

Australian Standard®

**Graphical symbols for general
engineering**

**Part 6: Process measurement
control functions and
instrumentation**

This Australian Standard was prepared by Committee ME/72, Technical Drawing. It was approved on behalf of the Council of Standards Australia on 20 February 1989 and published on 18 August 1989.

The following interests are represented on Committee ME/72:

Association of Computer Aided Design
Association of Consulting Engineers, Australia
Australian Chamber of Commerce
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Bureau of Steel Manufacturers of Australia
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**Part 6: Process measurement
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PREFACE

This Standard was prepared by the Standards Australia Committee on Technical Drawing to provide a universal means of communication between 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 and, in recognition of this, this Standard sets out basic requirements for symbols, directed towards the needs of those whose prime interest is in basic measurement and control functions.

The Standard is based on ISO 3511/1, *Process measurement control functions and instrumentation—Symbolic representation, Part 1: Basic requirements*; ISO 3511/2, *Process measurement control functions and instrumentation—Symbolic representation, Part 2: Extension of basic requirements*; and ISO 3511/4, *Industrial process measurement control functions and instrumentation—Symbolic representation, Part 4: Basic symbols for process computer, interface and shared display/control functions*. Various changes and additions have been incorporated based on Instrument Society of America Standards and industry practices in Australia. In particular, the flow symbols specified in ISO 3511/1, ISO 3511/2, and ISO 3511/4 were considered too large for graphical display.

The symbols are not intended to replace graphical symbols for equipment as specified in other Australian Standards. This Standard has been developed to stand alone without the need for significant reference to other Standards and, for this reason, duplicates some symbols already shown in other Standards in the AS 1101 series.

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STANDARDS AUSTRALIA

Australian Standard

Graphical symbols for general engineering

Part 6: Process measurement control functions and instrumentation

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE. This Standard specifies symbols and an identifying code system for depicting instruments, instrumentation systems, process computers and shared display/control functions in the field of process measurement and control in the process industries.

1.2 APPLICATION. The symbols given in this Standard are intended for adoption by draftpersons and instrument specialists in the preparation and interpretation of technical drawings and diagrams for the purpose of conveying technical information.

The symbols are intentionally limited to identification on process flow diagrams, piping and instrument diagrams, etc. and do not provide means of illustrating specific instruments or parts thereof.

1.3 REFERENCED DOCUMENTS. The following documents are referred to in this Standard:

AS

1100	Technical drawing
1100.101	Part 101: General principles
1100.501	Part 501: Structural engineering drawing
1101	Graphical symbols for general engineering
1101.5	Part 5: Piping, ducting and mechanical services for buildings
1109	Graphical symbols for process flow diagrams for the food industry

1.4 DEFINITIONS. For the purpose of this Standard, the definitions below apply.

1.4.1 Actuating element—that part of a correcting unit which adjusts the correcting element in response to a signal from the controller.

NOTE: Actuating elements are also known as ‘actuators’.

1.4.2 Alarm—a device which is intended to attract attention to a defined abnormal condition by means of a discrete audible signal or visible signal, but which does not itself institute corrective action.

1.4.3 Configurable—indicates the capability of the system to allow the user to select from preprogrammed functions (modular software units) those which are necessary to accomplish a control strategy or other complex functions, without the use of computer language.

1.4.4 Control panel—a panel mounted in a main plant or control room receiving information from several plant areas and providing an operator interface.

1.4.5 Converter—a transducer which responds to an instrument signal and changes its form.

1.4.6 Correcting element—that part of a correcting unit which directly adjusts the value of the operating conditions.

1.4.7 Correcting unit—the unit comprising those elements (actuating and correcting) which adjust the operating conditions in response to a signal from the controller.

1.4.8 Distributed control system (DCS)—a system for process control purposes which, while being functionally integrated, consists of subsystems which may be physically separated and remotely located from one another. These subsystems are normally connected by a communication link (e.g. data bus).

