

JIS

JAPANESE INDUSTRIAL STANDARD

Instrumentation Symbols

JIS Z 8204—1983

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JAPANESE INDUSTRIAL STANDARD

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Instrumentation Symbols

Z 8204-1983

1. Scope

This Japanese Industrial Standard specifies the instrumentation symbols to express functions of instrumentation control or equipment on the process diagrams of equipment industries such as chemistry, iron and steel, petroleum refining, etc.

Remark: It is desirable to use these instrumentation symbols to the following cases:

- (1) Where functions of instrumentation control or equipments are to be described on the design drawings, piping diagrams, specifications, catalogues, written estimates, purchase orders, other technical or trading drawings and documents.
- (2) Where the instrumentation appliances, their accessories, pipings, and wirings are to be identified or marked.

2. Definitions

For the purposes of this standard, the definitions specified in JIS Z 8103 and the following apply.

- (1) instrumentation control equipment A equipment to catch quantitatively each variable or state or further to control.
- (2) instrumentation appliance An appliance to compose the instrumentation control equipment. For example, the appliance to be used for detector, transmitter, display unit, regulator, control valve, etc.

Applicable Standards:

JIS C 6271-Graphical Symbols for Binary Logic Elements

JIS Z 8103-Glossary of Terms Used in Instrumentation

Corresponding International Standard:

ISO 3511/1-1977 Process measurement control functions and instrumentation—Symbolic representation—Part 1: Basic requirements

- (3) actuating variable A variable to cause a certain actuation.
- (4) control station A controlling device or equipment for operator having functions such as display, setting, control, automatic and manual switching, etc.
- (5) loop A system constituted for display, recording or controlling of process variable and interconnected instrumentation appliances.

The number attached for division of loops is defined as loop number.

- (6) measurement point A point to be measured on a general piping or a plant appliance.
- (7) final control element The device that changes the signal from control meter or controller to manipulated variable to actuate the control object, and is a combination of controlling ends such as valve, damper, louvre, etc. and controlling means such as power cylinder, diaphragm motor, motor appliance, etc.
- (8) instrument signal line The line to indicate piping, wiring, etc. to transmit the signal expressed by pneumatic pressure, oil hydraulic pressure, electric quantity and others.
- (9) electric signal The signal expressed by electric quantity.
- (10) pneumatic pressure signal The signal expressed by pneumatic pressure. It includes the signal expressed by pressure of gas other than air for the same purposes.
- (11) oil-hydraulic pressure signal The signal expressed by oil-hydraulic pressure. It includes the signal expressed by pressure of liquid other than oil for the same purposes.
- (12) fine pipe A fine pipe to transmit pressure. For example, a pipe from the temperature detector of a pressure type thermometer and the like till the transmitter, display unit, controller or self-control valve.
- (13) route radiation The radiation directed in the specified direction by radiation rays, visible rays, etc.
- (14) internal connection The connection performed by internal data transmission route or software of system without external wiring.
- (15) computer An electronic computer for control to perform computing process or control by collecting instrumentation data in online real time.

- (16) CRT An operating station to be used in time-sharing with a number of loops held in common.
- (17) multiloop controller A control unit to be used in time-sharing by assembling control system by arbitrary connection of internal processing module and control module indicated by software and with plural loops held in common.

3. Classification of Symbols

The symbols shall be classified into basic symbols and detail symbols as follows:

- (1) Basic Symbols The basic symbols are those to be used to indicate the basic functions of instrumentation control equipment, and, for example, they are used in the case where the summary of relationship between the instrumentation and the process are indicated on the summary process drawing.
- (2) Detail Symbols The detail symbols supplement the basic symbol, and are symbols to be used where the kind of elements of the equipment is indicated in addition to the functions of instrumentation control, for example they are used to indicate the contents of instrumentation control equipment on the detailed process diagram.

For the detail symbols, only the necessary parts may be used corresponding to the required details.

4. Basic Symbols

4.1 Construction of Basic Symbol The basic symbol shall be constructed by letter symbol, identifying number, and graphic symbol.

