IEC 61869-13

Edition 1.0 2021-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Instrument transformers –
Part 13: Stand-alone merging unit (SAMU)

Transformateurs de mesure –
Partie 13: Concentrateur autonome (SAMU)

IEC 61869-13:2021-02(en-fr)

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INSTRUMENT TRANSFORMERS –

Part 13: Stand-alone merging unit (SAMU)

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.
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International Standard IEC 61869-13 has been prepared by IEC technical committee 38: Instrument transformers.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
38/634/FDIS	38/640/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 61869 series, published under the general title *Instrument transformers*, can be found on the IEC website.

This Part 13 is to be used in conjunction with IEC 61869-9:2016, *Digital interface for instrument transformers*, and IEC 61869-6:2016, *Additional general requirements for low-power instrument transformers*, which, in turn, are based on IEC 61869-1:2007, *General requirements*.

This Part 13 follows the structure of IEC 61869-1:2007 and IEC 61869-6:2016 and supplements or modifies their corresponding clauses.

When a particular clause/subclause of Part 1 or Part 6 is not mentioned in this Part 13, that subclause applies. When this document states "addition", "modification" or "replacement", the relevant text in Part 1 or Part 6 is to be adapted accordingly.

For additional clauses, subclauses, figures, tables, annexes or note, the following numbering system is used:

– clauses, subclauses, tables, figures and notes that are numbered starting from 1301 are additional to those in Part 1 and Part 6;

– additional annexes are lettered 13A, 13B, etc.

An overview of the planned set of standards at the date of publication of this document is given below. The updated list of standards issued by IEC TC 38 is available at the website: www.iec.ch.

PRODUCT FAMILY STANDARDS IEC		PRODUCT STANDARD IEC	PRODUCTS	OLD STANDARD IEC
61869-1 GENERAL REQUIREMENTS FOR INSTRUMENT TRANSFORMERS		**61869-2**	ADDITIONAL REQUIREMENTS FOR CURRENT TRANSFORMERS	60044-1 60044-6
		61869-3	ADDITIONAL REQUIREMENTS FOR INDUCTIVE VOLTAGE TRANSFORMERS	60044-2
		61869-4	ADDITIONAL REQUIREMENTS FOR COMBINED TRANSFORMERS	60044-3
		61869-5	ADDITIONAL REQUIREMENTS FOR CAPACITOR VOLTAGE TRANSFORMERS	60044-5
	61869-6 ADDITIONAL GENERAL REQUIREMENTS FOR LOW-POWER INSTRUMENT TRANSFORMERS	**61869-7**	ADDITIONAL REQUIREMENTS FOR ELECTRONIC VOLTAGE TRANSFORMERS	60044-7
		61869-8	ADDITIONAL REQUIREMENTS FOR ELECTRONIC CURRENT TRANSFORMERS	60044-8
		61869-9	DIGITAL INTERFACE FOR INSTRUMENT TRANSFORMERS	
		61869-10	ADDITIONAL REQUIREMENTS FOR LOW-POWER PASSIVE CURRENT TRANSFORMERS	
		61869-11	ADDITIONAL REQUIREMENTS FOR LOW-POWER PASSIVE VOLTAGE TRANSFORMERS	60044-7
		61869-12	ADDITIONAL REQUIREMENTS FOR COMBINED ELECTRONIC INSTRUMENT TRANSFORMERS AND COMBINED STAND-ALONE SENSORS	
		61869-13	STAND-ALONE MERGING UNIT	
		61869-14	ADDITIONAL REQUIREMENTS FOR CURRENT TRANSFORMERS FOR DC APPLICATIONS	
		61869-15	ADDITIONAL REQUIREMENTS FOR VOLTAGE TRANSFORMERS FOR DC APPLICATIONS	

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.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

General

This document is an IEC 61869 series product standard which defines additional requirements for a stand-alone merging unit (SAMU).

The general block diagram showing a typical SAMU application example is given in Figure 1301.