1.4.9 Instrument—a device or combination of devices used directly or indirectly to measure, display, or control a variable. This term does not apply to internal components of the instruments, e.g. resistor or receiver bellows.

1.4.10 Locally mounted instrument—an instrument that is mounted adjacent to the point of measurement.

1.4.11 Local panel—any panel mounted in the field (either adjacent to or remote from the point of measurement).

1.4.12 Loop—a combination of one or more interconnected instruments arranged to measure or control a process variable.

1.4.13 Point of measurement—the point in the process at which a measurement is or may be made.

1.4.14 Primary element—the element or device which generates conditions in the measured variable that may be detected by a sensing element.

NOTE: A primary element may also be a sensing element.

1.4.15 Process computer—Programmable device which operates on-line in real time on primarily sensing-element-based process data, to perform user specifiable supervision or control functions (or both).

1.4.16 Programmable—indicates the capability of the system to accept instructions in computer language given by the user for performing control strategies or complex functions.

1.4.17 Remote mounted instrument—an instrument that is mounted at a distance from the point of measurement, and may be mounted in either a local panel or control panel.

1.4.18 Sensing element—the element directly responsive to the value of the measured variable.

1.4.19 Shared display/shared control system—System in which shared functions, such as display, control, and communication of process data, are shared in time, i.e. ‘time-shared’ functions. These functions are generally accomplished by devices containing preprogrammed algorithms which are user-accessible, configurable, and connectable to perform a given control strategy or function.

1.4.20 Tag number—the unique set of identifying letters and numbers allocated to each functional element of a loop.

1.4.21 Transducer—an element or device which receives information in the form of one physical quantity and converts it to information in the form of the same or any other physical quantity.

1.4.22 Transmitter—a transducer which responds to a process variable by means of a sensing element, and converts it to a standard transmission signal which is a function only of the measurement.

1.5 SIZE OF SYMBOLS AND DRAWING PRACTICE. Precise dimension and properties of graphical symbols are difficult to specify. The symbols of this Standard have been drawn to a size convenient for publication and comprehension. The

size of symbols used will depend on the size and detail required in the drawing, but the relative proportions of the symbols should be maintained.

For instruments, computer-based functions, and shared displays/control functions, one key dimension should be used to form the symbol, i.e. the same dimension for the diameter, side, diagonal, or across the flats for the circle, square, diamond, or hexagon. The key dimension is chosen to provide adequate space for the function identifying letters and loop number to be located within the symbol.

Where it is desirable or necessary to vary the proportions or relative size to give a symbol prominence or for space limitations or other appropriate reason, the degree of variation shall be such that the symbol remains unique and readily recognizable.

Where it is the intention to reduce the size of the drawing on reproduction, the symbols including letters etc. shall be enlarged proportionally.

Drawing practices used for linework and lettering shall comply with AS 1100.101.

1.6 ORIENTATION OF SYMBOLS. Unless otherwise specified, the orientation of a symbol may be different from that given in Section 3 without changing the meaning.

SECTION 2. CODES AND ABBREVIATIONS

2.1 IDENTIFYING CODE FOR INSTRUMENT FUNCTIONS (TAG NUMBER).

2.1.1 Tag number. The identification of an instrument shall be defined by a letter and loop number code contained within the instrument function symbol. This code shall be constructed on the following basis (see Table 2.1):

- The first letter shall denote the measured or initiating variable, and shall be in accordance with Column 2 of Table 2.1, but should be modified, if necessary, by the addition of a letter in accordance with Column 3 therein.
- Succeeding letters shall be in accordance with Column 4 of Table 2.1.
- Where there are two or more succeeding letters, they shall be placed one after the other, in sequence I R C T Q S Z A. The letter I may be omitted for a self-indicating recorder.
- The allocated loop number should be unique and common to other instruments or instrument devices of the loop.
- A suffix may be added to identify replicated devices in the loop.
- A prefix may be added to identify plant areas.