4.2 Letter Symbols

4.2.1 Letter Symbol General The letter symbol shall consist of variable symbol, variable modifier symbol and functional symbol, and be constructed in this sequence in accordance with Table 1 (except those indicated with letters of round Gothic type).

Table 1. Letter Symbol

Letter symbol	Meaning of symbol		
	Variable symbol	Variable modifier symbol	Functional symbol
A			Alarm
B			Condition display, operation display
C			Controlling
D	Density or specific gravity	Difference	
E	Electrical variables (¹)		Detector
F	Instantaneous flow rate	Ratio	
G	Position or length		Glass
H	Manual		
I			Indicating
J		Automatic scan	
K	Time		Operating station
L	Level		
M	Moisture or humidity		
N	Optional choice (²)		Optional choice (²)
O	Optional choice (²)		Limit orifice
P	Pressure or vacuum		Sampling point or measuring point
Q	Quality (¹) Example: Composition, concentration, conductivity	Integrating	Integrating
R	Radiation		Recording
S	Speed, number of revolutions, frequency		Switching
T	Temperature		Transmitting

Table 1 (Continued)

Letter symbol	Meaning of symbol		
	Variable symbol	Variable modifier symbol	Functional symbol
U	Multivariable ⁽³⁾		Multifunction instrument
V	Viscosity		Controlling element of valve and the like
W	Mass or force ⁽¹⁾		Protecting tube
X	Unclassified variables ⁽⁴⁾		Other functions
Y	Optional choice ⁽²⁾		Computing element, transducer, relay
Z			Emergency or safety acting

Notes ⁽¹⁾ The specification symbol (refer to 5.4) or a note may be added to clarify the measuring object.

⁽²⁾ Where the letter symbols to be used by user's optional choice have not been allocated in Table 1 to the variables, and the variables are used repeatedly in the equipment, they may be used provided that they are suitably specified on the variables by the user.

⁽³⁾ The letter symbol U may be used with representing respective variable symbols where multivariables are fed into a single unit.

⁽⁴⁾ The letter symbol X shall be used as the variable classified into none in the range limited to the equipment and the content shall be described clearly, as required. For example, ITV and the like.

Remark: The items described by letters of round Gothic type in the column of functional symbol shall be used exclusively as the letters of detail symbol.

4.2.2 Variable Symbols The variable symbol shall be letter symbols indicating the measuring variable and actuating variable, and expressed by capital letters.

4.2.3 Variable Modifier Symbols The variable modifier symbol is used in combination with the variable symbol as required and shall be expressed by capital letter. However, where there is no fear to cause misunderstanding, small letter may be used.

4.2.4 Functional Symbols The functional symbol is a letter symbol to express the function and expressed by capital letter.

The sequence where not less than two functional symbols are arranged shall be as I, R, C, T, Q, S, Z, A.

For the function required not to be identified specially, this symbol may be omitted. For example, in flowrate indicating control alarm instrument, where it is not required to identify that it is attached with a indicator it becomes FCA, and where it is not required to identify that it is attached with an alarm it becomes FIC instead of FICA.

Remark: Where the functional symbol A is modified to display upper limit alarm and lower limit alarm, respectively H, and L may be used to display as specification symbols (refer to 5.4). The deviation, changing rate, etc. may be indicated with a specification symbol in the same way. In this case, meaning of the symbol shall be clarified to use.

4.3 Identifying Number The identifying number is used to identify the individual measurement and control loop and shall be expressed by Arabic numeral.

4.4 Graphic Symbols

4.4.1 Circle Symbols The function of instrumentation control shall be indicated with the letter symbol and identifying number described inside the circle symbol (Table 2) indicated by a fine continuous line of about 10 mm in diameter. Where it is impossible to describe these inside the circle, a part of them may be described outside the circle.

Table 2

Division of place		Graphic symbol
General case where the division of place of monitor and control is not required.		
Where the division of place of monitor and control is required	Site	
	Instrument room ⁽⁵⁾	

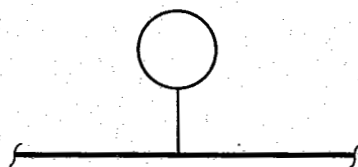
Note ⁽⁵⁾ The place where the operator carries out ordinarily the monitor and control of the equipment.

