions of compliance with this Standard shall publish a statement, online or in an APA publication, attesting to such compliance, including whether compliance is verified through any of the following:

6.1.1 Self-certification;

6.1.2 Independent validation by contracted parties with no other fiscal or professional association with the instrument manufacturer;

6.1.3 A peer consortium of instrument manufacturers; or

6.1.4 Validation through an ad hoc committee appointed by the APA President and Board of Directors.

6.2 The APA Board shall provide a letter of compliance upon written request from instrument manufacturers who provide documentary evidence of their compliance with this Standard.

7. References

7.1 APA Editorial Staff (2019). Introduction to the NCCA ASCII Standard. *Polygraph & Forensic Credibility Assessment, 48(2),* 125-135.

7.2 Boucsein, W. (2012). *Electrodermal activity (2nd ed.)*. New York: Springer.

7.3 Boucsein, W., Fowles, D. C., Grimnes, S., Ben-Shakhar, G., Roth, W. T., Dawson, M. E., & Filion, D. (2012). Publication recommendations for electrodermal measurements. *Psychophysiology, 49,* 1017–1034.

7.4 Edelberg, R. (1967). Electrical properties of skin. In C. C. Brown (Ed.) *Methods in Psychophysiology* (1-53). Baltimore, MD: Williams & Wilkins.

7.5 Handler, M., Nelson, R., Krapohl, D., & Honts, C. (2010). An EDA primer for polygraph examiners. *Polygraph, 39(2),* 68-108.