2.1.2 Qualifying letters. Where it is required to denote HIGH or LOW, the qualifying letters H or L may be used in association with the symbol. Other letters may be used, e.g. for middle.

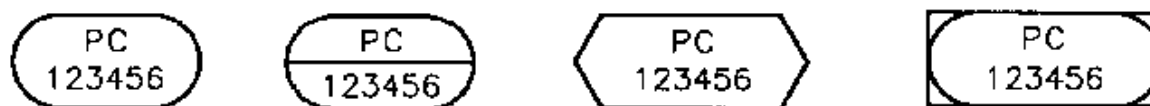
2.1.3 Position of qualifying letters. Qualifying letters, where used, may be placed inside the symbol, or outside the symbol and adjacent to it.

2.1.4 Position of function-identifying letters. Function-identifying letters shall be placed inside the symbol and, for panel-located equipment, above the horizontal line.



2.1.5 Position of loop number. If required, the loop number shall be shown inside the symbol.

The number shall be below the identifying letters and, for panel-located equipment, below the horizontal line.



2.2 ABBREVIATIONS FOR POWER SUPPLY AND PURGE FLUID SUPPLIES. The following abbreviations are suggested to denote the types of power supply:

AS	Air supply
ES	Electric supply
GS	Gas supply
HS	Hydraulic supply
NS	Nitrogen supply
SS	Steam supply
WS	Water supply

These designations may also be applied for purge fluid supplies.

The power supply level may be added to the instrument supply line, e.g. 'AS 100' means a 100-kilopascal air supply; 'ES 24DC' means a 24-volt direct current supply.

TABLE 2.1
LETTER CODE FOR IDENTIFICATION OF INSTRUMENT FUNCTION

1	2	3	4
Letter	First letter* (measured or initiating variable)	Modifier*	Succeeding letter* (display or output function)
A	Analysis†	—	Alarm
B	Burner, flame	—	State or status display
C	—	—	Control
D	Density	Difference	—
E	All electrical variables†	—	Sensing element‡
F	Flowrate	Ratio	—
G	Gauging position or length	—	Glass
H	Hand (manually initiated) operated	—	High (alarm)
I	—	—	Indicating
J	—	Scan	—
K	Time or time program	—	Barrier
L	Level	—	Low (alarm)
M	Moisture or humidity	—	User's choice§
N	User's choice§	—	User's choice§
O	User's choice§	User's choice§	—
P	Pressure or vacuum	—	Test point connection
Q	—	Integrate or totalize	Intergrating or summing
R	Radiation	—	Recording
S	Speed or frequency	—	Switching
T	Temperature	—	Transmitting
U	Multivariable	—	Multifunction unit
V	Vibration	—	Valve, damper, louvre, actuating element, unspecified correcting unit
W	Weight or force	—	Wells
X	Unclassified variables, e.g. T.V. camera§	—	Cathode ray tube, etc
Y	User's choice§	—	Computing relay, relay
Z	—	—	Emergency or safety acting

* Upper case letters should be used throughout, but, for modifiers alone, lower case letters may be used if this facilitates understanding.

† A note shall be added outside the circle to specify the property measured.

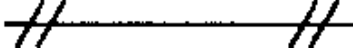
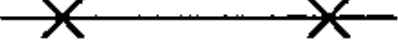
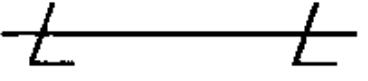
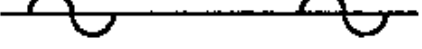
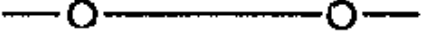
‡ Including any integral protection of the sensitive portion, e.g. a diaphragm and capillary system in a sealed system or mechanical protection of the sensing element.

§ 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.

|| 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.

