INTERNATIONAL STANDARD

ISO 14617-4

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Graphical symbols for diagrams —

Part 4: Actuators and related devices

Symboles graphiques pour schémas —

Partie 4: Organes de commande et dispositifs associés

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 14617 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14617-4 was prepared by Technical Committee ISO/TC 10, *Technical product documentation*, Subcommittee SC 10, *Process plant documentation and tpd-symbols*.

ISO 14617 consists of the following parts, under the general title *Graphical symbols for diagrams*:

— *Part 1: General information and indexes*

— *Part 2: Symbols having general application*

— *Part 3: Connections and related devices*

— *Part 4: Actuators and related devices*

— *Part 5: Measurement and control devices*

— *Part 6: Measurement and control functions*

— *Part 7: Basic mechanical components*

— *Part 8: Valves and dampers*

— *Part 9: Pumps, compressors and fans*

— *Part 10: Fluid power converters*

— *Part 11: Devices for heat transfer and heat engines*

— *Part 12: Devices for separating, purification and mixing*

— *Part 15: Installation diagrams and network maps*

Other parts are under preparation.

Introduction

The purpose of ISO 14617 in its final form is the creation of a library of harmonized graphical symbols for diagrams used in technical applications. This work has been, and will be, performed in close cooperation between ISO and IEC. The ultimate result is intended to be published as a standard common to ISO and IEC, which their technical committees responsible for specific application fields can use in preparing International Standards and manuals.

Graphical symbols for diagrams —

Part 4:
Actuators and related devices

1 Scope

This part of ISO 14617 specifies graphical symbols for basic elements in actuators, complete actuators and actuating devices in diagrams.

For the fundamental rules of creation and application of graphical symbols in diagrams, see ISO 81714-1.

For an overview of ISO 14617, information on the creation and use of registration numbers for identifying graphical symbols used in diagrams, rules for the presentation and application of these symbols, and examples of their use and application, see ISO 14617-1.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 14617. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 14617 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 14617-1:2002, *Graphical symbols for diagrams — Part 1: General information and indexes*

ISO 14617-2:2002, *Graphical symbols for diagrams — Part 2: Symbols having general application*

ISO 14617-7:2002, *Graphical symbols for diagrams — Part 7: Basic mechanical components*

ISO 14617-8:2002, *Graphical symbols for diagrams — Part 8: Valves and dampers*

ISO 81714-1:1999, *Design of graphical symbols for use in the technical documentation of products — Part 1: Basic rules*

3 Terms and definitions

For the purposes of this part of ISO 14617, the following terms and definitions apply.

NOTE The list has been restricted to terms whose meaning is not obvious and which have not been defined elsewhere in an International Standard, or which have been defined in various ways in different standards. In preparing these definitions, ISO and IEC standards on terminology have been consulted; see the references in parentheses. However, most of the definitions in those standards were prepared by different technical committees within a restricted scope. This means that many terms so defined have to be given more general or neutral definitions when applied in the context of graphical symbols.

3.1
actuator
part of a component for the displacement of the movable parts of, for example, a shut-off valve or an electromechanical switching device

[IEC 60050-581]

3.2
actuating device
actuator consisting of several functionally interrelated components or elements, the description of which needs a diagram

[IEC 60050-581]

EXAMPLE An actuator consisting of a fluid or electric motor, a set of auxiliary contacts and a measuring transducer transmitting information on the actual position of the actuated device.

3.3
manual actuator
actuator for operation by human force

3.4
automatic
〈control, operation〉 self-acting (not needing human intervention)

[ISO 5598, IEC 60050-351]

3.5
automatic actuator
actuator activated without human intervention

EXAMPLE Actuation by a process variable or from a remote control unit.

3.6
automatic return device
device for returning movable parts, for example, those of a valve to initial position (at-rest position) after an actuating force has been removed

3.7
clutch
device for connecting and disconnecting working parts, for example, of a machine

[IEC 60050-441]

3.8
delay device
device providing a time interval between the instant when an actuating force is applied or removed and the instant when the consequent change of position or state of the affected parts starts

3.9
detent
device which retains movable parts, for example, those of a valve, in a certain position until sufficient force is applied to overcome the detaining force in order to move the parts to another position

[ISO 5598]

3.10
latching device
mechanical device giving movable parts, for example, those of a valve, the possibility to move in one direction but preventing them from returning until the latch has been released

[ISO 5598]

