IEC 61069-6

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 6: Assessment of system operability

Mesure, commande et automation dans les processus industriels – Appréciation des propriétés d'un système en vue de son évaluation –
Partie 6: Évaluation de l'opérabilité d'un système

IEC 61069-6:2016-06(en-fr)

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FOREWORD

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International Standard IEC 61069-6 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 1998. 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 61069-6:1998 to make the overall set of standards more organized and consistent;
b) IEC TS 62603-1 has been incorporated into this edition.

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

FDIS	Report on voting
65A/794/FDIS	65A/804/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- withdrawn,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.

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

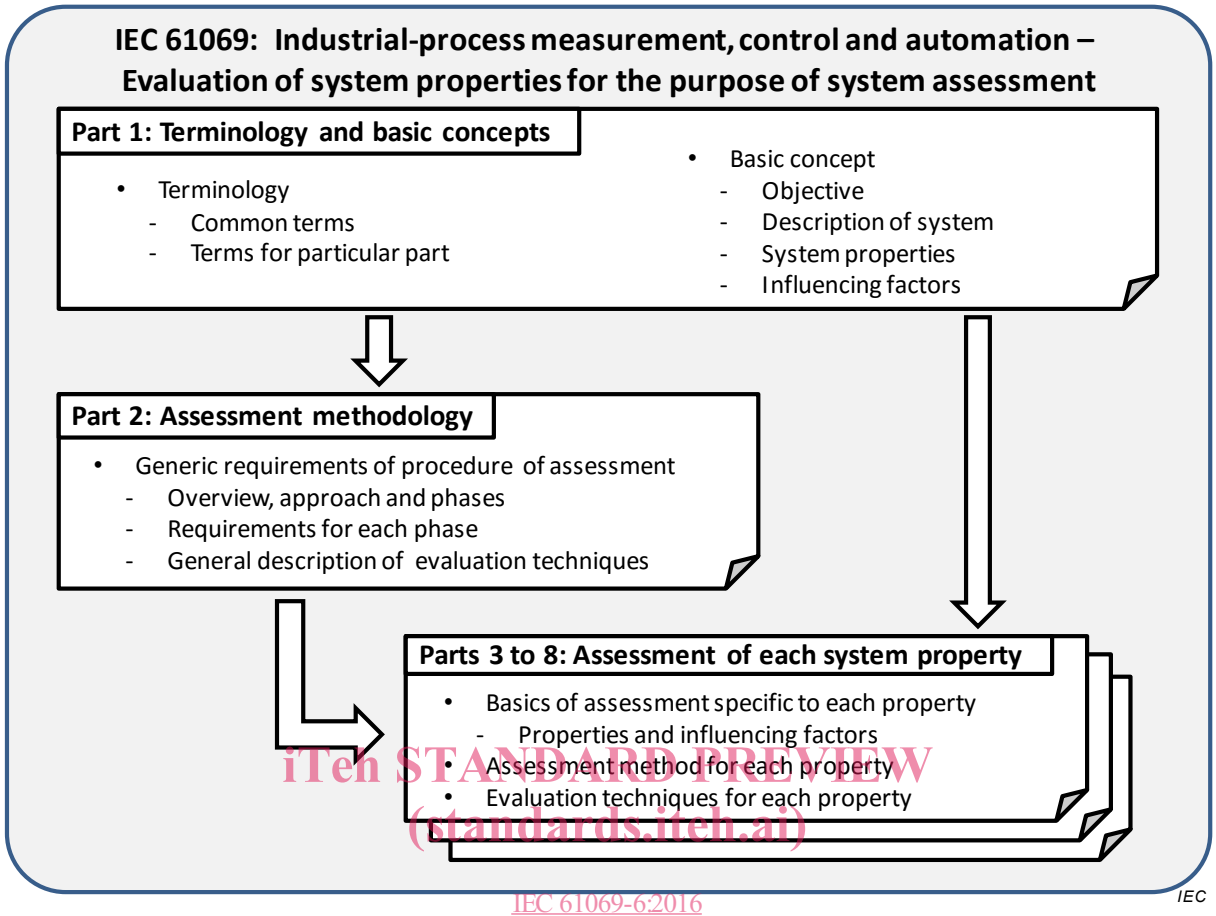

Figure 1 – General layout of IEC 61069

Some example assessment items are integrated in Annex C.

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

Part 6: Assessment of system operability

1 Scope

This part of IEC 61069:

– specifies the detailed method of the assessment of operability of basic control system (BCS), based on the basic concepts of IEC 61069-1 and methodology of IEC 61069-2;

– defines basic categorization of operability properties;

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

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

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 61069-1:2016, *Industrial-process measurement, control and automation – Evaluation of system properties for the purpose of system assessment – Part 1: Terminology and basic concepts*

IEC 61069-2:2016, *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 61069-1 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 the following apply.