Remark: Where the letter symbol and identifying number are described inside the circle, the letter symbol shall be described on the upper part and the identifying number on the lower part. Where the place of monitor and control is an instrument room, the letter symbol shall be described on the upper part of the horizontal line and the identifying number, on the lower part. Further, the letter symbol may be described on the left side of upper part of the circle and the identifying number, on the right side.

4.4.2 Lines The lines to be used for graphic symbol shall be in accordance with the following:

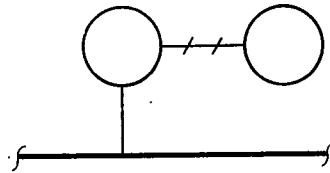
- (1) Connection Line of Instrument and Process The connection line of an instrument and a process shall be a continuous thin line as shown in Fig. 1, and be thinner than the lines used to delineate the general piping or the plant appliances.

Fig. 1



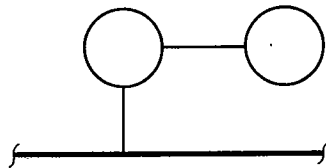
- (2) Signal Line The signal line shall, as a rule, be a continuous thin line having strokes inclined at approx. 60° to the line at the equal interval as shown in Fig. 2 and be indicated thinner than general piping lines.

Fig. 2



Alternatively, a continuous thin line without stroke may be used as shown in Fig. 3 where there is no risk of confusion.

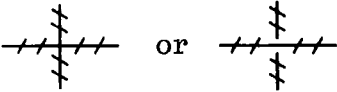
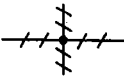
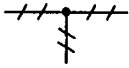
Fig. 3



Remark: In specially inevitable case, the broken line (---) may be used instead of continuous line. However, these two methods shall not be mixed.

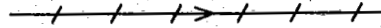
- (3) Connection Type of Signal Lines The connection type of signal lines shall be as given in Table 3.

Table 3

Connection state	Graphic symbol
Where not connected	
Where connected	
Where branched	

- (4) Flowing Direction of Signal Line Where it is necessary in complex circuits and the like to indicate the direction of signal, an arrow shall be added as shown in Fig. 4.

Fig. 4



Alternatively, where there is no risk of confusion, a continuous thin line without stroke may be used as shown in Fig. 5.

Fig. 5

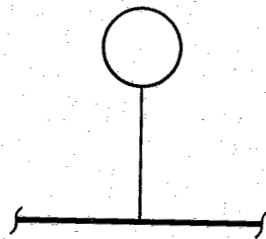


- 4.4.3 Measuring Point The measuring point shall be as follows:

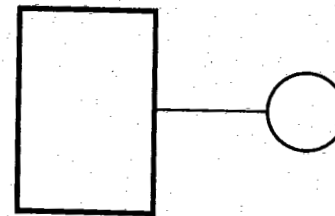
- (1) The measuring point shall be indicated by a point of intersection of leader line (continuous thin line) connecting to the profile line indicating general piping or plant appliance as shown in Fig. 6.

Fig. 6

(a) In the Case of General Piping



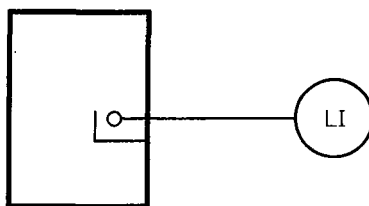
(b) In the Case of Plant Appliance



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- (2) The position of measuring point shall be at a functionally correct place and comply with the sequence of process flow, but it is not necessarily required to indicate the definite place of the equipment.
- (3) Where the measuring point is required to indicate clearly, it may be indicated by a circle of about 2 mm in diameter at the end of leader line in the diagram indicating plant appliance as shown in Fig. 7.

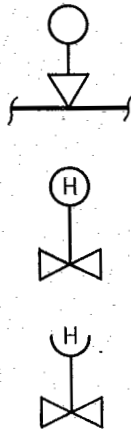
Fig. 7



Remark: Exclusively where inevitable, × mark may be used instead of ○ mark. Provided that the two methods shall not be used with mixing.

