INTERNATIONAL STANDARD

ISO 15519-2

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Specifications for diagrams for process industry —

Part 2:
Measurement and control

Spécifications pour schémas de l'industrie de traitement —

Partie 2: Mesurage et contrôle

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 10, *Technical product documentation*, SC 10, *Process plant documentation*.

ISO 15519 consists of the following parts, under the general title *Specifications for diagrams for process industry*:

— *Part 1: General rules*

— *Part 2: Measurement and control*

Introduction

0.1 General

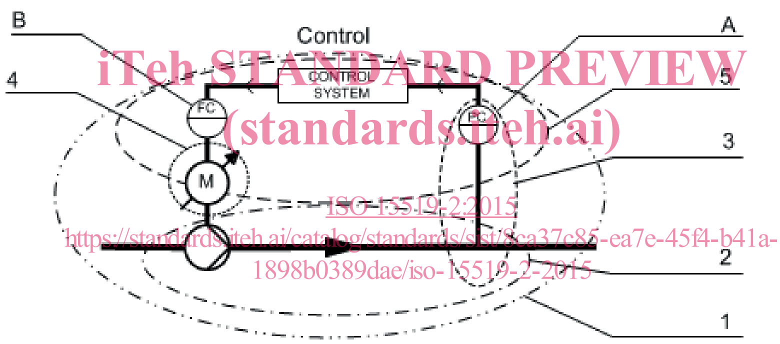
The ISO 15519 series consists of standards for specification of diagrams for process industry, published under the general title: Specification for diagrams for process industry.

This International Standard specifies preparation of different types of diagrams and use of graphical symbols, letter codes, and reference designation in diagrams. This International Standard addresses all process industry fields for example chemical, petrochemical, power, pharmaceutical, foodstuff, pulp, and paper.

This part of ISO 15519 deals with representation of measurement, actuation, and control in process diagrams which in this context covers process flow diagrams (PFD), process and instrument diagrams (PID), process control diagrams (PCD), and typical diagrams (TYD).

0.2 Engineering interrelations

Process diagrams, which represent the configuration of the process system and of the measurement, actuation, and control systems, involves engineering disciplines like process, mechanical, instrumentation, electrical, and control as illustrated in Figure 1.



Key

1 process
2 mechanical
3 instrumentation
4 electrical
5 control
A measurement
B actuation

Figure 1 — Interrelations between engineering disciplines

Figure 1 illustrates the discipline complexity of process systems which force diagrams not only to focus on individual disciplines but overlap to neighbouring disciplines. This is, for example, done in the process and instrumentation diagram which shows mechanical, instrumentation, and electrical objects in same diagram.

As process engineering by tradition is an ISO discipline and control engineering is IEC discipline representation of measurement and control in diagrams need to be coordinated and unambiguously.

0.3 Control system technology and influence on documentation

The technological development within Information Technology constantly challenges the process industry to use “state of the art” technology for engineering of process and control systems. This puts pressure on the standardization organisations to deliver up to date International Standards. As development time and expected lifetime of a standard at present is overtaken several times by the IT development, the standard developers need to develop standards which focus on basic principles and rules to secure high quality documentation and exchange of information.

At present, the configuration and functionality of the process control system are programmed direct in modern control system as control Programmable Logic Controller (PLC) and Distributed Control Systems (DCS). In addition, these systems are self-documenting which could lead to the assumption that traditional diagram documentation are superfluous.

Diagrams are however an important tool for documentation and representation of process system information in all lifecycle phases of a process plant. In the development and engineering phase, diagrams are used also for exchange and sharing of technical information between engineering disciplines and in operation and maintenance phases diagrams are used in daily operation and as part of operation and maintenance manuals.

0.4 Letter codes

ISO 14617-6, 7.3.1 have been moved to this part of ISO 15519 and the description has been changed to “Letter codes for Process Control Information (PCI)”.

ISO 14617-6 will be revised at first periodical review or revision after publication of this International Standard.

0.5 Figures

Figures in this International Standard are only examples for illustration of a given rule in the standard.

0.6 Reference designation

In this part of ISO 15519, IEC 81346-1, IEC 81346-2, and ISO/TS 81346-3 are used to illustrate the application of reference designation in diagrams.

Specifications for diagrams for process industry —

Part 2: Measurement and control

1 Scope

This part of ISO 15519 provides rules and guidelines for representation of measurement, control, and actuation in diagrams for process industry.