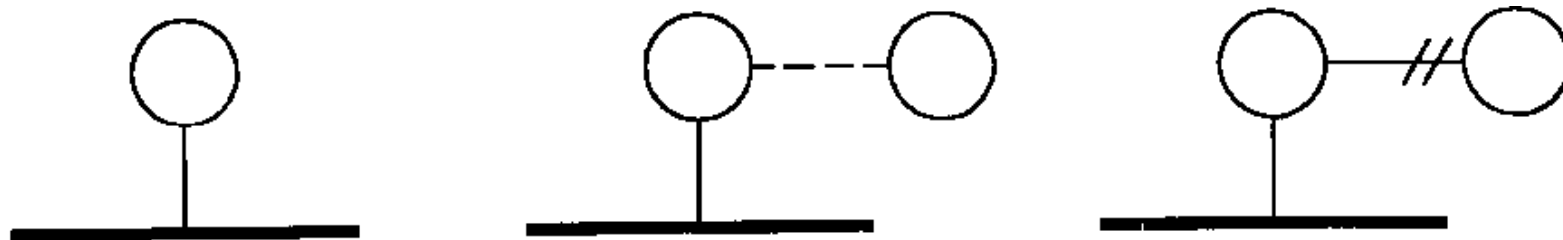
SECTION 3. SYMBOLS

TABLE 3.1
TYPES OF LINE AND INSTRUMENT LINE SYMBOLS

Reference number	Symbol	Meaning
3.1.01		Process line, flow line of a process (Continuous thick line in accordance with AS 1100.101)
3.1.02		Line used to delineate a plant (Continuous medium line in accordance with AS 1100.501)
3.1.03		Instrument connection to a process or mechanical link or instrument supply (Continuous thin line in accordance with AS 1100.101)
3.1.04		* Pneumatic signal † This symbol applies to a signal using any gas as the signal medium. If a gas other than air is used, the gas shall be identified by a note on the signal symbol or otherwise (Thickness of line as in Item 3.1.03)
3.1.05		* Electric signal or undefined signal (Dashed thin line in accordance with AS 1100.101)
3.1.06		Capillary tubing (filled system) † (Thickness of line as in Item 3.1.03)
3.1.07		Hydraulic signal † (Thickness of line as in Item 3.1.03)
3.1.08		* Electromagnetic signal or sonic signal (with wiring or tubing) † (Thickness of line as in Item 3.1.03.)
3.1.09		* Electromagnetic signal or sonic signal (not guided) † NOTE: Electromagnetic phenomena include heat, radio waves, nuclear radiation, and light.
3.1.10		* Software link interconnection of system functions via keyboard or program instructions (soft wiring as opposed to hard wiring) † (Thickness of line as in item 3.1.03.)

* Does not conform to ISO.

† A typical distance between qualifiers is 25 mm.

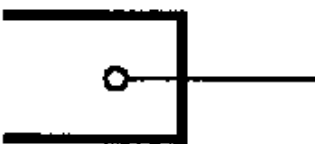
Examples of application:

NOTE: Instrument symbols are drawn in a thin line.

TABLE 3.2
DIRECTION OF FLOW, CROSSINGS, AND JUNCTIONS OF
INSTRUMENT SIGNALS

Reference number	Symbol	Meaning
3.2.01		Direction of flow NOTE: The arrowhead should be located as close as practicable to the receiving device and should be used only where necessary to clarify signal direction.
3.2.02		Crossings of instrument signals (not connected)
3.2.03		Junctions of instrument signals (connected) The diameter of the connecting dots shall be approximately 5 times the width of the associated lines.

