International Standard 3511/2

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Process measurement control functions and instrumentation — Symbolic representation — Part 2: Extension of basic requirements

Fonctions et instrumentation pour la mesure et la régulation des processus industriels — Représentation symbolique — Partie 2: Extension des principes de base

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3511/2 was developed by Technical Committee ISO/TC 10, *Technical drawings*, and was circulated to the member bodies in May 1983.

It has been approved by the member bodies of the following countries:

Australia	India	Sweden
Austria	Italy	Switzerland
Belgium	Japan	United Kingdom
Brazil	Netherlands	USA
Czechoslovakia	Norway	USSR
Germany, F.R.	Poland	

No member body expressed disapproval of the document.

This part of ISO 3511 was developed by sub-committee 3, *Graphical symbols for instrumentation*. The symbols are intended to be used to represent functions and, in special cases, equipment on technical drawings such as schematic diagrams or process flow-diagrams. However, this field of engineering is closely related to electrical instrumentation dealt with by IEC/TC 65 or in part by IEC/SC 3A. For this reason there has been close coordination in a joint working group and the results were accepted by members of ISO and IEC.

Printed in Switzerland

Process measurement control functions and instrumentation — Symbolic representation — Part 2: Extension of basic requirements

0 Introduction

This International Standard has been devised to provide a universal means of communication among the various interests involved in the design, manufacture, installation and operation of measurement and control equipment used in the process industries.

Requirements within the industries vary considerably; in recognition of this, this International Standard is presented in four parts, as follows:

Part 1: Basic requirements (directed towards the needs of those employing comparatively simple measurements and control means).

Part 2: Extension of basic requirements.

Part 3: Detailed symbols for instrument interconnection diagrams.

Part 4: Basic symbols for process computer, interface, and shared display/control functions.[1)]

The four parts together are intended to:

a) meet the requirements of those who, possibly employing more sophisticated measurement and control means, may wish to depict such aspects as the measurement techniques embodied in a particular instrument, or the means — hydraulic, pneumatic, electrical, mechanical — used for its actuation;

b) provide standard symbolic representation for process measurement control functions and instrumentation. These symbols are not intended to replace graphical symbols for electrical equipment as contained in IEC Publication 117.

1 Scope and field of application

This part of ISO 3511 is an extension of part 1, which is limited to identification of instrument functions.

This part of ISO 3511 includes additional symbols and is intended for the communication of measurement and control functions among instrument specialists and other engineers involved with vessels, piping, layout design and operation.

The symbols are used on piping and instrumentation diagrams and engineering line diagrams.

2 Reference

IEC 117-15, *Recommended graphical symbols; graphical symbols — Part 15: Binary logic elements.*

3 Definitions

The definitions given in ISO 3511/1 equally apply to this part of ISO 3511.

The following definition also applies:

3.1 sensing element: That part of an instrument loop that first senses the value of a process variable and that assumes a predetermined and intelligible state or output.

NOTE — The sensing element may be separate from or integral with another functional element of a loop, but should be given an individual tag number only if it is separate.

Examples:

Where a direct-connected pressure transmitter has an integral pressure-sensitive element, the combined element and transmitter assembly shall be tagged PT.

Where an external pressure cell is connected to a transmitter, the pressure cell shall be tagged PE and the transmitter shall be tagged PT.

4 Letter code

4.1 Identifying letters

The function of the instrument shall be defined by a letter code included within the instrument symbol circle.

4.2 Basis for the letter code

The letter code is built up similarly to the letter code for basic symbols given in ISO 3511/1 but the table extends the letters available for use.

1) At present at the stage of draft.

Table — Letter code for identification of instrument functions

NOTE — Entries in normal type are identical with the entries in the table of ISO 3511/1. Entries in italics indicate the supplementary symbols.