General rules and guidelines for preparation of diagrams for process industry, for example types and descriptions of diagrams, layout of diagrams, graphical symbols, lines and connection, reference designation, are given in ISO 15519-1.

Rules and guidelines for preparation of electrotechnical diagrams are given in IEC 61082-1.

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.

ISO 10209, *Technical product documentation — Vocabulary — Terms relating to technical drawings, product definition and related documentation*

ISO 14617 (all parts), *Graphical symbols for diagrams*

ISO 15519-1, *Specification for diagrams for process industry — Part 1: General rules*

IEC 81346-1, *Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations — Part 1: Basic rules*

IEC 81346-2, *Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations — Part 2: Classification of objects and codes for classes*

ISO/TS 81346-3, *Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations — Part 3: Application rules for a reference designation system*

3 Terms, definitions, and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 15519-1, ISO 10209, IEC 81346-1, and the following apply.

3.1 Terms related to control

3.1.1
actuator
functional unit that generates from the controller output variable the manipulated variable to drive the final controlling element

Note 1 to entry: If the final controlling element is mechanically actuated, it is controlled via an actuated drive. The actuator drives the actuating drive in this case.

Note 2 to entry: See Annex E for the relationship between related terms.

[SOURCE: IEC 60050-351:2013, 351-28-07]

3.1.2
closed-loop control
process whereby one variable (quantity), namely the controlled variable is continuously measured, compared with another variable (quantity), namely the reference variable, and influenced in such a manner as to adjust to the reference variable

Note 1 to entry: Characteristic for closed-loop control is the closed action in which the controlled variable continuously influences itself in the action path of the closed loop.

[SOURCE: IEC 60050-351:2013, 351-26-01]

3.1.3
control function
manipulation via the final controlling element of process media or process objects in order to bring the media or object into a condition or state defined by the process control system on basis of measured process variables and pre-defined values

3.1.4
control loop
assembly of elements incorporated in the closed action of a closed-loop control

[SOURCE: IEC 60050-351:2013, 351-26-11]

3.1.5
final controlling element

functional unit forming part of the controlled system and arranged at its input, driven by the manipulated variable and manipulating the mass flow or energy flow

Note 1 to entry: If the final controlling element is mechanically actuated, an additional actuator (positioner) is used in some cases.

Note 2 to entry: The output variable of the final controlling equipment is usually not free from feedback. The interface between the actuator and the final controlling element should therefore be selected in such a way that the manipulated variable is not affected by feedback from the final controlling element.

Note 3 to entry: See Annex E for the relationship between related terms.

[SOURCE: IEC 60050:2013, 351-28-08]

3.1.6
manipulate
to change flows of mass, energy, or information by means of a final controlling element

Note 1 to entry: Manipulating can be affected continuously or by switching operations.

Note 2 to entry: In control engineering, the final controlling element is regarded as belonging to a process.

[SOURCE: IEC 60050-351:2013, 351-22-08]

3.1.7
open-loop control
process in a system whereby one or more variables (variable quantities) as input variables influence other variables (variable quantities) as output variables in accordance with the proper laws of the system

Note 1 to entry: Characteristic for open-loop control is the open action path or in case of a closed action path the fact that the output variables being influenced by the input variables are not continuously influencing themselves and not by the same input variables.

[SOURCE: IEC 60050-351:2013, 351-26-02]

3.1.8
process variable
quantity, quality, or condition of a process media or process object which value may be subject to change and can usually be measured

3.2 Document types

3.2.1
process flow diagram
PFD
diagram representing the configuration of a process plant or a process system by means of graphical symbols

3.2.2
process and instrumentation diagram
PID
diagram representing the technical realization of a process system by means of graphical symbols for equipment, connections, process measurement, and manipulating objects

Note 1 to entry: The diagram type *process and instrumentation diagram*, used in this part of ISO 15519, is technically identical with the *piping and instrumentation diagram.* The argument for change of the designation is that the diagram type is used for both fluid and solid material processes. The abbreviation PID deviates from the traditional used abbreviation PID for the Piping and instrumentation diagram.

3.2.3
process control diagram
PCD
diagram representing the configuration of measuring, control, and actuating functions of a process system, by means of graphical symbols for measuring, control, and manipulating functions

3.2.4
typical diagram
TYD
diagram representing the detailed configuration of a definite measuring or actuating system which can be referred to in an associated diagram by a graphical symbol and document reference

3.3 Abbreviated terms

IEV	International Electrotechnical Vocabulary
PCD	Process control diagram
PCI	Process control information
PFD	Process flow diagram
PID	Process and instrumentation diagram
SIF	Safety instrumented function
SIL	Safety integrity level
TYD	Typical diagram

4 Documentation and process control principles

4.1 Introduction

The clause defines principles for documentation of process control (measurement, control, and actuation) and interchange information between process and control engineering.