TABLE 3.3
POINT OF MEASUREMENT

Reference number	Symbol	Meaning
3.3.01		Point of measurement Application: A point in the plant where provision is made for measurement (for example, of temperature), but to which no instrument is permanently attached. 
3.3.02		Point of measurement with a defined location Application: Where it is desirable, for clarification, to identify the location of the point of measurement, e.g.  Surface point of measurement on surface of process pipe or equipment (e.g. a skin-type or surface-mounted thermocouple)  Point of measurement inside process equipment at a particular point (e.g. a reactor bed temperature measurement)

* Does not conform to ISO

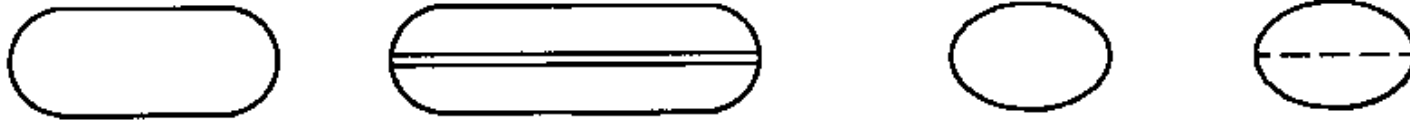
TABLE 3.4
INSTRUMENTS

Reference number	Symbol	Meaning
3.4.01		Instrument, locally mounted
3.4.02		Instrument, local panel mounted, on front of panel
3.4.03		Instrument, local panel mounted, behind panel
3.4.04		Instrument, central panel mounted, on front of panel
3.4.05		Instrument, central panel mounted, behind panel

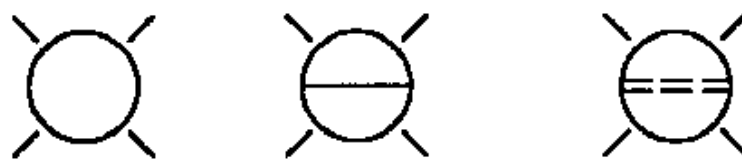
* Does not conform to ISO.

Application:

- (a) The diameter of the circle should be approximately 10 mm. (See also Clause 1.5.)
- (b) The circle is the basic symbol, but ellipses or elongated circles are acceptable to accommodate alphanumeric identifications specific to an industry, e.g.



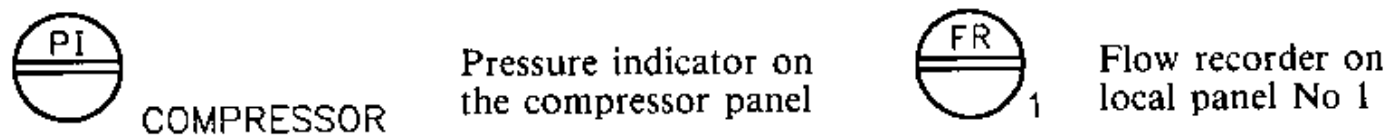
- (c) The basic symbol may be extended for use as status indication by adding four peripheral lines thus—



- (d) The letter code specified in Table 2.1 shall be used to designate the instrument function, e.g. for a pressure indicator:



- (e) The particular panel may be identified alongside the symbol by an alphanumeric identifier or a note located at the lower right sector, e.g.:



- (f) Where two or more instrument circles touch, the functions indicated by the letters in the circles are all incorporated in one enclosure, e.g.



- (g) The horizontal lines may be located at any height in the circle.

TABLE 3.5
BASIC SYMBOLS FOR COMPUTER-BASED FUNCTIONS

NOTE: It is permissible to use the basic symbol for computer-based functions throughout for any software-based digital system. This is not intended to preclude the use of the basic symbol for shared display/control functions (see Table 3.6) if the user considers this to be appropriate.