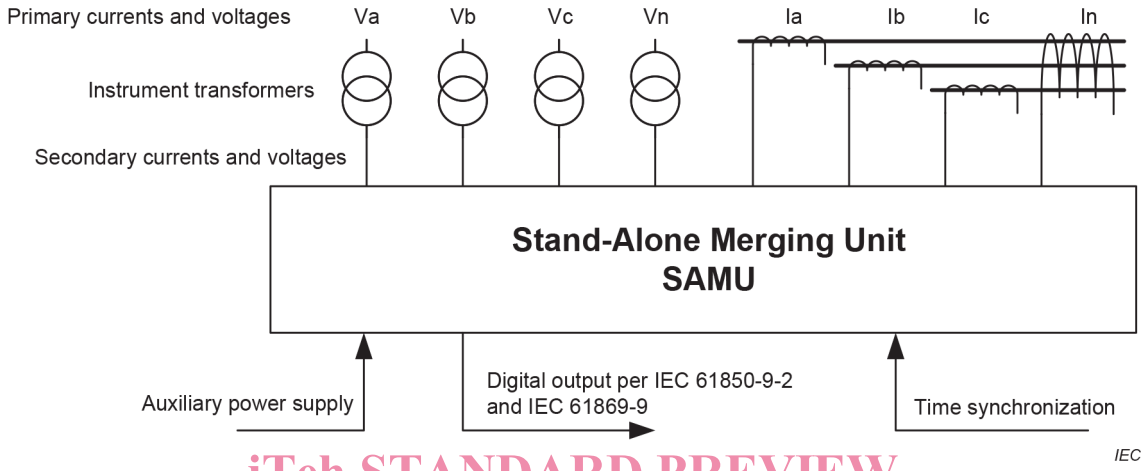

Figure 1301 – Stand-alone merging unit (functional concept example)

An application example showing a three-phase dead tank circuit breaker equipped with bushing type current transformers and a stand-alone merging unit mounted inside the breaker control cabinet is shown in Figure 1302.

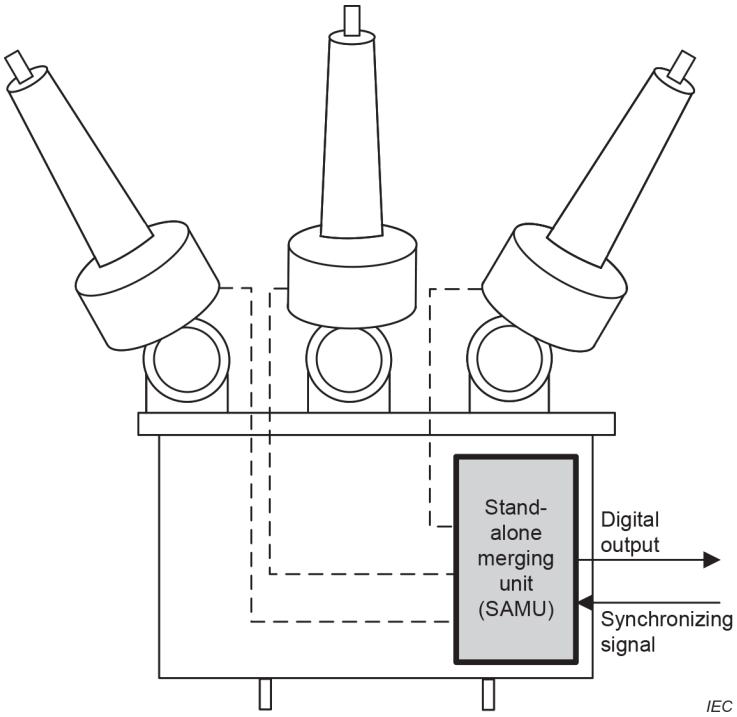

Figure 1302 – Stand-alone merging unit application example

The SAMU output may be used by many devices and is therefore of interest to multiple technical committees in addition to TC 38, for example: TC 57: Power systems management and

associated information exchange, TC 95: Measuring relays and protection equipment, TC 13: Electrical energy measurement and control, TC 85: Measuring equipment for electrical and electromagnetic quantities, and TC 17: High-voltage switchgear and controlgear, as shown in Figure 1303.