4.4.4 Control Means The control means shall be indicated by control end and operation part as shown in Table 4.

Table 4

Classification	Application	Graphic symbol	Remark
Control end	Where the kind of control end is not determined		An equilateral triangle of 5 mm in one side
	Where the control end is a valve		
Operation part	In the case of automatic operation		A circle of about 5 mm in diameter of continuous thin line
	Where the automatic operation part is attached with a hand-operation part		
	In the case of hand operation		A semicircle of about 5 mm in diameter of continuous thin line
Control means	Examples of combination of control end and operation part		

5. Detail Symbols

5.1 Constitution of Detail Symbols The detail symbols shall be constituted of letter symbol, identifying number, and graphic symbol, and, if required, specification symbol may be added.

5.2 Letter Symbols The letter symbols shall consist of variable symbol, variable modifier symbol and functional symbol, and be constructed in this sequence in accordance with Table 1.

The contents specified in 4.2 apply also to the detail symbols.

The sequence where not less than two functional symbols are arranged shall be as I, B, R, X, Y, C, T, Q, U, S, Z, A, K, V.

5.3 Identifying Number

5.3.1 Numbers of Loop Constituting Instruments The numbers of loop constituting instruments shall consist of the letter symbols indicating the functions of respective instruments and the loop number. For example, the instrument number of each instrument of loop number 23 constituted of orifice, transmitter, display regulator, and control valve shall, as a rule, be indicated as FE-23, FT-23, FIC-23, and FV-23.

Remark: The numbering method to attach a symbol indicating element at the last of loop number such as FIC-23 E, FIC-23 T, FIC-23 C, and FIC-23 V may be used in specially inevitable case due to unifying with the already established.

5.3.2 Taking of Serial Numbers A serial numbers shall, as a rule, be taken for each variable in objective plant or system.

Example: FIC-1, FR-2, FI-3, ..., PIC-1, PI-2, ...

Remark: A method to take the serial number in a plant or system independent of variable may be used.

5.4 Specification Symbol The specification symbol is a symbol to be used when desired to express the more detailed content which cannot be expressed by variable symbol, functional symbol, etc., and shall be marked outside and adjacent to the circle symbol. The marking shall be carried out by symbol letter or Arabic numerals and those other than specified in this standard be used after the meaning of this symbol is defined clearly.

The specification symbols shall be used in the following cases:

- (1) Where the variables are clarified furthermore [refer to Note (1)]

Example:  CO_2 CO_2 indicates CO_2 analyzer.

- (2) Where the functions are explained in details furthermore.

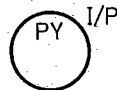
Example:



H, and L indicate the flow rate upper limit and alarm lower limit (refer to Remark in 4.2.3).

- (3) Where the computing functions are clarified (refer to 5.5.3).

Example:



I/P indicates a current-pneumatic-pressure transducer.

- (4) Otherwise, where the user considers to be necessary.

5.5 Graphic Symbol

5.5.1 Instrument Signal Lines The classification of instrument signal lines shall be as given in Table 5.

Table 5. Instrument Signal Lines

Classification	Graphic symbol
Electric signal (E)	—  — 
Pneumatic-pressure signal (A)	—  — 
Oil-hydraulic-pressure signal (L)	—  — 
Fine tube	—  — 
Route radiation (radiation rays, visible rays)	—  — 
Internal connection	—  — 

Remark: Where it is specially inevitable, the graphic symbols in Table 6 may be used instead of graphic symbols of Table 5. Provided that these shall not be mingled with the method of Table 5.

Table 6

Classification	Graphic symbol
Electric signal	— — — —
Pneumatic-pressure signal	// // //
Oil-hydraulic-pressure signal	/ / /
Fine tube	— x x x —
Route radiation	— ~ ~ ~ —

5.5.2 Graphic Symbols of Detectors, Operation Parts, Control Ends, etc.
Where the kinds of detectors, operation parts, control ends, etc. are divided, they shall be in accordance with Tables 7 to 13.