3.11
blocking device
mechanical device preventing movable parts, for example, those of a valve, from moving in any direction until the blocking device has been released

3.12
trip-free device
⟨electromechanical switching⟩ mechanical device ensuring that a, for example, circuit-breaker, trips and remains in tripped position independent of other operating commands

[IEC 60050-441]

3.13
interlocking device
mechanical device making the operation of movable parts of one component, for example, a contactor, dependent on the position or state of another component with movable parts

[IEC 60050-441]

3.14
operation
transfer of mechanical parts, for example, the closing member of a shut-off valve or the contacts of an electromechanical switching device

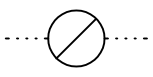
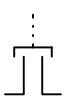
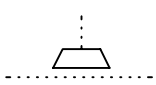
[IEC 60050-441]

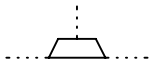
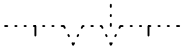
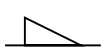
NOTE 1 The transfer direction can be defined as opening operation, closing operation, ON-operation, OFF-operation, etc.

NOTE 2 The term has a specific meaning in conjunction with electric measuring relays. An over/under... relay is operating when its characteristic quantity reaches the set value by increasing/decreasing value (IEC 60050-448).

4 Basic elements

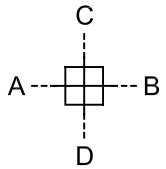
4.1 Symbols of a basic nature

4.1.1	**2008**		Mechanical gear pair
4.1.2	**2009**		Clutch, disengaged in unactuated state
4.1.3	**2010**		Clutch, engaged in unactuated state
4.1.4	**2011**		Brake, disengaged in unactuated state

4.1.5	**2012**		Brake, applied in unactuated state
4.1.6	**651**	Form 1  200 %	Delay device The action is delayed when the direction of movement is towards the centre of the arc. See R651 (4.2.1).
4.1.7	**652**	Form 2  200 %	
4.1.8	**653**	 200 %	Delay device The action is delayed in both directions. See R651 (4.2.1).
4.1.9	**654**	 200 %	Automatic return device The return direction is towards the apex. See R652 (4.2.2) and R653 (4.2.3). For the use of the symbol together with symbols for valves, see R2101 (8-4.2.1).
4.1.10	**2002**		Spring See R2001 (7-4.2.2).
4.1.11	**655**	 200 %	Detent for detaining in a discrete position See R652 (4.2.2).
4.1.12	**656**		Detent for detaining in a discrete position shown in disengaged position
4.1.13	**657**		Detent for detaining in a discrete position shown in engaged position
4.1.14	**658**		Indication of position without detention Two positions are shown.
4.1.15	**659**	 200 %	Detent for detaining in any position See R652 (4.2.2).
4.1.16	**660**	 200 %	Detent for detaining in any position; drift to the left permitted
4.1.17	**661**	 200 %	Latching device

4.1.18	**662**		Latching device shown in disengaged position
4.1.19	**663**		Latching device shown in engaged position
4.1.20	**664**	 200 %	Blocking device
4.1.21	**665**		Trip-free mechanism See R654 (4.2.4).
4.1.22	**666**	 200 %	Interlocking device

4.2 Application rules for the symbols in 4.1

4.2.1	**R651**	The double line shall be attached to the symbol for the element of a component or device that is delayed. For examples, see X653 (4.5.3) and X654 (4.5.4).
4.2.2	**R652**	The symbol may be omitted if the behaviour of the component is understood by the symbol for the actuator. Cf. 5.1, R683 (5.2.3), and R685 (5.2.5). For examples, see 5.5.
4.2.3	**R653**	In symbols for valves with spring return, the symbol may be replaced with symbol 2002 (4.1.10) for a spring. It shall then be located such that the spring is imagined to be released when the valve returns to its at-rest position, independent of the physical design. Cf. R2001 (7-4.2.2). For an example, see X688 (5.5.8).
4.2.4	**R654**	In the symbol, the connect points A to D of the figure below shall be used in the following way. A For mechanical connection to normal operation means. B For mechanical connection to actuated parts, for example, the contacts of an electromechanical switching device. C, D For mechanical connection to actuator with an overriding function. 