4.2 Diagram types, structures, and life cycle aspects

Diagrams are used for visual representation of process functions. Objects and connections, represented by graphical symbols, serve as carrier of technical information either represented direct in the diagram or in associated lists or databases.

Depending on the task of the diagram and the stage in the live cycle matrix described in Figure 3, diagrams can represent process functions on high and generic level or on detailed and specific level.

Figure 2 represents the interrelationship between different types of diagrams from different standardization bodies.

The grade of detailing goes from top to down. The information flow from process engineering to control engineering is illustrated by the arrows.

Specification of amount and types of measurements and actuated objects connected to the control system are predominately made on basis of the process and instrumentation diagram.

The process control diagram specifies configuration of control system for process systems or process sub-systems. The information flow is showed reversible in order to illustrate the optimization process between process and control engineering especially during conceptual engineering.

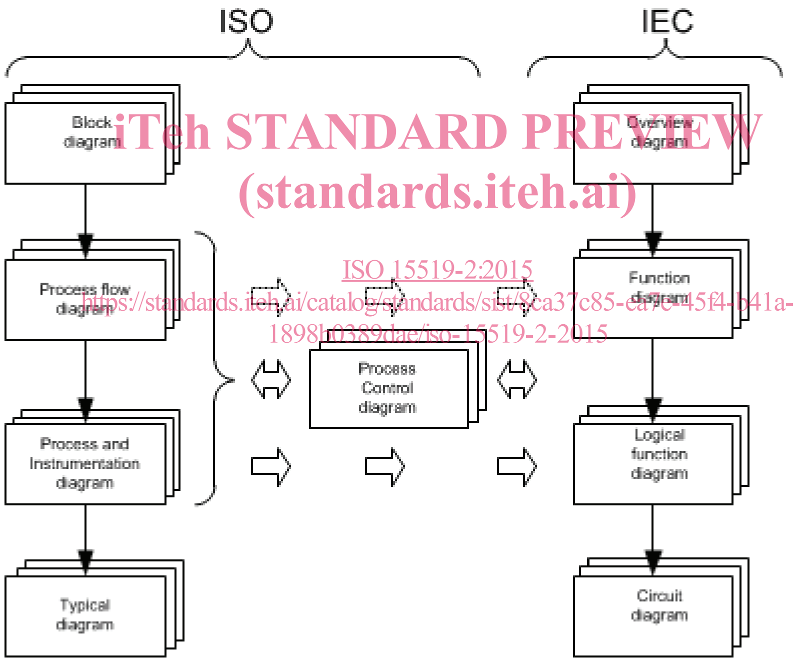


Figure 2 — Interrelationship between ISO and IEC diagrams

Rules for design of process diagrams, use of graphical symbols, etc. are described in Clauses 6 and 7.

The diagram types in Figure 2 contain differentiated types and amounts of information to suit the needs in the actual life cycle stages of the project. Figure 3 illustrates the application of three types of diagrams during the life cycle stages and the graduated application value of the diagrams in the different life cycle stages represented by the width of the bars.