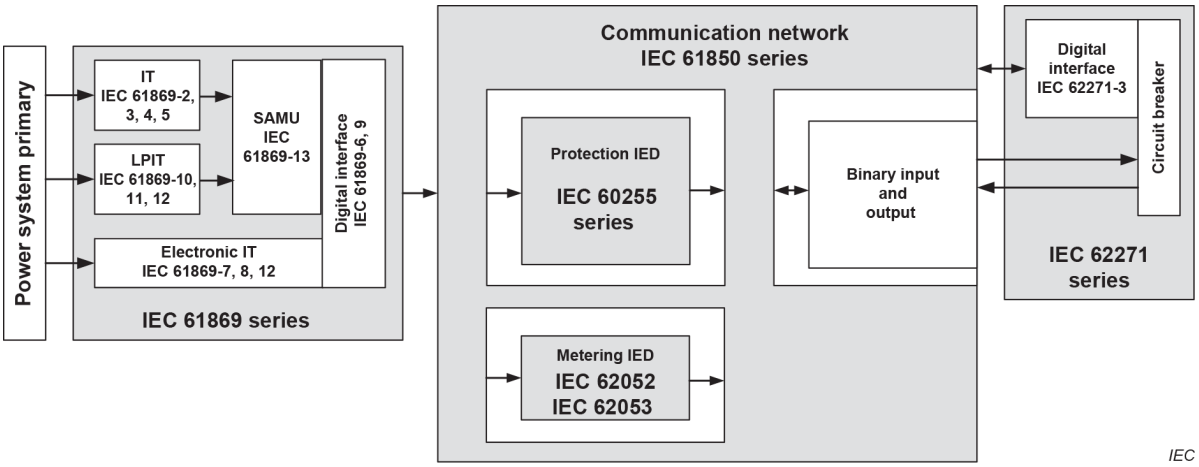

Figure 1303 – Illustration of the SAMU position in relation to other devices and standards in the functional chain

Position of this document in relation to IEC 61850 (all parts) of TC 57

IEC 61850 (all parts) is a series used to define various aspects of power utility communications. Its applicability to this document is inherited through IEC 61869-9 which defines applicable sample rates and a digital interface in accordance with IEC 61850-9-2 and related standards.

Position of this document in relation to IEC 60255 (all parts) of TC 95

IEC 60255 (all parts) standardizes the design and performance aspects applicable to measuring relays and protection equipment used in the various fields of electrical engineering. Since the SAMU is an integral part of the digital substation-based protection system, its EMC performance and environmental aspects are considered for harmonization with IEC 60255-1, IEC 60255-26 and safety aspects defined in IEC 60255-27. SAMU outputs are inputs for protection functions covered by the IEC 60255-1xx series.

Position of this document in relation to IEC 62052 (all parts) and IEC 62053 (all parts) of TC 13

IEC 62052 (all parts) and IEC 62053 (all parts) provide standardization in the field of AC and DC electrical energy measurement and control. Since the SAMU digital output may be used as input to energy measurement devices, its accuracy and EMC performance aspects should be considered.

Position of this document in relation to IEC 62271 (all parts) of TC 17

IEC 62271 (all parts) applies to AC switchgear and controlgear designed for indoor and/or outdoor installation and for operation at service frequencies up to and including 60 Hz on systems having rated voltages above 1 000 V. Similar to IEC 62271-3 which defines the switchgear interface based on IEC 61850, this document defines the SAMU which may be installed inside the same switchgear cabinet and is therefore subject to the same environmental stress.

INSTRUMENT TRANSFORMERS –

Part 13: Stand-alone merging unit (SAMU)

1 Scope

Clause 1 of IEC 61869-1:2007 is replaced by the following:

This part of IEC 61869 is a product standard and covers only additional requirements for stand-alone merging units (SAMUs) used for AC applications having rated frequencies from 15 Hz to 100 Hz. The digital output format specification is not covered by this document; it is standardized in IEC 61869-9 as an application of IEC 61850, which specifies the power utility communication architecture.

This document covers SAMUs having standardized analogue inputs (for example: 1 A, 5 A, 3,25 V / √3 or 100 V / √3) provided by instrument transformers compliant with relevant product standards (e.g. IEC 61869-2 to IEC 61869-5, IEC 61869-7, IEC 61869-8, IEC 61869-10, IEC 61869-11, IEC 60044-1 to IEC 60044-6, IEC 60185, IEC 60186, IEEE C57.13), and aims to convert them to the digital output compliant with IEC 61869-9. Other input and output types are outside the scope of this document. Appropriate SAMU functionality can be combined with switchgear controller functionality defined in IEC 62271-3 or other IED functionality defined in IEC 60255 (all parts).

Cyber security requirements are outside the scope of this document and are covered by the IEC 62351 series.

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.

