IEC 61069-3

Edition 2.0 2016-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Industrial-process measurement, control and automation – Evaluation of system properties for the purpose of system assessment –
Part 3: Assessment of system functionality

Mesure, commande et automation dans les processus industriels – Appréciation des propriétés d'un système en vue de son évaluation –
Partie 3: Évaluation de la fonctionnalité d'un système

IEC 61069-3:2016-06(en-fr)

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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FOREWORD

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International Standard IEC 61069-3 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 1996. 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 61069-3:1996 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/791/FDIS	65A/800/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 website 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- withdrawn,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.

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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.

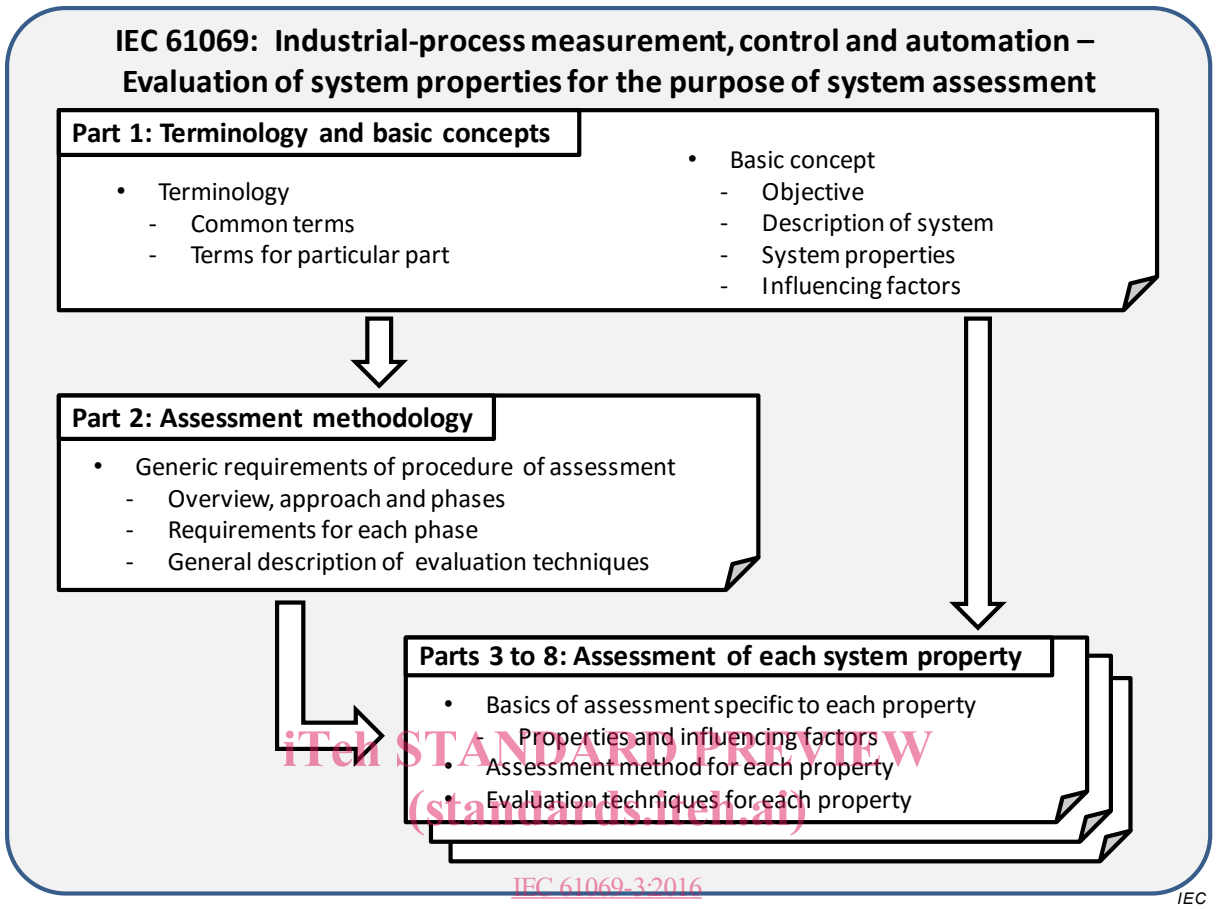

Figure 1 – General layout of IEC 61069

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 3: Assessment of system functionality

1 Scope

This part of IEC 61069:

– specifies the detailed method of the assessment of functionality 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 functionality properties,

– describes the factors that influence functionality and which need to be taken into account when evaluating functionality, and

– provides guidance in selecting techniques from a set of options (with references) for evaluating the functionality.

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 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*

3 Terms, definitions, abbreviated terms, acronyms, conventions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61069- apply.

3.2 Abbreviated terms, acronyms, conventions and symbols

For the purposes of this document, the abbreviated terms, acronyms, conventions and symbols given in IEC 61069-1 apply.

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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.

4 Basis of assessment specific to functionality

4.1 Functionality properties

4.1.1 General

A system is able to perform the required mission if the functions provided by the system cover the mission. The extent to which this is the case can be expressed as the system property coverage.