NOTE Life cycle stage principles are described in ISO 15226 and ISO/IEC 15288

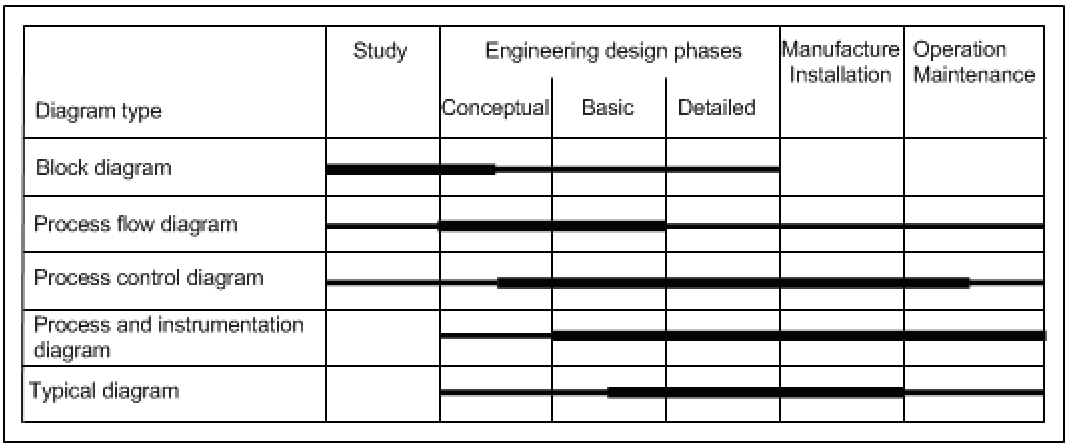


Figure 3 — Typical illustration of life cycle application value of diagrams

Measuring, control, and actuation are illustrated in diagrams with variable degree of detailing depending of needs for the actual life cycle stage. In the start of a project the representation in process flow diagrams (PFD) is pure functional. Later in the project course, when more detailed diagrams are developed, for example: process control diagram and process and instrumentation diagrams (PID), the amount of information is increased and the representation is extended to also to include products like sensors built in the process system also.

4.3 Process control interrelations

The function of process control is to steer and supervise the respective processes in accordance with predefined aims of process control engineering.

This is carried out by the following:

— recording of measured process situation (process variables);

— comparing measured values with predefined values;

— initiate actions via the control equipment and/or operator (control functions) to the final control elements.

Figure 4 illustrates the interrelations between process (measuring and manipulating) and control functions (control equipment and human operator).