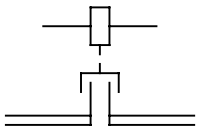
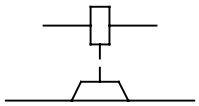
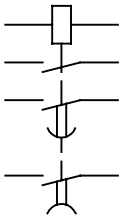
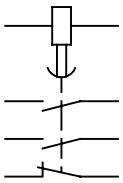
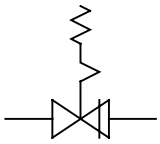
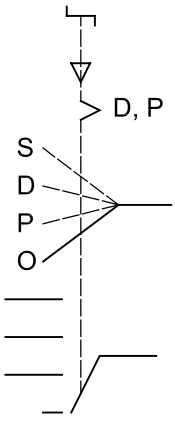
4.3 Symbol giving supplementary information

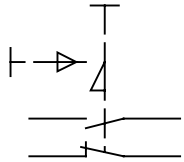
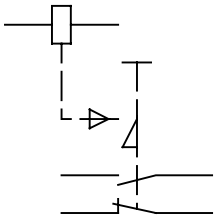
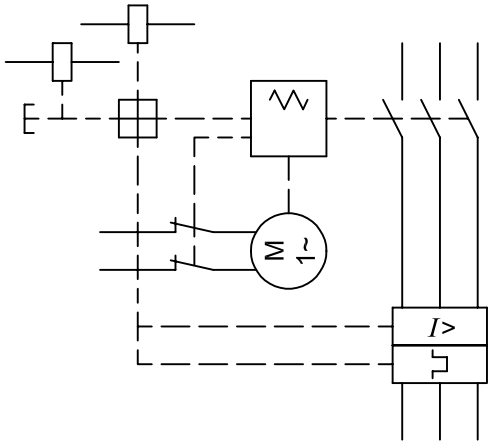
None.

4.4 Application rule for the symbol in 4.3

None.

4.5 Application examples

4.5.1	**X651**	 402, 2009, IEC	Solenoid-operated clutch, disengaged at no-voltage
4.5.2	**X652**	 403, 2012, IEC	Solenoid-operated brake applied at no-voltage
4.5.3	**X653**	 404, 651, 652, IEC, IEC	Electromechanical all-or-nothing relay with three contacts, the second one delayed when the coil is energized, the third one delayed when the coil is de-energized
4.5.4	**X654**	 404, 651, IEC, IEC, IEC	Electromechanical all-or-nothing relay, the whole relay delayed when the coil is energized
4.5.5	**X655**	 403, 655, 2002, 2101, 2112	Spring-loaded safety valve detained open after operation
4.5.6	**X656**	 404, 654, 655, 685, 701, IEC	Manually operated multi-position control switch shown in position 0 (off), detained in positions P (parking) and D (drive) and with automatic return from position S to D Cf. symbol 701 (5.3.1).

4.5.7	**X657**	 404, 654, 662, 681, IEC, IEC	Manually operated control switch with a manually disengaged latch
4.5.8	**X658**	 404, 654, 662, 681, IEC, IEC, IEC	Manually operated control switch with an electrically disengaged latch
4.5.9	**X659**	 171, 404, 665, 682, 741, 2002, IEC, IEC, IEC, IEC, IEC, IEC	Three-pole electromechanical switching device with — trip-free mechanism; — spring-operating mechanism; — electric motor for the recharge of the spring; — closing coil; — trip coil; — instantaneous overcurrent release; and — thermal overload release.

5 Manually operated actuators

5.1 Symbols of a basic nature

NOTE For the interpretation of two parallel actuator symbols, see R681 (5.2.1).

5.1.1	**681**		Manual actuator See R682 (5.2.2).
5.1.2	**682**		Manual actuator operated by pushing See R682 (5.2.2) and R683 (5.2.3).
5.1.3	**683**		Manual actuator operated by pulling See R682 (5.2.2) and R683 (5.2.3).
5.1.4	**684**		Manual actuator operated by pushing and pulling See R682 (5.2.2) and R684 (5.2.4).

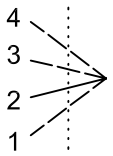
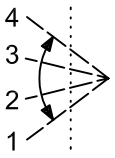
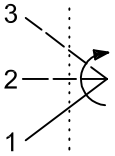
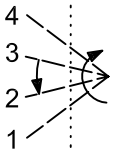
5.1.5	**685**		Manual actuator operated by turning See R682 (5.2.2) and R685 (5.2.5).
5.1.6	**686**		Manual actuator in form of removable handle See R682 (5.2.2) and R685 (5.2.5).
5.1.7	**687**		Manual actuator in form of key See R682 (5.2.2) and R685 (5.2.5).
5.1.8	**688**		Manual actuator in form of lever See R682 (5.2.2) and R684 (5.2.4).
5.1.9	**689**		Manual actuator in form of pedal See R682 (5.2.2) and R683 (5.2.3).
5.1.10	**690**		Manual actuator in form of treadle See R682 (5.2.2) and R684 (5.2.4).
5.1.11	**691**		Manual actuator with special shape for safety purpose, for example, emergency stop
5.1.12	**692**		Device for restricted access to actuator, for example, a cover to be turned up