For a system designed for a set of rigid and fixed tasks, coverage can describe fully the functionality of a system.

Tasks required, however, can differ for different applications of the system or the mission can change or be extended over time due to changes in the industrial process or arrangements in the control strategy. To cope with this, the system should provide means for configuring the selection and arrangement of modules, and should have a system configuration which provides flexibility for additions and modifications.

To fully assess the functionality of a system, the system properties are categorised in a hierarchical way.

Functionality properties are categorized as shown in Figure 2.

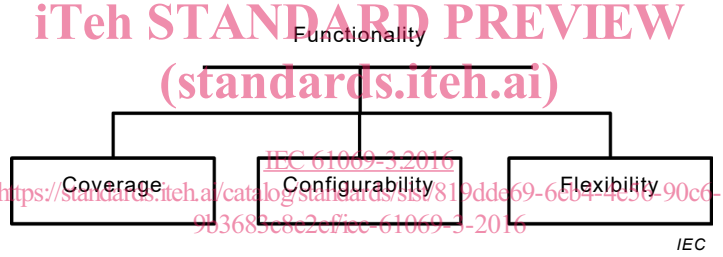

Figure 2 – Functionality

Functionality cannot be assessed directly and cannot be described by a single property. Functionality can only be determined by analysis and testing of each of the functionality properties individually.

Some of the functionality properties can be expressed in quantitative terms as an absolute or relative value; others can only be described in a qualitative way with some quantitative elements.

When assessing the functionality of a system, the availability of facilities necessary for the system to operate should be taken into account.

4.1.2 Coverage

Coverage is determined by:

– the range of distinct functions provided, each differentiated by type, execution frequency, data volume, etc.;

– the variety of ways in which the functions cooperate, as determined by the system configuration, to perform the task(s) required;

– the number of replications available of each function, as determined by the way in which the system modules provide these functions and how these functions are allocated within the modules.

The way in which the individual functions are set up and combined to perform tasks can impose interdependent limits on each function. It can also impose limits on the simultaneous use of separate functions when there is sharing of system resources.

The coverage of the system should be quantified as a coverage factor, which is the ratio of tasks which the system covers against the totality of tasks required by the system mission. If appropriate, partial coverage factors should be expressed for each individual task.

System mission = n Tasks

Coverage factor (CF) = tasks covered / n tasks

4.1.3 Configurability

Configurability is dependent upon the architecture of the system and the ease with which modules can be selected, set up, arranged and combined to assemble function(s) to perform tasks required by the mission of system.

There can be configuration elements at any level of the system. Methods to configure systems are shown in Figure 3. The method can be implemented by hardware or software.

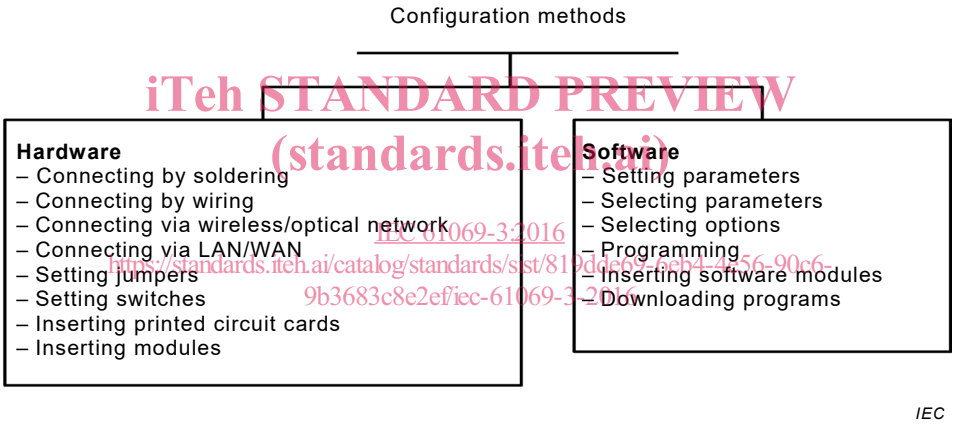

Figure 3 – Configuration methods

It is also important to bear in mind that configuration changes can modify system properties unexpectedly.

The configuration facilities are parts of the system and considered as "supporting functions" if they are fully described in the system specification document.

In practice the activity of configuring a system sometimes requires deep knowledge of system architecture, module behaviour and module interfaces. The need for this knowledge can be reduced by the configuration facilities.

Depending on the mode of operation of the system ("on-line", "off-line", etc.) some of the configuration actions are permissible or not permissible. Some actions (such as module set-up, changes to module connections, module insertion or removal, etc.) are possible only while the system is disabled from process operation. Configurability cannot be quantified as a number. It can be described in a qualitative manner by detailing configuration actions and tools, and stating for each of these the know-how, skills and time required.

4.1.4 Flexibility

4.1.4.1 General

The flexibility of a system depends on the ways the system can be adapted.