4 Basis of assessment specific to operability

4.1 Operability properties

4.1.1 General

For a system to be operable the system provides the operator with a transparent and consistent window into the tasks to be performed, through its human-machine interface. The extent to which means for interaction with these tasks provided by the system are efficient,

intuitive, transparent and robust interaction can be expressed by the operability system property.

The human-machine interface functions are part of the system and enable the operator to monitor and manipulate the system itself, the external systems and the process.

The requirements for operability are strongly affected by the skill and knowhow of the personnel operating the system.

The degree of the operability system property varies depending on the phases of the system mission during its life cycle.

Operability requirements can differ between these phases of the life cycle of the system. They depend upon the tasks to be performed during the phase and the duration of the phase.

The operability requirements can be high where the duration of a phase is short and its relevance for the system mission critical. The requirements can be low where the duration of a phase is long, so that sequences of required actions for certain operations can be learnt by the operator over the long term the system is used.

In the assessment of operability, one is concerned with the way which information given by the operator to the system (such as commands and requests), is processed by the system. Additionally, one is concerned with the transparency of information coming from the system to the operator, such as process/system state and values, trends, reports, etc.

While special operability measures are sometimes needed during the design and/or maintenance phases of the system, the operability requirements are mostly understood as those necessary during the operational phase of an industrial process plant.

All phases of life cycle of the system should be taken into account for evaluation of system operability properties. During each phase the system will typically be operated by a different group of operators, with different operability requirements.

In addition, planned, unplanned and disturbed plant operation might need different operating schemes and hence operability requirements.

Annex D shows the various phases, the operator(s) using the system during these phases, their typical tasks and the type of interfaces utilized.

The perception of the operability system property is strongly affected by the performance system property (especially speed of response) and the functionality system property.

Operability properties are categorized as shown in Figure 2.

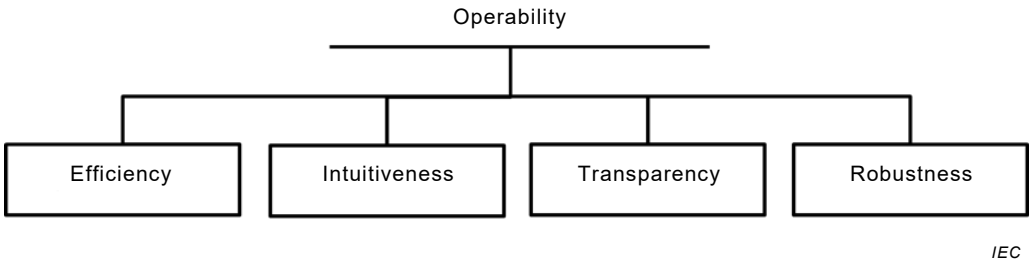

Figure 2 – Operability

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

Some aspects can be quantified by analysing the ergonomic aspects of the properties, and by measuring the number of actions and time required to accomplish a given task (the efficiency of the human-machine interface), others can be qualified in a descriptive way.

Efficiency, intuitiveness, transparency and robustness each cannot be quantified as a single number. However they can be expressed by a qualitative description containing some quantified elements, such as:

– a coverage factor, obtained by comparing the operating means provided by the system with the specific requirements as stated in the system requirements document;
– applicable ergonomic standards; and
– the time required to give a command, and to request information.

4.1.2 Efficiency

A system has operability efficiency if it allows the operator, with a minimum risk of making errors, to perform his task(s) with a minimum amount of mental and physical effort within an acceptable time frame.

The extent to which the operating means provided by the system minimise operator time and effort required in using the system to accomplish his tasks within stated constraints is a measure of the operability efficiency of the system.

The operability efficiency depends, among others, on the following elements:

– the ergonomic design of the devices (keyboard, mouse, voice input, dedicated knobs, screens, indicators, etc.) used as operating means in support of the human-machine interface;
– the geographical lay-out, the number of these devices and their relative location on the operators' workplace;
– the shape of the operators' workplace;
– the limitations imposed by the operating environment and protective clothing (indoor, outdoor, day, night, goggles, gloves, etc.);
– the methods to be used to retrieve information, to issue commands, etc.

4.1.3 Intuitiveness

Intuitiveness represents the simplicity and instant understanding the system provides, which enables the operators to give commands and present information to the operators. Additionally intuitiveness takes into account the skills, educational level and general culture of the operators, who are performing tasks, by using the functions provided by the system.

The degree to which the operational means are consistent with common working practices is a measure of the operability intuitiveness of the system.

The operability intuitiveness depends on the following factors:

– the extent to which standard generic rules and methods for the operation of “action” items are followed;
– the conventions followed to present information to the operator, for example red for emergency conditions, etc.;
– the conventions followed to give commands, for example turning a knob clockwise to increase a value, etc.