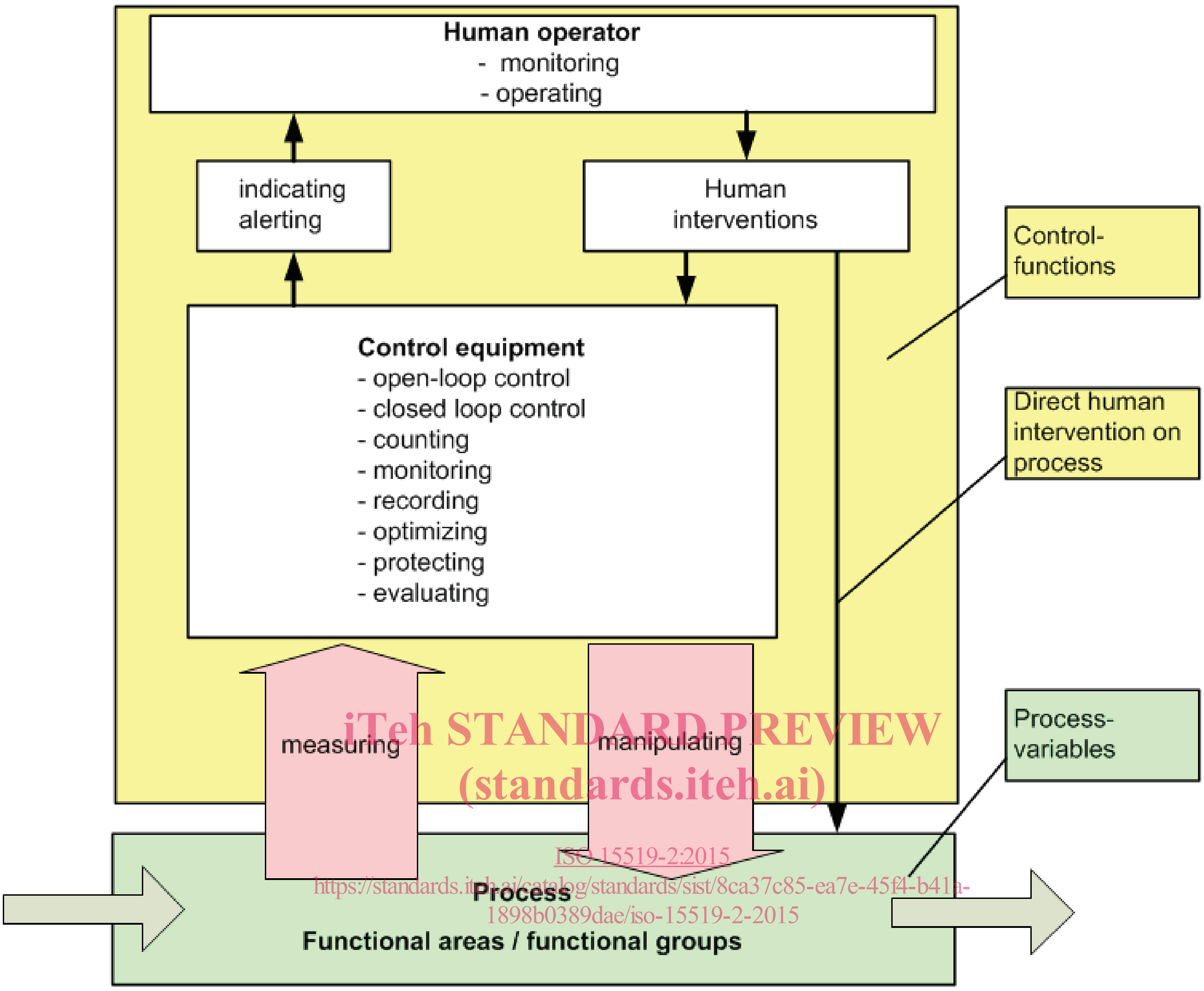


Figure 4 — Illustration of interrelations between process variables and control functions

4.4 Information exchange between process and control systems

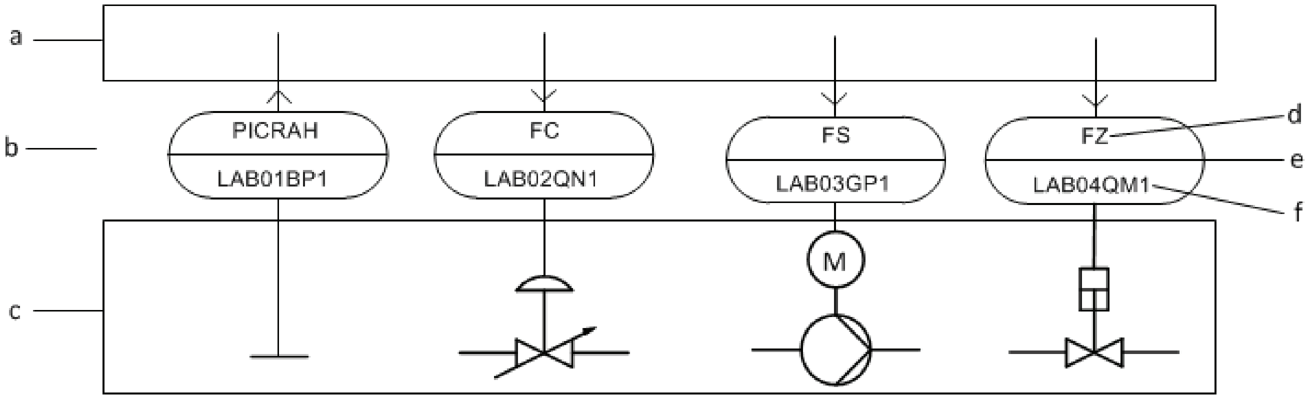
Letter codes are used for the exchange of information between process and control system. The individual information is identified by reference designation.

From the process system letter codes for measured process variables are transferred to the control system.

Correspondingly are letter codes for manipulation of process variables transferred from control system to the process system.

For visual emphasizing of letter codes, reference designation, and additional information in diagrams, process control information (PCI) symbols are used as information carrier.

The information exchange is illustrated in Figure 5. A detailed representation of especially the control system is given in informative Annex D.



Key

A control system
B information exchange
C process
D letter code of process variables and control functions
E PCI symbol
F reference designation

Figure 5 — Information exchange between process and control system

PCI symbols, letter codes, and reference designation are dealt with in Clause 5.

5 Exchange of process control information

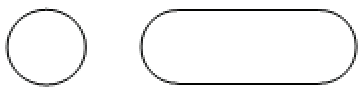
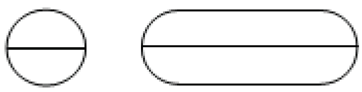
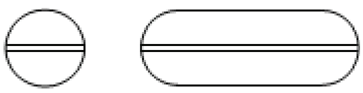
5.1 Symbols for information exchange

5.1.1 General

Exchange of information between the process system and the control system shall be represented within the process control information (PCI) symbol which consists of a circle or extended circle in case of not sufficient space for presentation of the information in one text string, see Table 1.

The information shall be placed inside and outside the PCI symbols, see 5.1.2 and 5.1.3.

Table 1 — PCI symbols and their applications

Symbols	Additional graphics	Measurement application	Actuation application
	None	Information available on field mounted instrument/display	Information from field mounted controller
	Horizontal single full line	Information available in central control system	Information from central control system
	Horizontal double full line	Information available in subsidiary control system	Information from subsidiary control system

The geographical availability or origin of information inside or outside the PCI symbol are illustrated by means of additional graphics within the PCI symbol, see Table 1.