5.2 Application rules for the symbols in 5.1

5.2.1	**R681**	When symbols for two or more actuators (manual or automatic) are located in parallel, an OR-relation between the actuators exists if not otherwise indicated, for example, by symbol 142 (2-4.3.2.28) for an AND-function at the junction point.
5.2.2	**R682**	The function associated with each position may be indicated adjacent to the symbols, when applicable, by symbols 701 (5.3.1) to 704 (5.3.4). For examples, see X684 (5.5.4) to X687 (5.5.7).
5.2.3	**R683**	When the symbol for pushing, pulling or pedal is used, automatic return is assumed. Thus, the symbol 654 (4.1.9) for automatic return may be omitted. For examples, see X681 (5.5.1) and X682 (5.5.2). On the other hand, if automatic return does not apply, symbol 655 (4.1.11) for a detent shall be used.
5.2.4	**R684**	When the symbol for pushing and pulling, lever, or treadle is used, automatic or non-automatic return shall be indicated. For examples, see X683 (5.5.3) and X684 (5.5.4).
5.2.5	**R685**	When the symbol for turning, removable handle, or key is used, non-automatic return (detent) is assumed. Thus, symbol 655 (4.1.11) for a detent may be omitted. On the other hand, if detaining does not apply, the symbol for automatic return shall be used.

5.3 Symbols giving supplementary information

NOTE For the significance and application of the solid and dashed lines, see R701 (5.4.1).

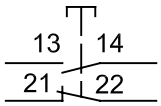
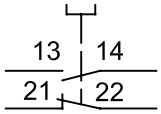
5.3.1	**701**		Indication of positions of a controlled element having four positions and operated towards position 4 by turning clockwise The actual position is position 2.
5.3.2	**702**		Indication of positions of a controlled element having four positions and operated by turning The actuator can move only between positions 1 and 4 clockwise (and back anticlockwise). The actual position is position 1.
5.3.3	**703**		Indication of positions of a controlled element having three positions and operated by turning The actuator can only be turned clockwise. The actual position is position 1.
5.3.4	**704**		Indication of positions of a controlled element having four positions and operated by turning The actuator can only be turned 360° clockwise except for a movement from position 3 to position 2. The actual position is position 1.

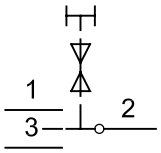
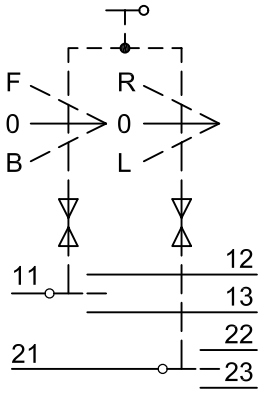
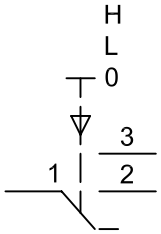
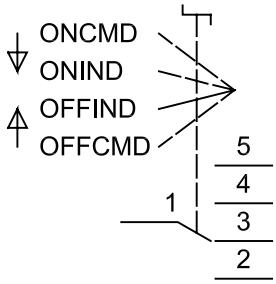
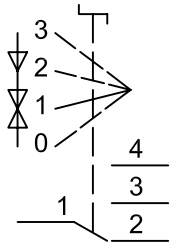
5.4 Application rules for the symbols in 5.3

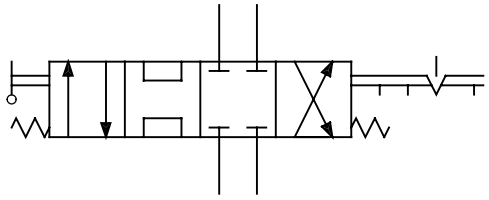
5.4.1	**R701**	The actual position shall be indicated by a solid line, the other positions by dashed lines. The symbol shall be oriented such that it shows the real turning direction of the actuator, i.e. if the change from position 1 to position 4 in symbol 701 (5.3.1) would instead have implied an anticlockwise turning, then the symbol has to be mirror-imaged with the “hinge point” to the left.