Clause 2 of IEC 61869-1:2007 is applicable with the following additions:

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-14:2009, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 + 12 h cycle)*

IEC 60068-2-78:2012, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60255-27:2013, *Measuring relays and protection equipment – Part 27: Product safety requirements*

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
IEC 61000-4-3:2006/AMD1:2007
IEC 61000-4-3:2006/AMD2:2010

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8 Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-9:2016, *Electromagnetic compatibility (EMC) – Part 4-9 Testing and measurement techniques – Impulse magnetic field immunity test*

IEC 61000-4-10:2016, *Electromagnetic compatibility (EMC) – Part 4-10 Testing and measurement techniques – Damped oscillatory magnetic field immunity test*

IEC 61000-4-11:2020, *Electromagnetic compatibility (EMC) – Part 4-11 Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

IEC 61000-4-13, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests*

IEC 61000-4-16:2015, *Electromagnetic compatibility (EMC) – Part 4-16 Testing and measurement techniques – Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz*

IEC 61000-4-17:1999, *Electromagnetic compatibility (EMC) – Part 4-17: Testing and measurement techniques – Ripple on d.c. input power port immunity test*
IEC 61000-4-17:1999/AMD1:2001
IEC 61000-4-17:1999/AMD1:2008

IEC 61000-4-18:2006, *Electromagnetic compatibility (EMC) – Part 4-18 Testing and measurement techniques – Damped oscillatory wave immunity test,*
IEC 61000-4-18:2006/AMD1:2010

IEC 61000-4-29:2000, *Electromagnetic compatibility (EMC) – Part 4-29 Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests*

IEC 61850-7-4, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes*

IEC 61869-1:2007, *Instrument transformers – Part 1: General requirements*

IEC 61869-2:2012, *Instrument transformers – Part 2: Additional requirements for current transformers*

IEC 61869-6:2016, *Instrument transformers – Part 6: Additional general requirements for low-power instrument transformers*

IEC 61869-9:2016, *Instrument transformers – Part 9: Digital interface for instrument transformers*

IEC 61869-10:2017, *Instrument transformers – Part 10: Additional requirements for low-power passive current transformers*

IEC 61869-11:2017, *Instrument transformers – Part 11: Additional requirements for low-power passive voltage transformers*

CISPR 11, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

CISPR 32:2015, *Electromagnetic compatibility of multimedia equipment – Emission requirements*
CISPR 32:2015/AMD1:2019

3 Terms and definitions

Clause 3 of IEC 61869-1:2007, Clause 3 of IEC 61869-6:2016 and Clause 3 of IEC 61869-9:2016 apply, with the following additions:

3.1 General terms and definitions

3.1.1301
port
access to a device or network where electromagnetic energy or signals may be supplied or received or where the device or network variables may be observed or measured

EXAMPLE Auxiliary power supply terminals.

[SOURCE: IEC 60050-131:2002, 131-12-60, modified – Added example, deleted note.]

3.1.1302
digital channel
channel
digital representation describing a single measurement quantity

EXAMPLE Phase current, phase voltage.

Note 1 to entry: Channels are individually rated and may contain a mathematical combination of multiple inputs (e.g. calculated neutral current).

Note 2 to entry: Multiple channels are grouped into a single stream and presented at the device digital output.

3.1.1303
digital stream
stream
group of channels brought together into a single digital message

Note 1 to entry: All channels in the stream share a common time stamp and a common sample rate in accordance with IEC 61869-9.

3.1.1304
channel group
set of channels with a common specification

Note 1 to entry: For example, set of three phase voltages or currents. All channels in the group share the same set of rating plate specifications. If the neutral voltage or current channel shares the same specification as the individual phases, then it is included in the same group.

3.1.1305
analogue input
device input intended to be fed by the secondary circuit of an instrument transformer with analogue secondary signal

3.2 Terms and definitions related to dielectric ratings and voltages

3.2.1301
rated input voltage
U_{ir}
RMS value of the voltage on which the performance of a device voltage input is based

Note 1 to entry: This value may be defined as a range.

3.2.1302
rated voltage factor
F_V
multiplying factor to be applied to the rated primary voltage to determine the maximum voltage at which a transformer must comply with the relevant thermal requirements for a specified time and with the relevant accuracy requirements

Note 1 to entry: For SAMUs, the term primary voltage is understood as the input voltage.

