

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Industrial-process measurement, control and automation – Evaluation of system properties for the purpose of system assessment –  
Part 4: Assessment of system performance**

**Mesure, commande et automation dans les processus industriels – Appréciation des propriétés d'un système en vue de son évaluation –  
Partie 4: Évaluation des caractéristiques de fonctionnement d'un système**



**THIS PUBLICATION IS COPYRIGHT PROTECTED**  
**Copyright © 2016 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

#### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

#### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

#### IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

#### IEC publications search - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [csc@iec.ch](mailto:csc@iec.ch).

#### A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

#### A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

#### Catalogue IEC - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

#### Recherche de publications IEC - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### Glossaire IEC - [std.iec.ch/glossary](http://std.iec.ch/glossary)

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

#### Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [csc@iec.ch](mailto:csc@iec.ch).

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Industrial-process measurement, control and automation – Evaluation of system properties for the purpose of system assessment –  
Part 4: Assessment of system performance**

**Mesure, commande et automation dans les processus industriels – Appréciation des propriétés d'un système en vue de son évaluation –  
Partie 4: Évaluation des caractéristiques de fonctionnement d'un système**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

ICS 25.040.40

ISBN 978-2-8322-3408-2

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

|                                                                                                       |    |
|-------------------------------------------------------------------------------------------------------|----|
| FOREWORD.....                                                                                         | 4  |
| INTRODUCTION.....                                                                                     | 6  |
| 1 Scope.....                                                                                          | 8  |
| 2 Normative references.....                                                                           | 8  |
| 3 Terms, definitions, abbreviated terms, acronyms, conventions and symbols.....                       | 9  |
| 3.1 Terms and definitions.....                                                                        | 9  |
| 3.2 Abbreviated terms, acronyms, conventions and symbols.....                                         | 9  |
| 4 Basis of assessment specific to performance.....                                                    | 9  |
| 4.1 Performance properties.....                                                                       | 9  |
| 4.1.1 General.....                                                                                    | 9  |
| 4.1.2 Accuracy.....                                                                                   | 10 |
| 4.1.3 Response time.....                                                                              | 10 |
| 4.1.4 Capacity.....                                                                                   | 10 |
| 4.2 Factors influencing performance.....                                                              | 11 |
| 5 Assessment method.....                                                                              | 12 |
| 5.1 General.....                                                                                      | 12 |
| 5.2 Defining the objective of the assessment.....                                                     | 12 |
| 5.3 Design and layout of the assessment.....                                                          | 12 |
| 5.4 Planning of the assessment program.....                                                           | 12 |
| 5.5 Execution of the assessment.....                                                                  | 12 |
| 5.6 Reporting of the assessment.....                                                                  | 12 |
| 6 Evaluation techniques.....                                                                          | 13 |
| 6.1 General.....                                                                                      | 13 |
| 6.2 Analytical evaluation techniques.....                                                             | 13 |
| 6.3 Empirical evaluation techniques.....                                                              | 13 |
| 6.3.1 General topics.....                                                                             | 13 |
| 6.3.2 Tests to evaluate accuracy.....                                                                 | 14 |
| 6.3.3 Tests to evaluate response time.....                                                            | 15 |
| 6.3.4 Tests to evaluate capacity.....                                                                 | 15 |
| 6.4 Additional topics for evaluation techniques.....                                                  | 15 |
| Annex A (informative) Checklist and example of SRD for system performance.....                        | 16 |
| Annex B (informative) Check list and/or example of SSD for system performance.....                    | 19 |
| B.1 SSD information.....                                                                              | 19 |
| B.2 Check points for system performance.....                                                          | 19 |
| Annex C (informative) An example of a list of assessment items (information from IEC TS 61069-1)..... | 20 |
| C.1 Overview.....                                                                                     | 20 |
| C.2 Accuracy – Time performances of the BCS.....                                                      | 20 |
| C.2.1 Absolute time synchronisation.....                                                              | 20 |
| C.2.2 Requirements of the time stamping.....                                                          | 20 |
| C.3 Response time.....                                                                                | 21 |
| C.3.1 Overall response time of the BCS.....                                                           | 21 |
| C.3.2 Switch-over time for redundant CPUs.....                                                        | 21 |
| C.3.3 Real-time constraints for control functions.....                                                | 21 |
| C.3.4 Controller cyclic time.....                                                                     | 21 |