1	2	3	4
	First letter[1]		**Succeeding letter**[1]
	Measured or initiating variable	**Modifier**	**Display or output functions**
A			Alarm
B			*Display of state* (for example, motor running)
C			Controlling
D	Density	Difference	
E	All electrical variables[2]		*Sensing element*
F	Flow-rate	Ratio	
G	Gauging, position or length		
H	Hand (manually initiated) operated		
I			Indicating
J		Scan	
K	Time or time programme		
L	Level		
M	Moisture or humidity		
N	User's choice[3]		*User's choice*[3]
O	User's choice[3]		
P	Pressure or vacuum		*Test-point connection*
Q	Quality[2] for example Analysis Concentration Conductivity	Integrate or totalize	Integrating or summating
R	Nuclear radiation		Recording
S	Speed or frequency		Switching
T	Temperature		Transmitting
U	Multivariable[4]		*Multifunction unit*
V	Viscosity		*Valve, damper, louvre, actuating element, unspecified correcting unit*
W	Weight or force		
X	Unclassified variables[3]		*Unclassified functions (for example cathode-ray tube)*
Y	User's choice[3]		*Computing relay, relay*
Z			Emergency or safety acting

1) Upper case letters shall be used for the measured or initiating variable and succeeding letters for display or output function. Upper case letters are preferred for modifiers, but lower case letters may be used if this facilitates understanding.

2) A note shall be added to specify the property measured.

3) Where a user has a requirement for measured or initiating variables to which letters have not been allocated and are required for repetitive use on a particular contract, the letters allocated to "User's Choice" may be used provided that they are identified or defined for a particular measured or initiating variable and reserved for that variable. Where a user has a requirement for a measured or initiating variable that may be used either once or to a limited extent, the letter X may be used provided that it is suitably identified or defined.

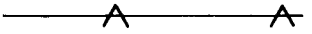
4) The letter U may be used instead of a series of first letters where a multiplicity of inputs representing dissimilar variables feed into a single unit.

NOTE — Where it is necessary to denote HIGH or LOW, the qualifying letters H or L may be used in association with the instrument symbol. Other letters may be used, for example for deviation, for rate of change, but these shall be defined on the drawing rather than in the table.

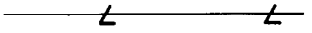
5 Instrument signal lines

5.1 Electrical (E)

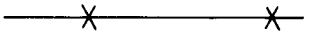
5.2 Pneumatic (A)



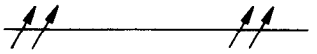
5.3 Hydraulic (L)



5.4 Capillary



5.5 Conducted radiation (radio waves, visible light)

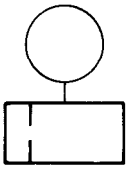


6 Primary elements, correcting elements, and actuating elements

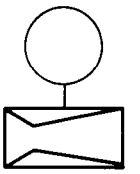
NOTE — In cases where it is necessary to use detail symbols in functional diagrams the symbols should be as given in ISO 3511/3, simplifying if possible. Examples are as follows.

6.1 Flow primary elements

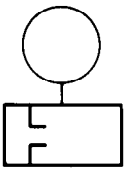
6.1.1 Orifice plate



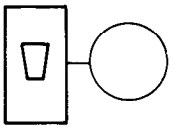
6.1.2 Venturi tube



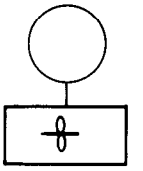
6.1.3 Nozzle



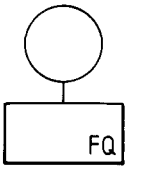
6.1.4 Variable area meter



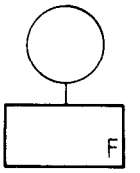
6.1.5 Turbine meter



6.1.6 Volume meter — general

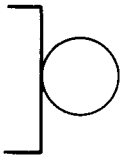


6.1.7 Any other flow primary element

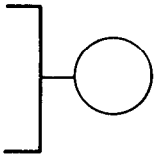


6.2 Level instrument connections

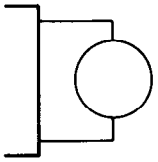
6.2.1 Integrally mounted instrument, for example welded-on type