Reference number	Symbol	Meaning
3.5.01		Computer and interface function performed by a programmable device with local accessibility for operator (operator interface locally mounted)
3.5.02		Computer and interface function performed by a programmable device with accessibility at a local panel (operator interface local-panel-mounted)
3.5.03		Computer and interface function performed by a programmable device with accessibility at a control panel (operator interface control-panel-mounted)

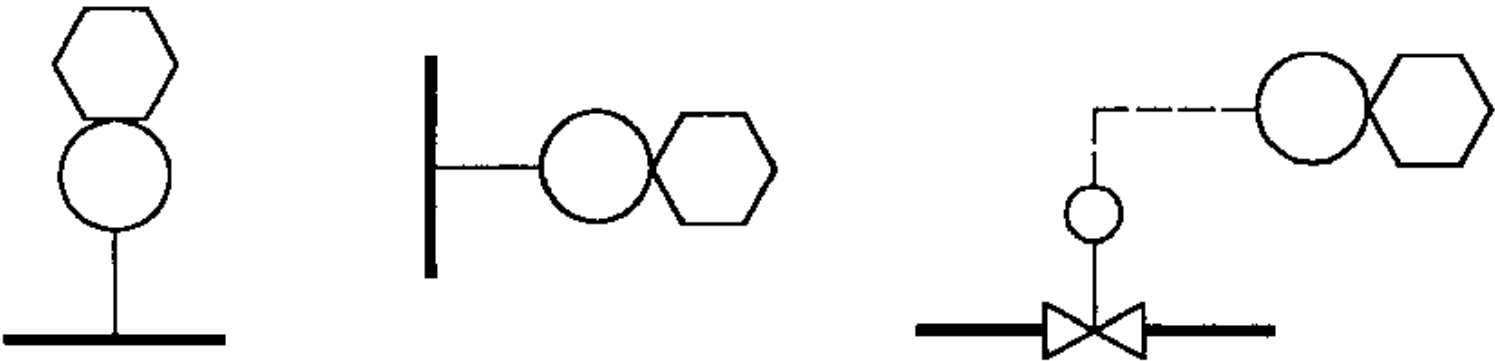
NOTE: Horizontal lines may be dashed to show inaccessible to operator function.

Application:

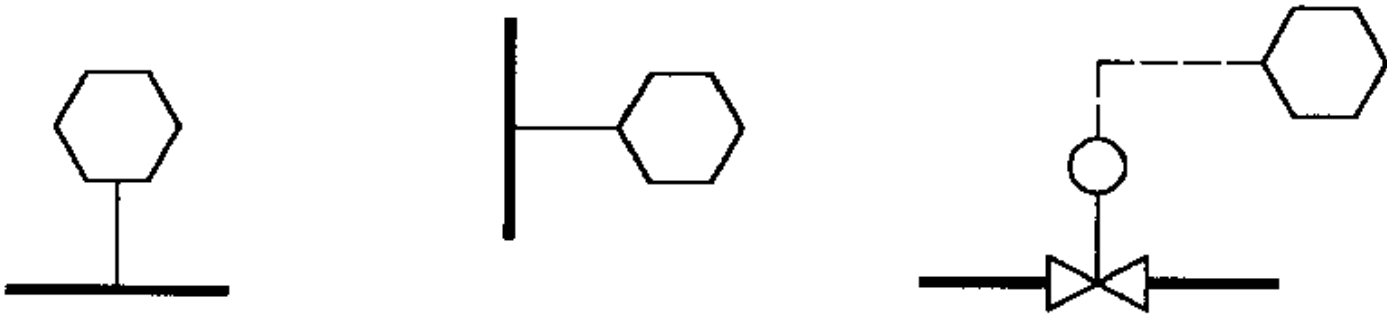
- (a) The width of the hexagon should be approximately 10 mm between two parallel sides.
- (b) The hexagon is the basic symbol, but elongated hexagons are acceptable to accommodate alphanumeric identifications specific to an industry, e.g.



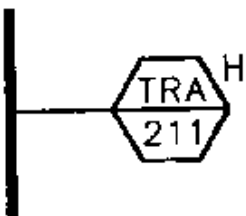
- (c) The basic symbol is usually applied in conjunction with other basic symbols showing measured process variables or actuated correcting unit. Symbols which touch each other imply communication between functions.