|                       |                                                  |    |
|-----------------------|--------------------------------------------------|----|
| C.3.5                 | Time constraints for display.....                | 22 |
| C.3.6                 | Call-up time .....                               | 22 |
| C.3.7                 | Video screen page refresh time .....             | 22 |
| Annex D (informative) | Model of an evaluation.....                      | 23 |
| D.1                   | General.....                                     | 23 |
| D.2                   | Analytical evaluation techniques.....            | 25 |
| D.2.1                 | General .....                                    | 25 |
| D.2.2                 | Accuracy.....                                    | 25 |
| D.2.3                 | Response time .....                              | 25 |
| D.2.4                 | Capacity .....                                   | 26 |
| D.3                   | Empirical evaluation techniques.....             | 26 |
| D.3.1                 | General .....                                    | 26 |
| D.3.2                 | Accuracy.....                                    | 26 |
| D.3.3                 | Response time/capacity .....                     | 28 |
| D.4                   | Precautions.....                                 | 31 |
| Bibliography          | .....                                            | 32 |
| Figure 1              | – General layout of IEC 61069.....               | 7  |
| Figure 2              | – Performance .....                              | 9  |
| Figure D.1            | – Schematic functional diagram of a system ..... | 23 |
| Figure D.2            | – Generic physical system model .....            | 25 |
| Table A.1             | – SRD performance checklist.....                 | 16 |
| Table C.1             | – Resolution and discrimination time .....       | 21 |

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL-PROCESS MEASUREMENT, CONTROL AND AUTOMATION –  
EVALUATION OF SYSTEM PROPERTIES FOR  
THE PURPOSE OF SYSTEM ASSESSMENT –****Part 4: Assessment of system performance**

## 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 61069-4 has been prepared by subcommittee 65A: System aspects of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 1997. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Reorganization of the material of IEC 61069-4:1997 to make the overall set of standards more organized and consistent;
- b) IEC TS 62603-1:2014 has been incorporated into this edition.

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

| FDIS         | Report on voting |
|--------------|------------------|
| 65A/792/FDIS | 65A/801/RVD      |

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

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

A list of all parts in the IEC 61069 series, published under the general title *Industrial-process measurement, control and automation – Evaluation of system properties for the purpose of system assessment*, can be found on the IEC website.

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

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

**IMPORTANT – The 'colour inside' logo on the cover page of this publication 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

IEC 61069 deals with the method which should be used to assess system properties of a basic control system (BCS). IEC 61069 consists of the following parts:

Part 1: Terminology and basic concepts

Part 2: Assessment methodology

Part 3: Assessment of system functionality

Part 4: Assessment of system performance

Part 5: Assessment of system dependability

Part 6: Assessment of system operability

Part 7: Assessment of system safety

Part 8: Assessment of other system properties

Assessment of a system is the judgement, based on evidence, of the suitability of the system for a specific mission or class of missions.

To obtain total evidence would require complete evaluation (for example under all influencing factors) of all system properties relevant to the specific mission or class of missions.

Since this is rarely practical, the rationale on which an assessment of a system should be based is:

- the identification of the importance of each of the relevant system properties;
- the planning for evaluation of the relevant system properties with a cost-effective dedication of effort to the various system properties.

In conducting an assessment of a system, it is crucial to bear in mind the need to gain a maximum increase in confidence in the suitability of a system within practical cost and time constraints.

An assessment can only be carried out if a mission has been stated (or given), or if any mission can be hypothesized. In the absence of a mission, no assessment can be made; however, evaluations can still be specified and carried out for use in assessments performed by others. In such cases, IEC 61069 can be used as a guide for planning an evaluation and it provides methods for performing evaluations, since evaluations are an integral part of assessment.

In preparing the assessment, it can be discovered that the definition of the system is too narrow. For example, a facility with two or more revisions of the control systems sharing resources, for example a network, should consider issues of co-existence and inter-operability. In this case, the system to be investigated should not be limited to the “new” BCS; it should include both. That is, it should change the boundaries of the system to include enough of the other system to address these concerns.

The part structure and the relationship among the parts of IEC 61069 are shown in Figure 1.

