ISO/IEC TS 27571

Edition 1.0 2026-04

TECHNICAL SPECIFICATION

Information technology - Brain-computer interfaces - Data format for non-invasive brain information collection

ICS 35.020; 35.200

ISBN 978-2-8327-1203-0

ISO/IEC TS 27571: 2026-04(en)

CONTENTS

Information technology - Brain–computer interfaces - Data format for non-invasive brain information collection

FOREWORD

1) ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

2) The formal decisions or agreements of IEC and ISO on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC and ISO National bodies.

3) IEC and ISO documents have the form of recommendations for international use and are accepted by IEC and ISO National bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC and ISO documents is accurate, IEC and ISO cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC and ISO National bodies undertake to apply IEC and ISO documents transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC and ISO document and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC and ISO do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC and ISO marks of conformity. IEC and ISO are not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this document.

7) No liability shall attach to IEC and ISO or their directors, employees, servants or agents including individual experts and members of its technical committees and IEC and ISO National bodies for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this ISO/IEC document or any other IEC and ISO documents.

8) Attention is drawn to the Normative references cited in this document. Use of the referenced publications is indispensable for the correct application of this document.

9) IEC and ISO draw attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC and ISO take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC and ISO had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch and www.iso.org/patents. IEC and ISO shall not be held responsible for identifying any or all such patent rights.

ISO/IEC TS 27571 has been prepared by subcommittee 43: Brain–computer interfaces, of ISO/IEC joint technical committee 1: Information technology. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
JTC1-SC43/185/DTS	JTC1-SC43/205/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1, and the ISO/IEC Directives, JTC 1 Supplement available at www.iec.ch/members_experts/refdocs and www.iso.org/directives.

INTRODUCTION

Brain–computer interfaces (BCIs) have emerged as a promising area of research with applications spanning from neurorehabilitation to human–computer interaction. Non-invasive BCI technologies such as electroencephalography (EEG), magnetoencephalography (MEG), functional near-infrared spectroscopy (fNIRS) and functional magnetic resonance imaging (fMRI) have contributed significantly to our understanding of the human brain. [1][1] However, the lack of a standardized data format for these diverse BCI technologies poses challenges to data sharing, integration and analysis. This document specifically addresses the integration challenges posed by multi-modal BCI systems, ensuring that data from different technologies can be combined effectively and efficiently. By establishing a uniform data format, this document facilitates deeper insights into neurological processes and enhances the practical deployment of BCI technologies across various fields.

To address this issue, this document provides a description of the current state-of-the-art and the need for a data fusion system to integrate and analyse data from different non-invasive BCI technologies. This document focuses on the following components: defining basic data elements for each technology, identifying technical information and metadata, designing an extensible and modular data structure, specifying metadata and annotation information for data comprehension and traceability, and establishing a unified data format for consistent data integration.

Data fusion demands situational awareness. It is a set of closed control loops that are responsible for

a) ingesting each type of data and applying appropriate processing (e.g. data deduplication and cleansing and anonymization),

b) normalizing those data into a common language using a consensual vocabulary,

c) semantically enriching the normalized data based on context,

d) understanding the normalized data in order to make decisions about the meaning of the data, and

e) recording this understanding as a set of conclusions.

The resulting standardization will accelerate advancements in BCI research and applications by promoting consistent data organization, enhancing data quality, and enabling more effective collaboration among researchers and practitioners in the field.

[1] Numbers in square brackets refer to the Bibliography.

1 Scope

This document specifies the basic brain–computer interface (BCI) data format including the definition of basic data elements, technology-specific information and metadata, design of an extensible and modular data structure, specification of metadata and annotation information, and the development of a standardized data format and naming convention for BCI data. This document is applicable to non-invasive BCI technologies, such as electroencephalography (EEG), magnetoencephalography (MEG), functional near-infrared spectroscopy (fNIRS) and functional magnetic resonance imaging (fMRI), and provides a comprehensive approach to BCI metadata formats in the product development environment. It takes into consideration various applications, ranging from neurological rehabilitation to human–computer interaction.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 8663, *Information technology - Brain–computer interfaces - Vocabulary*

ISO/TS 21526:2019, *Health informatics - Metadata repository requirements (MetaRep)*

Bibliography

[1] Wolpaw, J. R. and Wolpaw, E. W. (Eds.). (2012). *Brain-computer interfaces: principles and practice*. Oxford University Press

[2] ETSI GS ENI 005 V3.1.1 (2023-06), *Experiential Networked Intelligence (ENI); System Architecture*

[3] ISO/IEC 11179-3:2023, *Information technology - Metadata registries (MDR) - Part 3: Metamodel for registry common facilities*

[4] Makeig, S., Bell, A. J., Jung, T. P. and Sejnowski, T. J. (1996). Independent component analysis of electroencephalographic data. *Advances in neural information processing systems*, 8, 145-151

[5] Yoo, S. S. and Jolesz, F. A. (2002). Functional MRI for neurofeedback: feasibility study on a hand motor task. *Neuroreport*, 13(11), 1377-1381

[6] Pinti, P. et al. (2020). The present and future use of functional near-infrared spectroscopy (fNIRS) for cognitive neuroscience. *Annals of the New York Academy of Sciences*, 1464(1), 5-29

[7] Gramfort, A. et al. (2013). MEG and EEG data analysis with MNE-Python. *Frontiers in neuroscience*, 7, 267

[8] Brain Imaging Data Structure (BIDS) Specification, Electroencephalography, Version 1.11.1

[9] Gorgolewski, K. J. et al. (2016). The brain imaging data structure, a format for organizing and describing outputs of neuroimaging experiments. *Scientific data*, 3(1), 1-9

[10] The HDF Group. (2010). *Hierarchical Data Format*, version 5

[11] ISO 12052:2017, *Health informatics - Digital imaging and communication in medicine (DICOM) including workflow and data management*