Table 7. Flow-Rate Detectors

Classification		Graphic symbol
Orifice (⁶)		
Venturi tube		
Nozzle		
Area type flow-meter		
Turbine type flow-meter		
Volume type flow-meter		
Electromagnetic flow-meter		
(Measuring element) insertion type flow-meter		
Other flow-meter	Pipe-line mounting type	
	Outside pipe-line mounting type	

Note (⁶) Exclusively where it is inevitable, graphic symbol may be used. Provided that the two methods shall not be mingled.

Table 8. Level Indicator

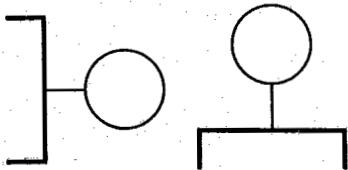
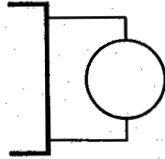
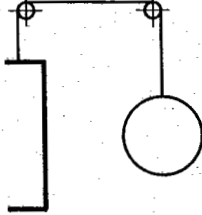
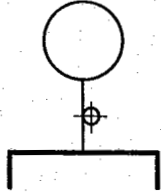
Classification	Graphic symbol
Appliance-body directly-mounting type level meter (Examples: binding glass type, load cell, etc.)	
Single-nozzle mounting type level meter (Examples: in-bulb level switch, bushing type level gauge)	
Two-nozzle mounting type level meter (Examples: differential pressure type, outer-cylinder type level gauge)	
Tank gauge (general type)	
Tank gauge (top-mounting type)	

Table 9. Self-Actuated Control Valves

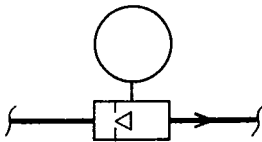
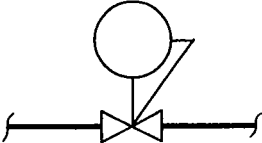
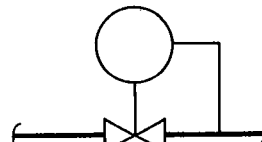
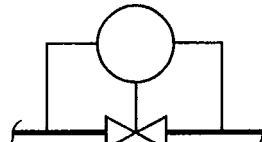
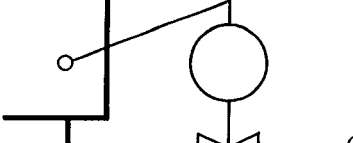
Classification	Graphic symbol
Self-actuated flow-rate control valve	
Inside detection type self-actuated pressure control valve	
Outside detection type self-actuated pressure control valve	
Outside detection type self-actuated differential pressure control valve (two taking-out nozzles)	
Self-actuated liquid level control valve	

Table 10. Operation Part

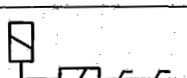
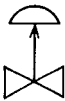
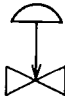
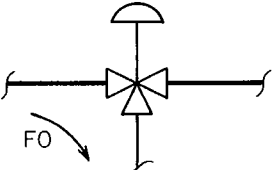
Classification	Graphic symbol
Diaphragm type	
Diaphragm type (pressure balance type)	
Electric motor type	
Electromagnetic type	
Piston type	
Manual-reset mounted electromagnetic type	
Remote-reset mounted electromagnetic type	
Oil-hydraulic pressure type	

Table 11. Control Ends

Classification	Graphic symbol
Valve (general)	
Angle valve	
Three-way valve	
Butterfly valve, damper, louver	
Ball valve	

Table 12. Actuation of Control Means

Classification	Graphic symbol (in the case of the diaphragm type control valve)
Valve which opens when power source is zero	
Valve which closes when power source is zero	
Valve which maintains the opening immediately prior thereto when the power source is zero	
Valve of which opening becomes indefinite when the power source is zero	
In the case of indicating the permissible transition direction when the power source is zero	
Valve of which outlet toward underside opens when the power source is zero	

Remark: Where it is specially inevitable, the valve which opens when the power source is zero may be indicated by FO, and the valve which closes when the power source is zero, by FC, and the valve which maintains the opening immediately prior thereto when the power source is zero, by FL.

Example of Valve which Opens when the Power Source Is Zero:

