ASME Y14.40.5-2002

(Identical to ISO 14617-5: 2002)

GRAPHICAL SYMBOLS FOR DIAGRAMS, PART 5: MEASUREMENT AND CONTROL DEVICES

An American National Standard

The American Society of
Mechanical Engineers

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ASME Y14.40.5, Graphical Symbols for Diagrams, Part 5: Measurement and Control Devices, was adopted on 19 December 2002 for use by the Department of Defense, DoD. Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: Commander, U.S. Army TACOM-ARDEC, ATTN: AMSTA-AR-QAW-E, Picatinny Arsenal, NJ 07806-5000. Copies of this document may be purchased from The American Society of Mechanical Engineers (ASME), 22 Law Drive, PO Box 2900, Fairfield, NJ 07007-2900; http://www.asme.org.

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(Project DRPR — 0373)

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AN AMERICAN NATIONAL STANDARD

GRAPHICAL SYMBOLS FOR DIAGRAMS, PART 5: MEASUREMENT AND CONTROL DEVICES

ASME Y14.40.5-2002
(Identical to ISO 14617-5: 2002)

Date of Issuance: June 25, 2003

The next edition of this Standard is scheduled for publication in 2007. There will be no addenda or written interpretations of the requirements of this Standard issued to this edition.

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FOREWORD

This Standard is the adoption as an American National Standard of ISO 14617-5: 2002. The ASME Standards Committee Y14, Engineering Drawing Practices and Related Documentation, is responsible for this Standard and supervises the U.S. participation in the ISO Technical Committee 10 activity responsible for the development and maintenance of its counterpart ISO 14617-5 through the U.S. Technical Advisory Group for ISO/TC 10.

This Standard is *identical* to ISO 14617-5: 2002 as that term is defined in ISO/IEC Guide 21: 1999 and part of a series of standards providing graphical symbols for diagrams in a variety of technical disciplines. The titles in this series are:

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.

Suggestions for improvement of this Standard are welcome. They should be sent to: The American Society of Mechanical Engineers, Attention: Secretary, Y14 Standards Committee, Three Park Avenue, New York, NY 10016.

This Standard was approved as an American National Standard on December 19, 2002.

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Engineering Drawing and Related Documentation Practices

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GRAPHICAL SYMBOLS FOR DIAGRAMS, PART 5: MEASUREMENT AND CONTROL DEVICES

1 SCOPE

This Standard specifies graphical symbols for components and devices used in measurement and control systems, represented in diagrams.

For the fundamental rules of creation and application of graphical symbols in diagrams, see ASME Y14.40.0.

For an overview of the ASME Y14.40 series, 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 ASME Y14.40.1.

2 REFERENCES

The following references contain provisions which, through reference in this text, constitute provisions of this Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the references indicated below. For undated references, the latest edition applies.

ASME Y14.40.0, Basic Rules for the Design of Graphical Symbols for Use in the Technical Documentation of Products

ASME Y14.40.1, Graphical Symbols for Diagrams, Part 1: General Information and Indexes

ASME Y14.40.2, Graphical Symbols for Diagrams, Part 2: Symbols Having General Application

ASME Y14.40.4, Graphical Symbols for Diagrams, Part 4: Actuators and Related Devices

Publisher: The American Society of Mechanical Engineers (ASME International), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300

IEC 60027 (all parts), Letter Symbols to Be Used in Electrical Technology[1]

IEC 60617-6: 1996, Graphical Symbols for Diagrams — Part 6: Production and Conversion of Electrical Energy[1]

IEC 60617-12: 1997, Graphical Symbols for Diagrams — Part 12: Binary Logic Elements[1]

IEC 60617-13: 1993, Graphical Symbols for Diagrams — Part 13: Analogue Elements[1]

Publisher: International Electrotechnical Commission (IEC), 3 rue de Varembé, Case Postale 131, CH-1211, Genève 20, Switzerland/Suisse

ISO 31 (all parts), Quantities and Units[1]

Publisher: International Organization for Standardization (ISO), 1 rue de Varembé, Case Postale 56, CH-1211, Genève 20, Switzerland/Suisse

3 TERMS AND DEFINITIONS

For the purposes of this Standard, the following terms and definitions apply.

