

AS 61869.13:2021



Instrument transformers

**Part 13: Stand-alone merging unit (SAMU)(IEC 61869-13:2021
(ED.1.0) MOD)**



AS 61869.13:2021

This Australian Standard ® was prepared by EL-013, Measurement and Protection Transformers. It was approved on behalf of the Council of Standards Australia on 08 November 2021.

This Standard was published on 19 November 2021.

The following are represented on Committee EL-013:

- Australian Industry Group
- CHOICE
- CIGRE Australia
- Electric Energy Society of Australia
- Energy Networks Australia
- Engineers Australia
- National Association of Testing Authorities Australia
- National Measurement Institute
- University of South Australia

This Standard was issued in draft form for comment as DR AS 61869.13:2021.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:

www.standards.org.au

ISBN 978 1 76113 613 9

Instrument transformers

Part 13: Stand-alone merging unit (SAMU) (IEC 61869-13:2021 (ED.1.0) MOD)

First published as AS 61869.13:2021.



© IEC Geneva Switzerland 2021 — All rights reserved
© Standards Australia Limited 2021

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of either the IEC or the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth). If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please see the contact details on the back cover or the contact us page of the website for further information.

Preface

This Standard was prepared by the Standards Australia Committee EL-013, Measurement and Protection Transformers.

The objective of this document is to cover only additional requirements for standalone 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 AS 61869.9 as an application of IEC 61850, which specifies the power utility communication architecture.

This document covers SAMUs having standardized analogue inputs (e.g. 1 A, 5 A, 3.25 V/ $\sqrt{3}$ or 100 V/ $\sqrt{3}$) provided by instrument transformers compliant with relevant product standards (e.g. AS 61869.2 to AS 61869.5, IEC 61869-7, IEC 61869-8, AS 61869.10, AS 61869.11, AS 60044.1 to IEC 60044-6, IEC 60185, IEC 60186, IEEE C57.13), and aims to convert them to the digital output compliant with AS 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.

This document is an adoption with national modifications, and has been reproduced from, IEC 61869-13:2021, *Instrument transformers – Part 13: Stand-alone merging unit (SAMU)*.

The modifications are additional requirements and are set out in Appendix ZZ, which has been added at the end of the source text.

Appendix ZZ lists the variations to IEC 61869-13:2021 for the application of this document in Australia.

As this document has been reproduced from an International Standard, the following applies:

- (a) In the source text “this part of IEC 61869” should read “this document”.
- (b) A full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

NOTES

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	7
1 Scope.....	9
2 Normative references	9
3 Terms and definitions	11
4 Normal and special service conditions	14
5 Ratings.....	15
6 Design and construction	23
7 Tests	32
8 Rules for transport, storage, erection, operation and maintenance.....	49
9 Safety.....	49
Annex 13A (informative) Measurement chain accuracy class considerations	50
Annex 13B (informative) Measurement examples of switching and lightning surge voltage in gas-insulated switchgear	52
Annex 13C (normative) Low-power instrument transformer inputs	63
Bibliography.....	67
Figure 1301 – Stand-alone merging unit (functional concept example).....	7
Figure 1302 – Stand-alone merging unit application example.....	7
Figure 1303 – Illustration of the SAMU position in relation to other devices and standards in the functional chain.....	8
Figure 1304 – Specified input current time constant T_I	13
Figure 1305 – Dynamic range concept example	19
Figure 604 (modified) – Examples of subassembly subjected to EMC tests – Usual structure used in HV AIS applications	34
Figure 1306 – Gradual shutdown – Startup test	38
Figure 1307 – C-O-C-O duty cycle	39
Figure 13A.1 – SAMU application example	50
Figure 13B.1 – Constructional example of GIS with typical surge voltage sources.....	52
Figure 13B.2 – Measured 550 kV GIS construction	53
Figure 13B.3 – Measurement results showing a switching surge peak voltage magnitude caused by the DS operation in Figure 13B.2	54
Figure 13B.4 – Measured 275 kV GIS construction	55
Figure 13B.5 – Switching and lightning surge voltage waveforms.....	56
Figure 13B.6 – Switching surge voltage measurement setup on a 550 kV GIS with/without an insulating flange surge absorber	57
Figure 13B.7 – Switching surge voltage measurement results when the DS was operated with/without the surge absorber.....	58
Figure 13B.8 – CT secondary circuit configuration for the 500 kV GIS	59
Figure 13B.9 – DS control circuit configuration for the 500 kV GIS test	59
Figure 13B.10 – Waveforms of switching surge voltage at measured point I (see Table 13B.3).....	60
Figure 13B.11 – Block diagram of the electronic VT with amplifier tested in the 500 kV GIS system	61