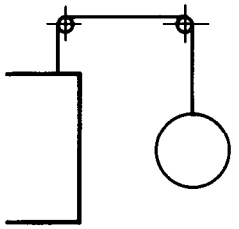
6.2.2 Instrument with single connection, for example internal float type



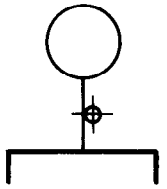
6.2.3 Instrument with two connections, for example external displacer type



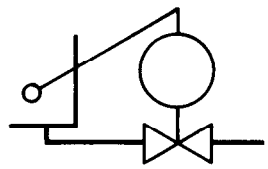
6.2.4 Tank gauge-float type



6.2.5 Tank gauge-float type, top-mounted

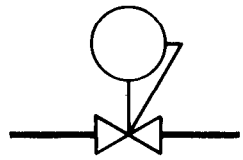


6.2.6 Level control valve — mechanical linkage

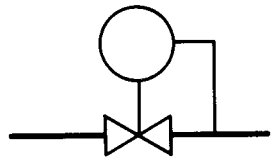


6.3 Pressure regulators, self-actuated

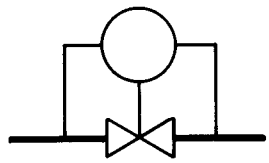
6.3.1 Pressure regulator with internal tap



6.3.2 Pressure regulator with external tap



6.3.3 Differential-pressure regulator with external taps



6.4 Actuating elements

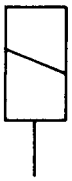
(where it is desired to show the type of actuating element)

6.4.1 Diaphragm actuator

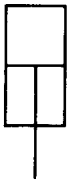
6.4.2 Diaphragm actuator, pressure-balanced

6.4.3 Rotary motor actuator

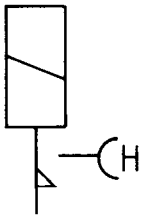
6.4.4 Solenoid actuator
(Preferred side relationship 1:2)



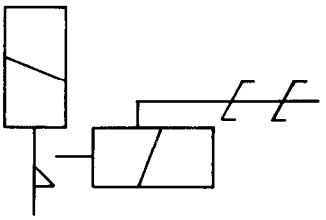
6.4.5 Piston actuator
(Preferred side relationship 1:2)



6.4.6 Solenoid actuator with reset (manual)



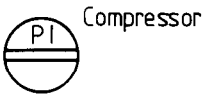
6.4.7 Solenoid actuator with reset (remote electrical)



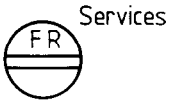
7 Local control panels

Instruments on local control panels can be specified by an additional horizontal line across the symbol.

The particular panel can be identified by a note alongside the symbol, for example:



Pressure indicator on the compressor panel



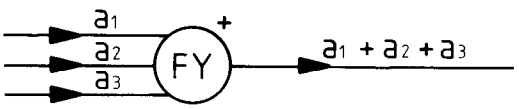
Flow recorder on the services panel

8 Signal modifiers, analogue

Lower case letter designations (for example a_1, a_2) are standardized values of signals, shown for descriptive purposes only. They are not part of the symbol. Other arithmetic functions may be similarly treated. Upper case letters (for example Z) represent signals without specific values.