3.1

sensor: primary element of a measuring chain that converts the input variable into a signal suitable for measurement.

3.2

signal converter: device that changes a signal into a different signal, the physical nature of the output being the same as that of the input.

3.3

measuring transducer transmitter: device that accepts information in the form of a physical or chemical variable and converts it to an output variable of the same or another nature, according to a definite law.

3.4

detector: device that accepts information in the form of a physical or chemical variable and transmits a binary signal at a specified condition, cf. *measuring transducer* (3.3).

3.5

indicator: device that shows the presence or absence of a phenomenon such as pressure, flow, and position or state, but which does not measure it.
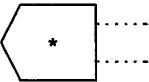
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[1] Copies may be obtained from the American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036.
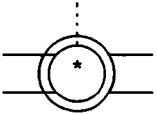
3.6

dead band threshold: finite range of values within which a variation of the input variable does not produce any noticeable change in the output variable.

3.7

bias: function giving an output corresponding to that portion of an input signal exceeding a predetermined threshold value.

4 SENSORS, SIGNAL CONVERTERS, AND MEASURING TRANSDUCERS

4.1 Symbols of a Basic Nature

| Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
4.1.1	751	Form 1	Sensor. The apex represents the sensing or incoming side. See R751 (4.2.1).
4.1.2	752	Form 2	
4.1.3	753	Form 1	Signal converter, measuring transducer. See R752 (4.2.2).
4.1.4	754	Form 2	
4.1.5	755	Form 1	Signal converter, measuring transducer without connection between input and output circuits. See R752 (4.2.2).
4.1.6	756	Form 2	
4.1.7	757		Thermocouple.
4.1.8	759		Tachometer generator.
4.1.9	760		Measuring transducer utilizing the synchro effect. See R753 (4.2.3).

4.2 Application Rules for the Symbols in Para. 4.1

Reference Number	Registration Number	Application Rules
4.2.1	R751	The asterisk shall be replaced with a letter symbol in accordance with ISO 31 or IEC 60027, or a graphical symbol for the quantity being measured, or else shall be omitted. The asterisk in the Form 1 symbol may also be replaced with an appropriate symbol, for example, according to 4.3.1, indicating the working principle.

Reference Number	Registration Number	Application Rules
4.2.2	R752	The asterisk shall be replaced with the letter symbol for the input quantity according to ISO 31 or IEC 60027, or by a graphical symbol, and the double asterisk shall be replaced with that of the output quantity.
4.2.3	R753	The asterisk shall be replaced with a letter code according to 4.3.2.

4.3 Symbols Giving Supplementary Information
4.3.1 General Symbols

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
4.3.1.1	715		Float type.
4.3.1.2	771		Displacer type.
4.3.1.3	2003		Membrane type; diaphragm type.
4.3.1.4	772		Orifice plate type.
4.3.1.5	773		Flow nozzle type.
4.3.1.6	774		Critical flow nozzle type.
4.3.1.7	775		Venturi tube type.
4.3.1.8	776		Flow elbow type.
4.3.1.9	777		Variable area flow type.
4.3.1.10	778		Pitot tube type.
4.3.1.11	2405		Rotary type, for example, turbine type.
4.3.1.12	IEC		Strain gauge type.
4.3.1.13	IEC		Capacitive type.
4.3.1.14	IEC		Conductive electrode type.
4.3.1.15	IEC		Transmitting ultrasonic type.
4.3.1.16	IEC		Receiving ultrasonic type.
4.3.1.17	IEC		Transmitting and receiving ultrasonic type.
4.3.1.18	IEC		Radioactive type.
4.3.1.19	IEC		Optical type.