[SOURCE: IEC 60050-321:1986, 321-03-12, modified – The symbol and the note have been added.]

3.2.1303
rated insulation voltage
RMS withstand voltage value assigned by the manufacturer to the equipment or to a part of it, characterizing the specified (long-term) withstand capability of its insulation

Note 1 to entry: The rated insulation voltage is not necessarily equal to the rated voltage of equipment which is primarily related to functional performance.

[SOURCE: IEC 60050-312:2014, 312-06-02, modified – Deleted "rated value of the" and the word "value" added.]

3.3 Terms and definitions related to current ratings

3.3.1301
rated primary current
I_{pr}
RMS value of the primary current on which the performance of the instrument transformer is based

Note 1 to entry: A SAMU is not connected to the power system primary. For SAMUs, the term rated primary current is interpreted as rated input current.

3.3.1302
rated short-circuit current
I_{psc}
RMS value of the AC component of a transient current on which the accuracy performance of the device is based

Note 1 to entry: While I_{th} is related to the thermal limit, I_{psc} is related to the accuracy limit. Usually, I_{psc} is smaller than I_{th}.

Note 2 to entry: For current transformers rated short-circuit current is applicable to the primary winding. In the case of SAMUs, the rated short-circuit current is applicable to the current input.

3.3.1303
rated symmetrical short-circuit current factor
K_{ssc}
ratio of the rated short-circuit current to the rated primary current

Note 1 to entry: SAMU inputs are not connected to the power system primary. Rated primary current in the case of SAMUs is interpreted as the rated input current.

$$K_{ssc} = \frac{I_{psc}}{I_{pr}}$$

3.4 Terms and definitions related to accuracy

3.4.1301
specified input current time constant
T_I
specified value of the time constant of the DC component of the rated short-circuit current I_{PSC} on which the transient performance of the device is based

Note 1 to entry: T_I is typically a result of the power system primary time constant T_P combined with the CT secondary loop time constant T_s (both are defined in IEC 61869-2). An example is shown in Figure 1304. T_I is used to specify the dynamic response performance.

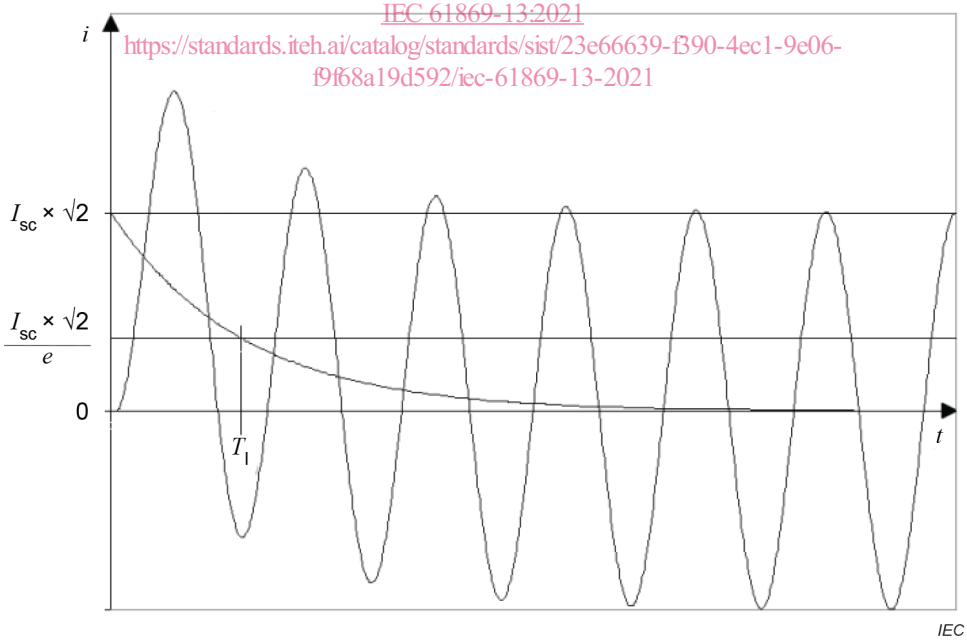

Figure 1304 – Specified input current time constant T_I

3.4.1302
input filter time constant
T_{sec}
value of the device AC coupled input circuit high-pass filter cut-off frequency f_c reported in the form of a time constant