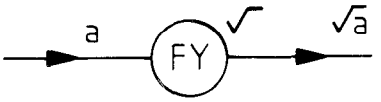
8.1 Addition

For example, flow signals



8.2 Root extraction (square root)

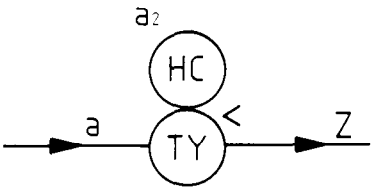
For example, flow signal



8.3 Limitation of output when a hand-set high-limit value is reached (same as selecting lower signal)

For example, temperature controller signal

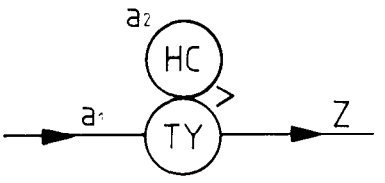
when $a_1 < a_2$ then $Z = a_1$
when $a_1 \geqslant a_2$ then $Z = a_2$



8.4 Limitation of output when a hand-set low-limit value is reached (same as selecting higher signal)

For example, temperature controller signal

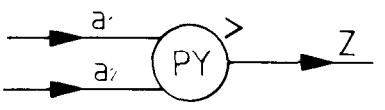
when $a_1 \leqslant a_2$ then $Z = a_2$
when $a_1 > a_2$ then $Z = a_1$



8.5 High-signal selector

For example, pressure signals

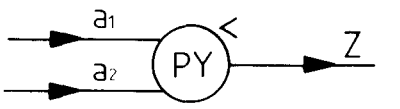
when $a_1 \geqslant a_2$ then $Z = a_1$
when $a_1 < a_2$ then $Z = a_2$



8.6 Low-signal selector

For example, pressure signals

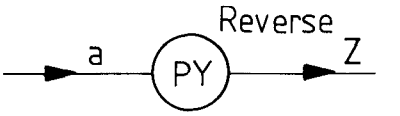
when $a_1 > a_2$ then $Z = a_2$
when $a_1 \leqslant a_2$ then $Z = a_1$



8.7 Reversing relay

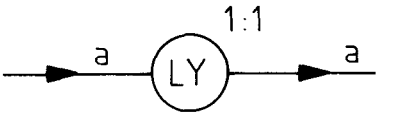
For example, pressure signal

$Z = 1 - a$



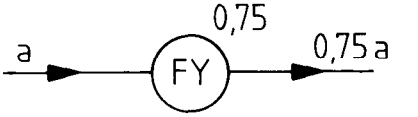
8.8 Volume booster

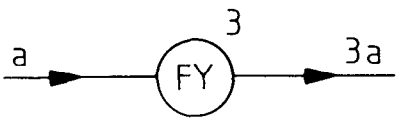
For example, level controller signal



8.9 Gain or attenuation relay

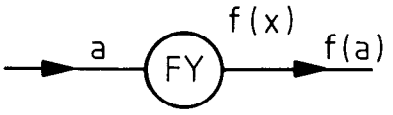
For example, flow signals





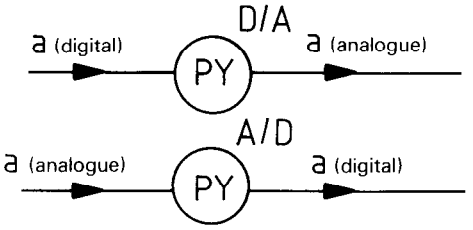
8.10 Characterizing relay f (x)

For example, flow signal



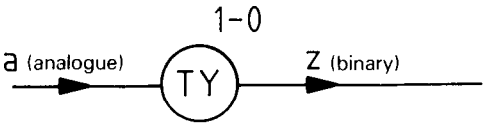
8.11 Digital-to-analogue or analogue-to-digital signal converter

For example, pressure signals



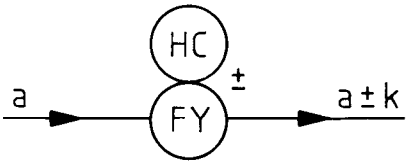
8.12 On-off relay 1-0

For example, temperature analogue input signal with binary output signal



8.13 Bias relay ±, + or −, representing relays respectively for plus-or-minus adjustability, for addition, or for subtraction.

For example, flow signal, with adjustable plus or minus bias, k



9 Binary logic

The basic elements are "and", "or", "not" and "time lag" and these shall have rectangular symbols in accordance with IEC 117-15.