Unlike other operability properties, intuitiveness is not a totally inherent property of the system. Some of the intuitiveness can depend on the particular user domain.

This domain can be defined in terms of culture, international and/or proprietary standards, etc.

4.1.4 Transparency

Transparency represents the ability, of the operating means provided by the system, to seemingly place the operator in direct contact with his tasks. This enables the operator to give commands and view information, returned from the system, with a realistic view of the actions (and their sequence).

The extent to which these means are provided is a measure of the transparency of the system.

The transparency depends on the following factors:

– the logical principles followed to present the functional and geographical structure of the process and the tasks to be performed by the operator;
– the way in which labels and names are used to identify the operating means, and the consistency of their use;
– the consistency in the application of colours, names, audible signals, etc. throughout all tasks and levels of information;
– the way of the dynamics of the tasks are realistically simulated, to give the operator a “real” feel of the task to be performed, etc.

Transparency includes that the information presented by the system is clear, concise, unambiguous, and non-contradictory. Non self-explanatory information can be explained by a more detailed description in easily accessible documentation or a help function for transparency.

4.1.5 Robustness

Robustness includes that the operating means provided by the system to enable the operator to give commands correctly interpret and respond to any operator action. If the operation means are ambiguous, additional information can be requested by the system for removing the ambiguities.

Robustness depends on the following factors:

– the extent to which deviation from the standard generic rules is permitted, and is interpreted;
– the extent to which the system is able to detect and notify deviations and to couple these deviations with requests for further information, etc.

4.2 Factors influencing operability

The operability properties of a system can be affected by the influencing factors listed in IEC 61069-1:2016, 5.3.

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

– tasks:
  - unusual or infrequent operating scenarios, during commissioning, emergency, etc.
– personnel:
  - the operability of a system is in itself not influenced by the abilities of the person, who operates the system. However, the requirements for the operability are usually based on an imaginary operator having the statistical mean values of the qualifications, such as skill and knowhow, of the personnel operating the system. Deviations from these mean values can influence each of operability properties.
– process:
  - noise on the incoming process lines
– utility:
  - distortions and disturbances originating from the utilities
– environment:
  - temperature, EMC, ageing, mounting, corrosive substances, and dust.

The operability also depends, on other influencing factors:

– procedures for access to and entry of information and data into the system;
– the extent of information obtained by a single request;
– information formats used;
– interface devices used (e.g. touchscreen, light-pen, keyboard).

5 Assessment method

5.1 General

The assessment shall follow the method as laid down in IEC 61069-2:2016, 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 61069-2:2016, 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 61069-2:2016, 5.3.

Defining scope of assessment shall follow the method laid down in IEC 61069-2:2016, 5.3.1.

Collation of documented information shall be conducted in accordance with IEC 61069-2:2016, 5.3.3

The statements compiled in accordance with IEC 61069-2:2016, 5.3.3 should include the following in addition to the items listed in IEC 61069-2:2016, 5.3.3:

– the operability properties required for each of the tasks and for the system, arranged in order of the relevant phase or phases of the system life cycle;
– the knowhow, experience and skill of the operators using the interface to perform each of the tasks defined in the SRD;
– the number of e.g. information sources, sensors and their association with tasks which require operators to use the human-machine interface simultaneously.

Depending on the phase of the system life cycle, assessment of operability can only be done with existing or similar systems in operation. These assessments should include the prior knowledge, skill and experience of the system designer, the plant-shift supervisors, the system maintenance personnel, etc.

Documenting collated information shall follow the method in IEC 61069-2:2016, 5.3.4.

Selecting assessment items shall follow IEC 61069-2:2016, 5.3.5.

Assessment specification should be developed in accordance with IEC 61069-2:2016, 5.3.6.

Comparison of the SRD and the SSD shall follow IEC 61069-2:2016, 5.3.

NOTE 1 A checklist of SRD for system dependability is provided in Annex A.

NOTE 2 A checklist of SSD for system dependability is provided in Annex B.

5.4 Planning of the assessment program

The perception of the operability system property can also be sensitive to internal system factors related to the functionality and performance properties, especially time response and update frequency.

The evaluation of the operability system property should therefore always be preceded by an evaluation of the functionality and performance properties, unless results are available from earlier evaluations.

Planning of the assessment program shall follow the method as laid down IEC 61069-2:2016, 5.4.

Assessment activities shall be developed in accordance with IEC 61069-2:2016, 5.4.2.

The final assessment program should specify points specified in IEC 61069-2:2016, 5.4.3.

5.5 Execution of the assessment

The execution of the assessment shall be in accordance with IEC 61069-2:2016, 5.5.

5.6 Reporting of the assessment

The reporting of the assessment shall be in accordance with IEC 61069-2:2016, 5.6.

The report shall include information specified in IEC 61069-2:2016, 5.6. Additionally, the assessment report should address the following points:

– No additional items are noted.