Figure 13B.12 – Lightning surge voltage as a function of surge absorbing capacitor value...	61
Figure 13B.13 – Lightning surge voltage as a function of coaxial cable length	62
Table 1301 – Insulation requirements for analogue inputs.....	16
Table 1302 – Measuring accuracy class 0,05.....	17
Table 1303 – Limits of current error and phase error for SAMU measuring accuracy current channels	18
Table 1304 – Limits of current errors for SAMU TPM class rated protection accuracy current channels	20
Table 1305 – Limits of voltage error and phase error for SAMU voltage channels	21
Table 1306 – SAMU TCTR class settings.....	23
Table 1307 – SAMU TVTR class settings.....	23
Table 1308 – Immunity requirements and tests	24
Table 1309 – Acceptance criteria for EMC immunity tests.....	25
Table 1310 – Radiated emissions tests	27
Table 1311 – Conducted emissions tests	27
Table 1312 – SAMU rating plate markings	28
Table 1313 – Ratings defined in accordance with IEC 61850-7-4	32
Table 10 – List of tests.....	33
Table 1314 – Dry-heat test – Operational.....	44
Table 1315 – Cold test – Operational.....	44
Table 1316 – Dry-heat test at maximum storage temperature	45
Table 1317 – Cold test at minimum storage temperature.....	45
Table 1318 – Change of temperature (Cyclic temperature test).....	46
Table 1319 – Damp heat steady state test	47
Table 1320 – Cyclic temperature with humidity test.....	48
Table 13A.1 – Combined accuracy class table	50
Table 13B.1 – Measurement results showing switching and lightning surge voltage recorded for the setup in Figure 13B.4	55
Table 13B.2 – Measurement results of switching surge voltage on CT secondary circuit.....	59
Table 13B.3 – Measurement results showing the switching surge voltage coupling to the DS control circuit	59
Table 13C.1 – ITRat setting units.....	65
Table 13C.2 – SAMU rating plate marking modifications	65

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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.
- 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 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.

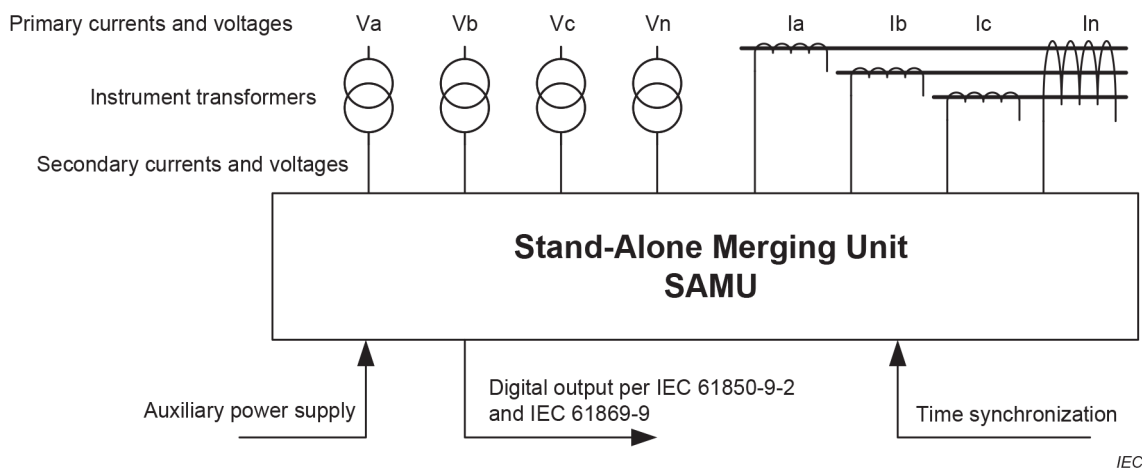


Figure 1301 – Stand-alone merging unit (functional concept example)

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.