3

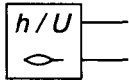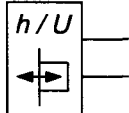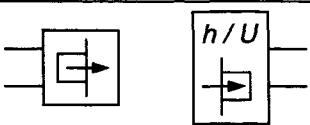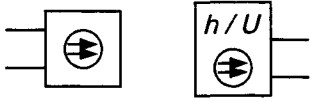| Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
4.3.1.20	IEC		Semiconductor type.
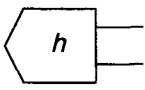
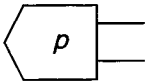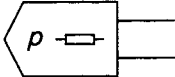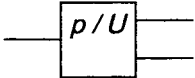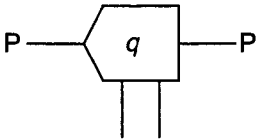### 4.3.2 Letter Symbols in Graphical Symbols for Measuring Transducers Utilizing the Synchro Effect
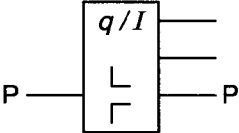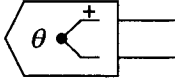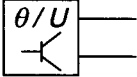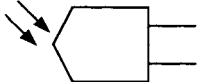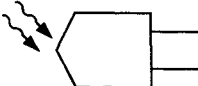
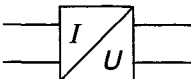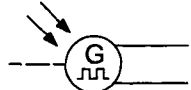| Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
4.3.2.1	791	B	Rotatable stator (succeeding letter).
4.3.2.2	792	C	Controlling (first letter).
4.3.2.3	793	D	Differential type (succeeding letter).
4.3.2.4	794	R	Resolving (first letter). Receiver (succeeding letter).
4.3.2.5	795	T	Torque measurement (first letter). Transformer (succeeding letter).
4.3.2.6	796	X	Measuring transducer/transmitter (succeeding letter).
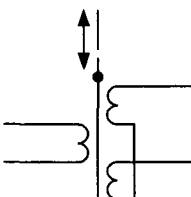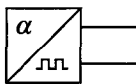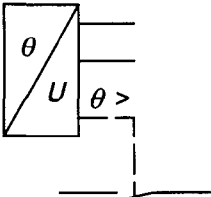
4.4 Application Rule for the Symbols in Para. 4.3
None.

4.5 Application Examples
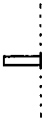
Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
4.5.1	X751	751	Level sensor.
4.5.2	X752	101, 112, 715	Level measuring transducer with voltage as output signal, float type.
4.5.3	X753	101, 112, IEC	Level measuring transducer, sonic type with integral source.
4.5.4	X754	101, 112, IEC, IEC	Level measuring transducer, sonic type with separate source.
4.5.5	X755	101, 112, IEC	Level measuring transducer, optical type with separate source.

4
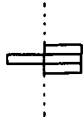
Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
4.5.6	X756	p 751	Pressure sensor.
4.5.7	X757	p 751, IEC	Pressure sensor, strain gauge type.
4.5.8	X758	p/U 101, 112	Pressure measuring transducer with voltage as output signal.
4.5.9	X759	P — q — P 751	Flow rate sensor. NOTE: The lines marked P represent the pipeline.
4.5.10	X760	q/I P — L Γ — P 101, 112, 773	Flow rate measuring transducer with built-in sensor of flow nozzle type with current as output signal. NOTE: The lines marked P represent the pipeline.
4.5.11	X761	θ ± 751, 757	Temperature sensor, thermocouple type.
4.5.12	X762	θ/U 101, 112, IEC	Temperature measuring transducer with built-in sensor of semi-conductor type with voltage as output signal.
4.5.13	X763	 751, IEC	Sensor for nonionizing radiation.
4.5.14	X764	 751, IEC	Sensor for ionizing radiation.