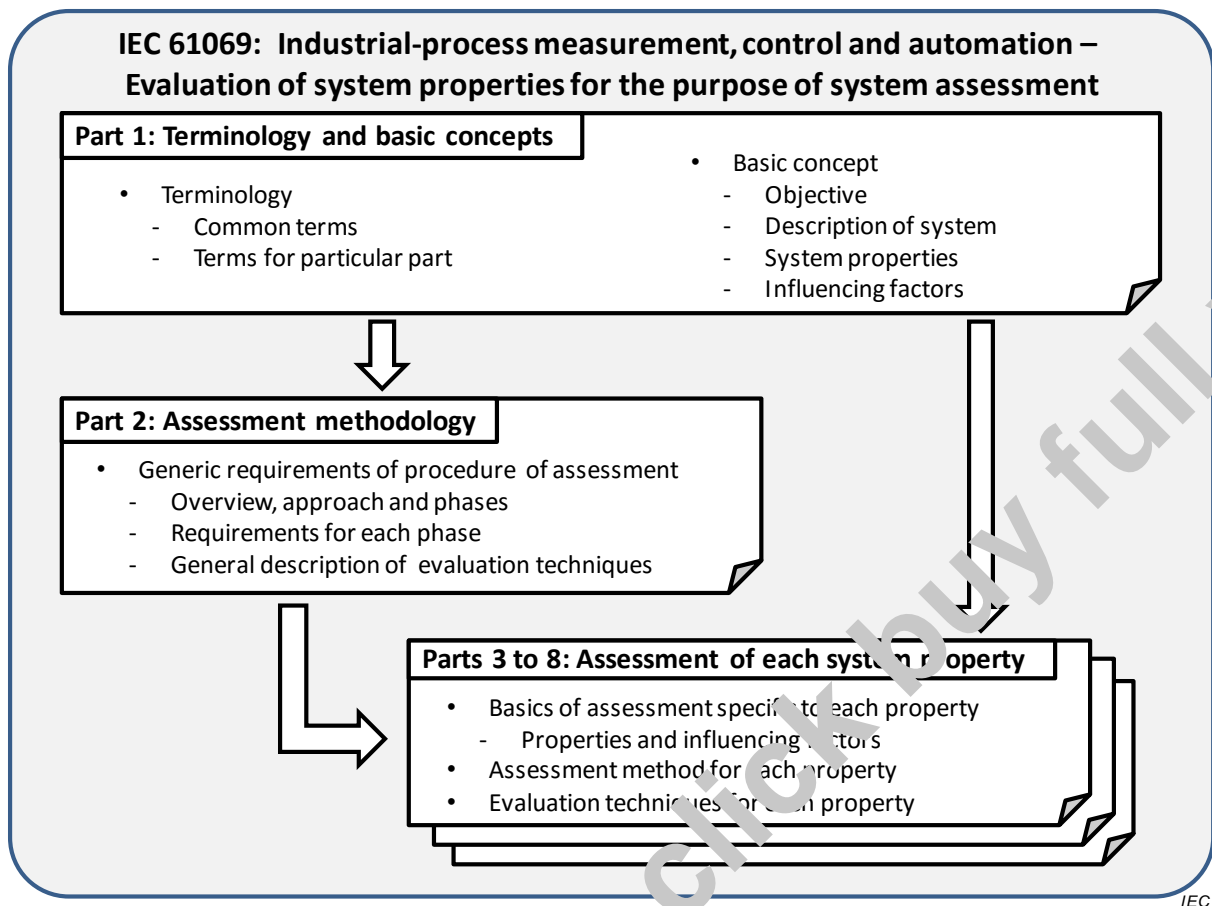


Figure 1 – General layout of IEC 61069

Some example assessment items are integrated in Annex C.

# INDUSTRIAL-PROCESS MEASUREMENT, CONTROL AND AUTOMATION – EVALUATION OF SYSTEM PROPERTIES FOR THE PURPOSE OF SYSTEM ASSESSMENT –

## Part 4: Assessment of system performance

### 1 Scope

This part of IEC 61069:

- specifies the detailed method of the assessment of performance of a basic control system (BCS) based on the basic concepts of IEC 61069-1 and methodology of IEC 61069-2,
- defines basic categorization of performance properties,
- describes the factors that influence performance and which need to be taken into account when evaluating performance, and
- provides guidance in selecting techniques from a set of options (with references) for evaluating the performance.

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068 (all parts), *Environmental testing*

IEC 60654 (all parts), *Industrial-process measurement and control equipment – Operating conditions*

IEC 60721 (all parts), *Classification of environmental conditions*

IEC 61000 (all parts), *Electromagnetic compatibility (EMC)*

IEC 61069-1:—1, *Industrial-process measurement, control and automation – Evaluation of system properties for the purpose of system assessment – Part 1: Terminology and basic concepts*

IEC 61069-2:—2, *Industrial-process measurement, control and automation – Evaluation of system properties for the purpose of system assessment – Part 2: Assessment methodology*

IEC 61326 (all parts), *Electrical equipment for measurement, control and laboratory use – EMC requirements*

---

1 Second edition to be published simultaneously with this part of IEC 61069.

2 Second edition to be published simultaneously with this part of IEC 61069.