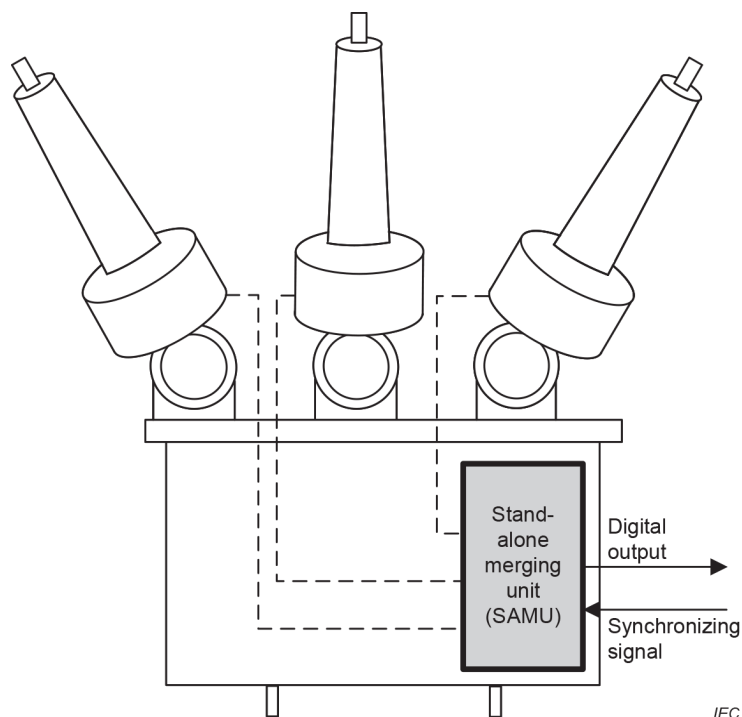


Figure 1302 – Stand-alone merging unit application example

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.

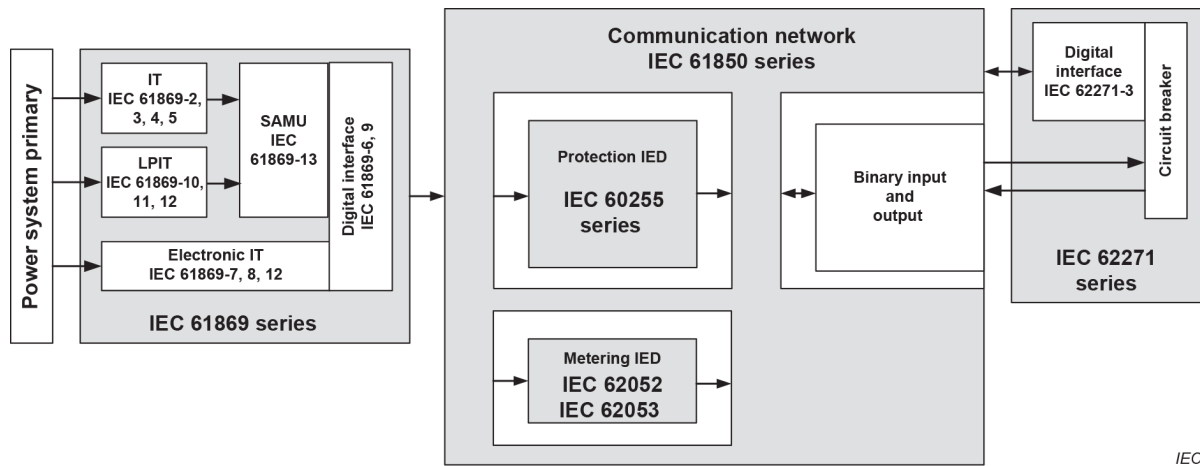


Figure 1303 – Illustration of the SAMU position in relation to other devices and standards in the functional chain

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, $3,25\text{ V} / \sqrt{3}$ or $100\text{ V} / \sqrt{3}$) 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*