10 Action of binary signals on analogue signals

When an input analogue signal A is influenced by a binary signal B, the output analogue signal Z can

a) retain the last value; or

b) assume a predetermined minimum value; or

c) assume a predetermined maximum value; or

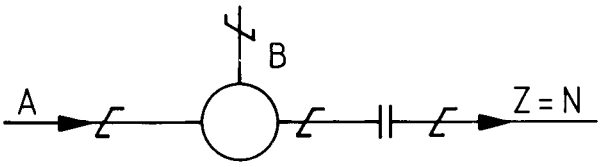
d) assume some other predetermined value.

This may occur in both the 1-state and the 0-state of the binary signal. Diagrams are shown with electrical signals but are otherwise typical for all signals.

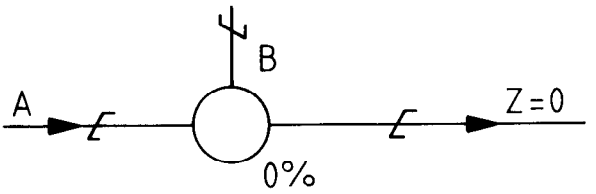
Where "A", "Z", etc., appear in the examples, they are not a part of the symbol. They are there for clarity of the symbol.

10.1 When B = 1, then Z = A. When B = 0, then there are four possibilities as follows:

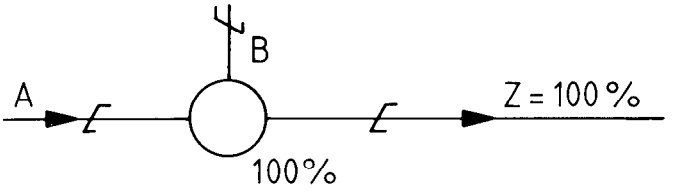
10.1.1 Z retains the last momentary value (N)



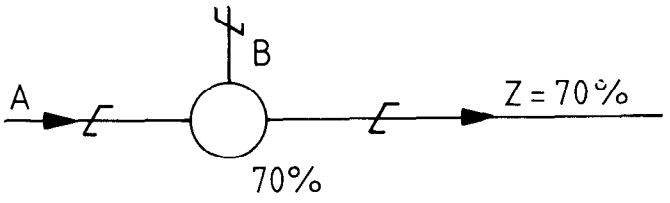
10.1.2 Z assumes the minimum value



10.1.3 Z assumes the maximum value

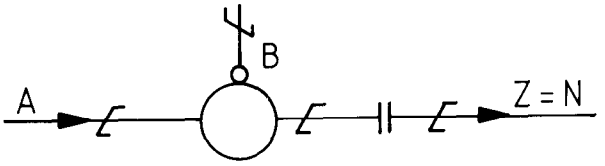


10.1.4 Z assumes a predetermined value, for example 70 %

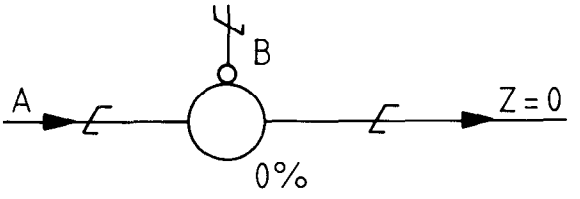


10.2 When B = 0, then Z = A. When B = 1, then there are four possibilities, as follows:

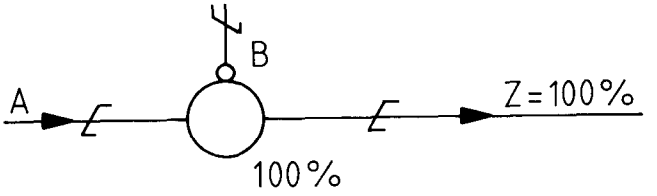
10.2.1 Z retains the last momentary value N



10.2.2 Z assumes the minimum value



10.2.3 Z assumes the maximum value



10.2.4 Z assumes a predetermined value, for example 70 %