The system has higher flexibility when it has more capability to add, remove, change and/or rearrange modules of the system.

Flexibility cannot be expressed by a single system property.

4.1.4.2 Scalability

A system can be designed in such a way that it is possible to scale the system. For example, a system might be able to increase in size (more I/O points) or in communication capabilities (more network interfaces) or supported operator workstations, or in some other countable/measurable way.

The extent to which the system can be scaled can be assessed by analysis of the system configuration, communication functions and shared resources.

Scalability can be expressed by a qualitative description containing some quantified elements.

4.1.4.3 Variability

A system can be designed in such a way that it is possible to vary the range of executable tasks.

Variability can be assessed by analysis of the system configuration, the degree of modularity, the specification of interfaces between the modules, and the number and scope of functions provided by the individual modules.

Variability can be expressed by a qualitative description containing some quantified elements.

4.1.4.4 Enhanceability

A system can be designed in such a way that it is possible to enhance certain system properties.

Enhanceability can be assessed by analysing the system configuration and the range of available modules with alternative property values.

Some examples of implementation which achieve higher enhanceability are:

– modules with a larger main memory to allow a decrease in response time via reduced data transfers;
– modules which allow an increased number of iterations of mathematical procedures to increase the accuracy of a calculated value;
– use of better protected input or output cards against electrical noise to increase the system's security, or to increase the system's usability in areas where there is explosive atmosphere.

The potential for improvement of these properties can extend beyond the requirements stated in the system requirements document.

Enhanceability can be expressed by a qualitative description containing some quantified elements.

4.2 Factors influencing functionality

The functionality of a system can be affected by the influencing factors listed in IEC 61069-1:–, 5.3.

For each of the system functionality properties listed in 4.1, the primary influencing factors are as follows:

a) Coverage can be affected by:

   No influencing factors.

b) Configurability can be affected by:

   1) licensing of specific functionality;

   2) installation, for example all modules and elements are in place.

c) Operational rules, dictated by the mission, training of personnel, and deficiencies in documentation, manuals and technical support can hamper the full use of the system functionality.

5 Assessment method

5.1 General

The assessment shall follow the method as laid down in IEC 61069-2:—, Clause 5.

5.2 Defining the objective of the assessment

Defining the objective of the assessment shall follow the method as laid down in IEC 61069-2:—, 5.2.

5.3 Design and layout of the assessment

Design and layout of the assessment shall follow the method as laid down in IEC 61069-2:—, 5.3.

Defining the scope of assessment shall follow the method laid down in IEC 61069-2:—, 5.3.1.

Collation of documented information shall be conducted in accordance with IEC 61069-2:—, 5.3.3.

The statements compiled in accordance with IEC 61069-2:—, 5.3.3, should include the following in addition to the items listed in IEC 61069-2:–, 5.3.3:

– No additional items are noted.

Documenting collated information shall follow the method in IEC 62069-2:—, 5.3.4.

Selecting assessment items shall follow IEC 61069-2:—, 5.3.5.

Assessment specification should be developed in accordance with IEC 61069-2: —, 5.3.6.

Comparison of the SRD and the SSD shall follow IEC 61069-2:—, 5.3.

NOTE 1 A check list of SRD for system functionality is provided in Annex A.

NOTE 2 A check list of SSD for system functionality is provided in Annex B.

5.4 Planning of the assessment program

Planning the assessment program shall follow the method as laid down in IEC 62069-2:—, 5.4.

Assessment activities shall be developed in accordance with IEC 61069-2:—, 5.4.2.

The final assessment program should specify points specified in IEC 61069-2:—, 5.4.3.

5.5 Execution of the assessment

The execution of the assessment shall be in accordance with IEC 61069-2:—, 5.5.

5.6 Reporting of the assessment

The reporting of the assessment shall be in accordance with IEC 61069-2:—, 5.6.

The report shall include information specified in IEC 61069-2:—, 5.6. Additionally, the assessment report should address the following points:

– information specified in Clause 6.

6 Evaluation techniques

6.1 General

Within IEC 61069-3 several evaluation techniques are suggested. Other methods may be applied, but in all cases the assessment report should provide references to documents describing the techniques used.

Those evaluation techniques are categorized as described in IEC 61069-2:—, Clause 6.

Factors influencing the functionality properties of the system as per 4.2 shall be taken into account.

The techniques given in 6.2, 6.3 and 6.4 are used to assess the functionality properties.

It is not possible to evaluate the functionality property as one entity. Instead each functionality property should be addressed separately.

Functionality which is built in the system but is not specified in the SRD may be omitted from the evaluation, but such omissions shall be recorded in the report.

NOTE An example of a list of assessment items is provided in Annex C.

6.2 Analytical evaluation techniques

6.2.1 Coverage

Coverage can be evaluated by analytically checking whether the number of modules or elements of the system and their scopes specified in the SSD are able to perform the system functions required for the tasks specified in the SRD.

The following information shall be included in the report:

– the tasks and the supporting functions analysed,
– the functions not provided,
– the deficiencies of function found.