- (d) For simplification of diagrams, the basic symbol alone may be used.



- (e) The letter code specified in Table 2.1 shall be used to denote and identify the process computer functions, e.g.



Temperature signal to computer with temperature recording and high alarm by computer normally accessible to operator at a central panel.

TABLE 3.6
BASIC SYMBOLS FOR SHARED DISPLAY/CONTROL FUNCTIONS

Reference number	Symbol	Meaning
3.6.01		Computer and interface function performed by a configurable device with shared functions for display or control (or both) and local accessibility for operator (operator interface locally mounted)
3.6.02		Computer and interface function performed by a configurable device with shared functions for display or control (or both) and accessibility at a local panel (operator interface local-panel-mounted)
3.6.03		Computer and interface function performed by a configurable device with shared functions for display or control (or both) and accessibility at a central panel (operator interface central-panel-mounted)

NOTE: Horizontal lines may be dashed to show 'inaccessible to operator function'.

Application:

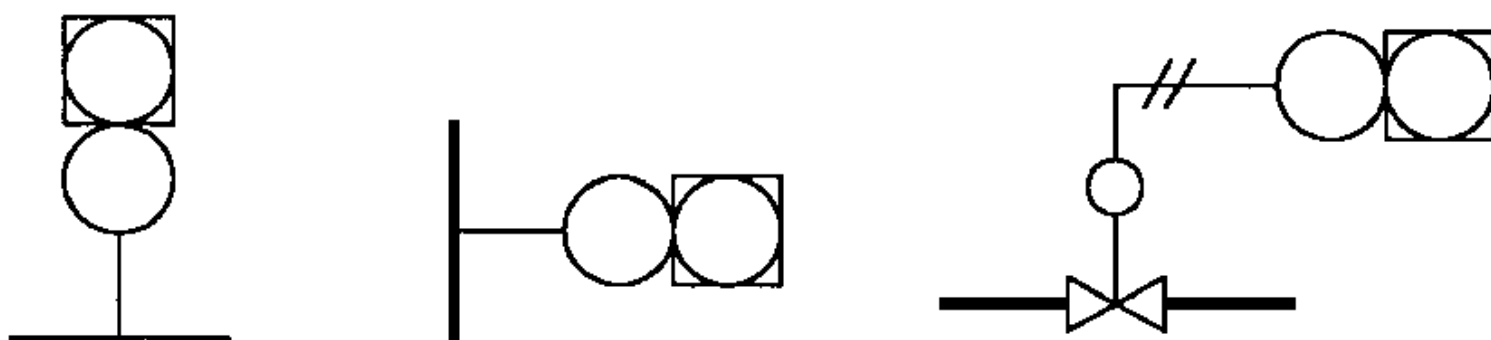
- (a) The width of the square and diameter of the circle should be approximately 10 mm.
- (b) The symbol is not rotatable.
- (c) The square with circle is the basic symbol, but an elongation of the symbol is acceptable to accommodate identification.



- (d) The letter code specified in Table 2.1 shall be used to denote and identify the shared display/control functions, e.g.



- (e) The basic symbol is usually applied in conjunction with other basic symbols showing measured process variables or actuated correcting unit. Symbols which touch each other imply communication between functions.



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(f) For simplification of diagrams, the basic symbol alone may be used.

