BS EN 61788-22-1:2017

BSI Standards Publication

Superconductivity

Part 22-1: Superconducting electronic devices - Generic specification for sensors and detectors (IEC 61788-22-1:2017)

Documents
Document Sharing Hub

Full document details: BS EN 61788-22-1:2017

National foreword

This British Standard is the UK implementation of EN 61788-22-1:2017. It is identical to IEC 61788-22-1:2017.

The UK participation in its preparation was entrusted to Technical Committee L/-/90, Super Conductivity.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2017
Published by BSI Standards Limited 2017

ISBN 978 0 580 90994 8

ICS 29.050

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2017.

Amendments/corrigenda issued since publication

Date	Text affected

Documents
Document Sharing Hub

Full document details: BS EN 61788-22-1:2017

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 61788-22-1

November 2017

ICS 17.220; 29.050

English Version

Superconductivity - Part 22-1: Superconducting electronic devices - Generic specification for sensors and detectors (IEC 61788-22-1:2017)

Supraconductivité - Partie 22-1:Composants électroniques supraconducteurs - Spécification générique pour capteurs et détecteurs (IEC 61788-22-1:2017)

Supraleitung - Teil 22-1: Supraleitende Elektronik - Generische Spezifikationen für Sensoren und Detektoren (IEC 61788-22-1:2017)

This European Standard was approved by CENELEC on 2017-08-31. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

© 2017 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

Ref. No. EN 61788-22-1:2017 E

AVA Documents Document Sharing Hub

Full document details: BS EN 61788-22-1:2017

European foreword

The text of document 90/388/FDIS, future edition 1 of IEC 61788-22-1, prepared by IEC/TC 90 "Superconductivity" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61788-22-1:2017.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2018-05-31
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2020-08-31

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61788-22-1:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

ISO/TS 80004-2:2015	NOTE	Harmonized as CEN ISO/TS 80004-2:2017 (not modified).

Documents
Document Sharing Hub

Full document details: BS EN 61788-22-1:2017

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60027	Series	Letter symbols to be used in electrical technology	EN 60027	Series
IEC 60050-815	-	International Electrotechnical Vocabulary - Part 815: Superconductivity	-	-
IEC 60417-DB	-	Graphical symbols for use on equipment	-	-
IEC 60617-DB	-	Graphical symbols for diagrams	-	-
ISO 1000 [1]	-	SI units and recommendations for the use of their multiples and of certain other units	-	-
ISO 7000	-	Graphical symbols for use on equipment - Registered symbols	-	-

[1] Superseded by ISO 80000-1.

Documents
Document Sharing Hub
Full document details: BS EN 61788-22-1:2017

This page deliberately left blank

Documents
Document Sharing Hub

Full document details: BS EN 61788-22-1:2017

CONTENTS

FOREWORD 4
INTRODUCTION 6
1 Scope 7
2 Normative references 7
3 Terms and definitions 7
4 Symbols 10
5 Terminology and classification 11
5.1 Terminology 11
5.2 Classification 14
6 Cryogenic operation condition 15
7 Marking 15
7.1 Device identification 15
7.2 Packing 15
8 Test and measurement procedures 15
Annex A (informative) Coherent detection 16
A.1 Superconducting hot electron bolometric (SHEB) type 16
A.2 Superconducting tunnel junction (STJ) type 17
A.3 Superconducting quantum interference device (SQUID) type 18
Annex B (informative) Direct detection 20
B.1 Metallic magnetic calorimetric (MMC) type 20
B.2 Microwave kinetic inductance (MKI) type 21
B.3 Superconducting strip (SS) type 22
B.4 Superconducting tunnel junction (STJ) type 22
B.5 Transition edge sensor (TES) type 23
Annex C (normative) Graphical symbols for use on equipment and diagrams 25
C.1 Superconducting region, one superconducting connection 25
C.2 Superconducting region, one normal-conducting connection 25
C.3 Normal-superconducting boundary 25
C.4 A variation 26
C.5 Josephson junction 26
Bibliography 27

Figure A.1 – SHEB mixer 17
Figure A.2 – STJ mixer 18
Figure A.3 – DC SQUID 19
Figure B.1 – MMC detector 20
Figure B.2 – MKI detector 21
Figure B.3 – SS detector 22
Figure B.4 – STJ detector 23
Figure B.5 – TES detector 24
Figure C.1 – Superconducting region, one superconducting connection 25
Figure C.2 – Superconducting region, one normal-conducting connection 25

Documents
Document Sharing Hub

Full document details: BS EN 61788-22-1:2017

Figure C.3 – Superconducting region, one superconducting connection, and one normal-conducting connection (normal-superconducting boundary, IEC 60417-6370:2016-09) 25

Figure C.4 – Series connection 26

Figure C.5 – Superconducting region, two superconducting connections with extremely small non-superconducting region (Josephson junction, IEC 60417-6371:2016-09) 26

Table 1 – Measurands 12

Table 2 – Classification of measurands 12

Table 3 – Nomenclature of superconducting sensors and detectors: type, full names, and acronym examples 13

Table 4 – Classification of detection principles 14

Documents
Document Sharing Hub

Full document details: BS EN 61788-22-1:2017

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SUPERCONDUCTIVITY –

Part 22-1: Superconducting electronic devices – Generic specification for sensors and detectors

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC 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 National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC 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 National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees 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 IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61788-22-1 has been prepared by IEC technical committee 90: Superconductivity.

The text of this standard is based on the following documents:

FDIS	Report on voting
90/388/FDIS	90/391/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61788 series, published under the general title *Superconductivity*, can be found on the IEC website.

AVA Documents
Document Sharing Hub

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

Documents
Document Sharing Hub

Full document details: BS EN 61788-22-1:2017

INTRODUCTION

Superconductivity offers various possibilities for the realization of sensing and detection of a variety of measurands. Several sensors and detectors have been developed, exploiting features like superconducting energy gaps, sharp normal-superconducting transition, nonlinear I–V characteristics, superconducting coherent states, and quantization of magnetic flux. All these properties can be influenced by the interaction with electromagnetic fields, photons, ions, etc. Superconducting sensors and detectors have extremely high performance for energy resolution, time response, and low noise, most of which cannot be realized by any other phenomena.

The word "sensor" is normally used for measuring stationary or slowly changing electromagnetic fields, physical quantities such as current and temperature. On the other hand, the word "detector" is normally used for single quanta such as photons from infrared to γ-rays and individual particles. However, the boundary between "sensor" and "detector" is ambiguous. In this document, therefore, both "sensor" and "detector" are used. Additionally, a detector using a sensor is possible, for example, X-ray detector using transition edge sensor (TES) that measures temperature rise due to the deposition of measurand energy. In this document, for example, the terminology "transition edge sensor X-ray detector" is used for X-ray detection using TES.

Superconducting sensors and detectors have been applied to a variety of fields including medical diagnosis, telecommunications, mineral exploration, astronomical instruments, quantum information processing, and analytical instruments. For users, IEC standardization is necessary because there is confusing terminology, there are no graphical symbols for diagrams, and no test methods.

Documents
Document Sharing Hub

Full document details: BS EN 61788-22-1:2017