5.5 Application examples

NOTE See also examples X656 (4.5.6) to X658 (4.5.8).

5.5.1	**X681**	 404, 682, IEC, IEC	Control switch operated by pushing When pushing, contact 13-14 closes and 21-22 opens. Automatic return is assumed in accordance with R683 (5.2.3).
5.5.2	**X682**	 404, 683, IEC, IEC	Control switch operated by pulling When pulling, contact 13-14 closes and 21-22 opens. Automatic return is assumed in accordance with R683 (5.2.3).

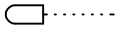
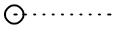
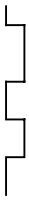
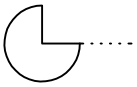
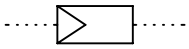
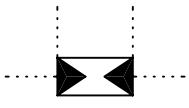
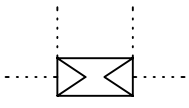
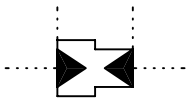
5.5.3	**X683**	 404, 654, 684, IEC	Control switch with three positions operated by pushing and pulling When pulling, the path 1-2 is closed, when pushing the path 2-3 is closed, with automatic return to the mid-position in which position both paths are open.
5.5.4	**X684**	 404, 501, 654, 688, 701, IEC	Control switch operated by a lever with four operation directions When the lever is moved from position 0 (off) to B (backwards) the current path 11-13 is closed. When the lever is moved from 0 to F (forwards) path 11-12 is closed. When the lever is moved from 0 to L (left) the path 21-23 is closed and when the lever is moved from 0 to R (right) path 21-22 is closed. The switch has an automatic return to position 0. The F-0-B operation and the R-0-L operation are independent of each other.
5.5.5	**X685**	 404, 654, 681, IEC	Manually operated control switch with three positions, 0 (off), L (low) and H (high) with automatic return to position 0
5.5.6	**X686**	 404, 654, 685, 701, IEC	Control switch operated by turning, with four positions and automatic return from the two extreme positions ONCMD (on-command) and OFFCMD (off-command) to the nearest stable positions ONIND (on-indication) and OFFIND (off-indication)
5.5.7	**X687**	 404, 654, 685, 701, IEC	Control switch operated by turning with four positions and automatic return from positions 0, 2 and 3 to position 1

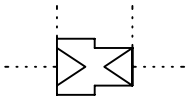
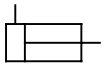
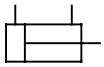
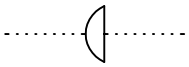
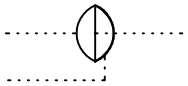
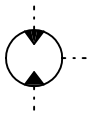
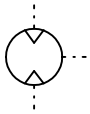
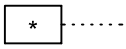
5.5.8	**X688**	 242, 402, 658, 688, 2002, 2161, 2171, 2172	Directional control valve with four positions, operated by a lever and with one stable position and automatic return from the other positions The left-/right-hand spring symbol indicates automatic return to the right or left.

6 Automatic actuators

6.1 Symbols of a basic nature

NOTE For the interpretation of two parallel actuator symbols, see R681 (5.2.1).

6.1.1	**711**		Plunger; tracer
6.1.2	**712**		Roller
6.1.3	**713**		Cam profile See R711 (6.2.1).
6.1.4	**714**		Cam-operated actuator
6.1.5	**715**		Fluid-level-operated actuator, for example, in the form of a float
6.1.6	**716**		Flow-target-operated actuator, for example, in the form of a mechanical flag
6.1.7	**717**		Single-acting hydraulic actuator
6.1.8	**718**		Single-acting pneumatic actuator
6.1.9	**719**		Double-acting hydraulic actuator
6.1.10	**720**		Double-acting pneumatic actuator
6.1.11	**721**		Double-acting hydraulic actuator with different active areas

6.1.12	**722**		Double-acting pneumatic actuator with different active areas
6.1.13	**723**		Actuator in the form of a single-acting fluid cylinder
6.1.14	**724**		Actuator in the form of a double-acting fluid cylinder
6.1.15	**725**		Single-acting diaphragm actuator
6.1.16	**726**		Double-acting diaphragm actuator
6.1.17	**2407**		Actuator in the form of a hydraulic motor with alternative directions of flow
6.1.18	**2408**		Actuator in the form of a pneumatic motor with alternative directions of flow
6.1.19	**733**		Actuator operating when a characteristic quantity passes a set value See R712 (6.2.2).