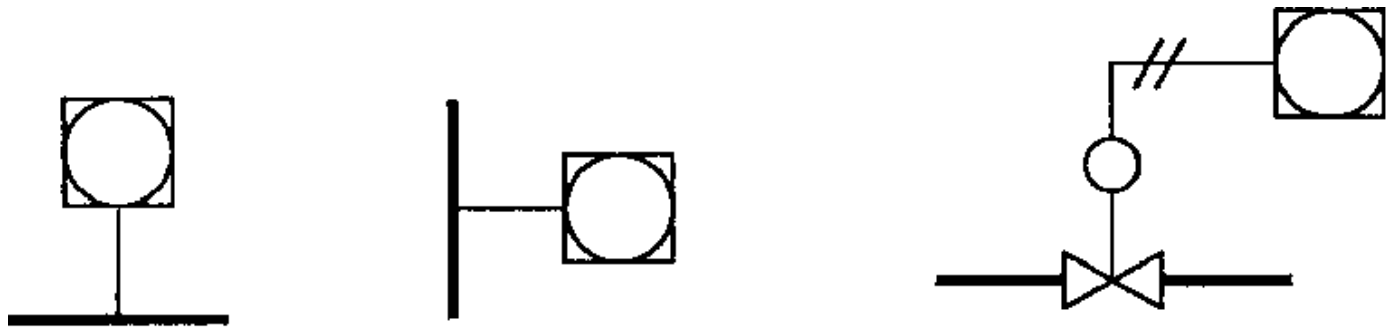


TABLE 3.7
INTERLOCKS

Reference number	Symbol	Meaning
3.7.01		Interlock, undefined logic
3.7.02		Interlock, effective if one or more inputs exist NOTE: Other logic functions may also be identified. e.g. AND, NOT.

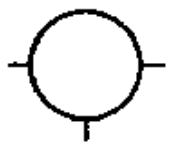
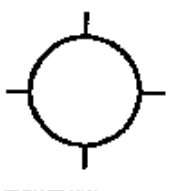
* Does not conform to ISO.

Application:

The size of the diamond should be approximately 10 mm across the diagonals.

TABLE 3.8
CORRECTING ELEMENTS

NOTE: For correcting elements other than those shown in this Table, established symbols (e.g. in AS 1101.5 and AS 1109) may be used.

Reference number	Symbol	Meaning
3.8.01		Correcting element of unspecified type
3.8.02		Two-port valve
3.8.03		Three-port valve (see Application)
3.8.04		Three-port valve (simplified)† (see Application)
3.8.05		Four-port valve† (see Application)
3.8.06		Five-port valve† (see Application) NOTE: Additional ports may be added. The central port is common.

* Does not conform to ISO.

† This symbol is simplified and preferred for use in piping and instrumentation diagrams (P & ID). Symbols for multiport valves are also shown in AS 1109.

Application:

Valves with three or more ports shall always be drawn showing the through connections in the de-energized position, e.g.

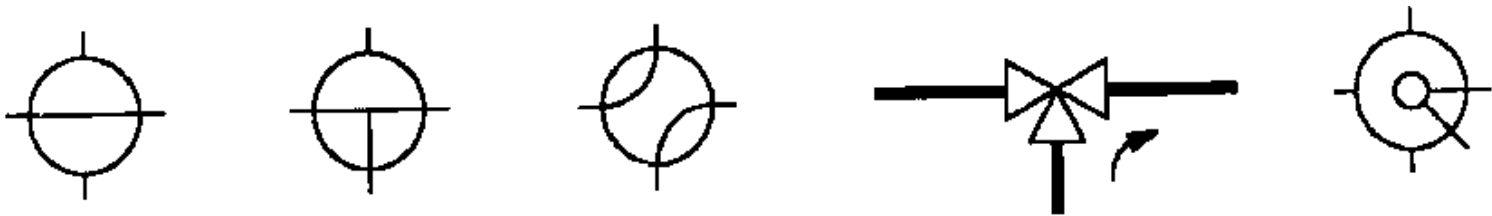


TABLE 3.9
BASIC ACTUATING ELEMENTS

NOTE: Specific types of valve actuators are shown in Table 3.11

Reference number	Symbol	Meaning
3.9.01		Automatic actuating element
3.9.02		Manual actuating element Examples of application: Automatic actuating element with integral manual actuating element  

* Does not conform to ISO.

Application:

The connection of actuating element symbol to the correcting element symbol is made by a thin line.