6.2 Application rules for the symbols in 6.1

6.2.1	**R711**	The shape of the symbol shall correspond to that of the cam itself. For example, see X711 (6.5.1). A cam with circular form may be shown developed as in the symbol shown.
6.2.2	**R712**	The asterisk shall be replaced with a symbol in accordance with clause 2-4.3.4. For examples, see X716 (6.5.4) and X717 (6.5.5).

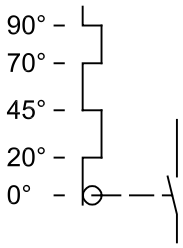
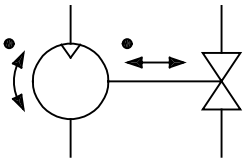
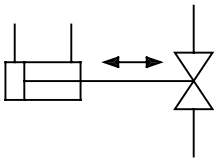
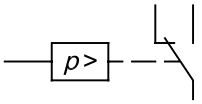
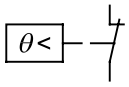
6.3 Symbol giving supplementary information

None.

6.4 Application rule for the symbol in 6.3

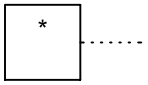
None.

6.5 Application examples

6.5.1	**X711**	 404, 712, 713, IEC	Cam profile and roller affecting a make contact The contact is closed between 20° and 45° and between 70° and 90°.
6.5.2	**X712**	 245, 256, 263, 403, 2101, 2406	Actuator in the form of a pneumatic motor When the motor rotates clockwise/anticlockwise, the valve opens/closes. Cf. R2101 (8-4.2.1).
6.5.3	**X713**	 245, 403, 724, 2101	Actuator in the form of a double-acting fluid cylinder When the cylinder moves to the left/right, the valve opens/closes. Cf. R2101 (8-4.2.1).
6.5.4	**X716**	 171, 404, 733, IEC	Pressure pilot switch operating when the actual pressure is greater than the set value
6.5.5	**X717**	 172, 404, 733, IEC	Temperature pilot switch operating when the actual temperature is less than the set value

7 Actuating devices

7.1 Symbol of a basic nature

7.1.1	**741**		Actuating device consisting of — a main element, for example, a lever for manual operation, a solenoid, a spring device for energy storing, and — auxiliary elements, for example, auxiliary contacts and a blocking device. See R741 (7.2.1).

7.2 Application rule for the symbol in 7.1

7.2.1	**R741**	The asterisk shall be replaced with a symbol indicating the operation method.

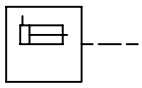
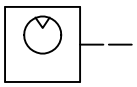
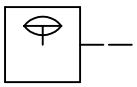
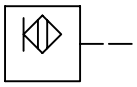
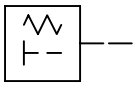
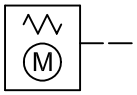
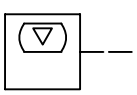
7.3 Symbol giving supplementary information

None.

7.4 Application rule for the symbol in 7.3

None.

7.5 Application examples

7.5.1	**X741**	 404, 723, 741	Actuating device, the main element of which is a single-acting fluid cylinder
7.5.2	**X742**	 404, 741, 2406	Actuating device, the main element of which is a pneumatic motor
7.5.3	**X743**	 404, 726, 741	Actuating device, the main element of which is a double-acting diaphragm actuator
7.5.4	**X744**	 122, 404, 741	Actuating device, operating with touch effect
7.5.5	**X745**	 404, 681, 741, 2002	Actuating device, spring-operated with manual spring charging
7.5.6	**X746**	 404, 741, IEC, 2002	Actuating device, spring-operated with spring charging by an electric motor
7.5.7	**X747**	 244, 404, 741, 2062	Actuating device operated by pneumatic power stored inside the actuator

Bibliography

[1] ISO 5598:1985, *Fluid power systems and components — Vocabulary*

[2] IEC 60050-351, *International Electrotechnical Vocabulary — Part 351: Automatic* control

[3] IEC 60050-411, *International Electrotechnical Vocabulary — Part 411: Rotating machinery*

[4] IEC 60050-441, *International Electrotechnical Vocabulary — Part 441: Switchgear, controlgear and fuses*

[5] IEC 60050-448, *International Electrotechnical Vocabulary — Part 448: Power system protection*

[6] IEC 60050-581, *International Electrotechnical Vocabulary — Part 581: Electromechanical components for electronic equipment*

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