5

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
4.5.15	X765	101, 111	Signal converter or measuring transducer with current as input and voltage as output.
4.5.16	X766	221, 759, IEC	Tachometer generator, DC type.
4.5.17	X767	225, 759, IEC	Tachometer generator, optical type.
4.5.18	X768	245, 404, 501, IEC, IEC	Position measuring transducer, differential transformer type.
4.5.19	X769	101, 111, 225	Measuring transducer for angle with pulse train as output variable.
4.5.20	X770	101, 111, 171, 404, IEC	Measuring transducer for temperature with voltage as output signal and contact closing when the temperature is greater than a set value.

5   FITTINGS FOR SENSORS AND MEASURING TRANSDUCERS

5.1 Symbols of a Basic Nature

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
5.1.1	801		Boss with well.
5.1.2	802		Insertion pipe.

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Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
5.1.3	803		Boss with insertion pipe.

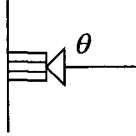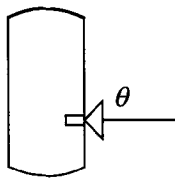## 5.2 Application Rule for the Symbols in Para. 5.1
None.

5.3 Symbol Giving Supplementary Information
None.

5.4 Application Rule for the Symbol in Para. 5.3
None.

5.5 Application Examples

| Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
5.5.1	X801	θ 405, 752, 801	Temperature sensor in boss with well on pipeline.
5.5.2	X802	θ 752, 802, 2062	Temperature sensor in insertion pipe on tank.

6 MEASURING TRANSDUCERS OF TRANSFORMER TYPE
See IEC 60617-6.

7 MEASURING AND RELATED INSTRUMENTS

7.1 Symbols of a Basic Nature

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
7.1.1	831		Thermometer.
7.1.2	832		Indicator. See R831 (7.2.1).
7.1.3	833		Recorder. See R831 (7.2.1).

7

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
7.1.4	834		Integrator. See R831 (7.2.1) and R832 (7.2.2).

7.2 Application Rules for the Symbols in Para. 7.1

Reference Number	Registration Number	Application Rules
7.2.1	R831	The arrow may, but the asterisk shall, be replaced with one of the following: (a) the letter symbol for the unit of the quantity indicated/recorded; (b) the letter symbol for the quantity indicated/recorded; (c) a chemical formula; (d) a graphical symbol. The symbol or formula used shall be related to the information displayed by the measuring or related instrument regardless of the means used to obtain the information. Letter symbols for units and quantities shall be selected from ISO 31 or IEC 60027. Nonstandardized graphical symbols or letter symbols may be used provided they are explained on the diagram or in a supporting document. If the letter symbol for the unit of a quantity indicated or recorded is used, it may be necessary to show the letter symbol for the quantity as supplementary information. It should be placed below the unit letter symbol. Supplementary information concerning the quantity indicated or recorded and any necessary qualifying symbol may be shown below the quantity letter symbol. To make it possible to distinguish between letter symbols for units and those for quantities, inclined lettering should be used for the quantity letter symbols in accordance with ISO 31 and IEC 60027.
7.2.2	R832	The number of rectangles at the top indicates the number of different summations by a multi-rate meter. If this is impractical, only one rectangle may be shown supplemented with [nx] inside—see symbol 345 (2-11.1.5)—where n shall be replaced with the number of summations.

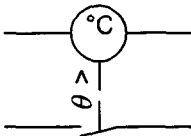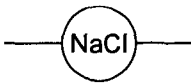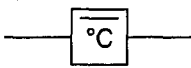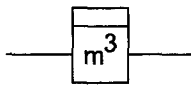## 7.3 Symbol Giving Supplementary Information
See para. 7.2.1.

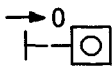## 7.4 Application Rule for the Symbols in Para. 7.3
None.

7.5 Application Examples

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
7.5.1	X842		Temperature meter, thermometer with dial-in degrees Celsius.

832

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Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
7.5.2	X843	171, 404, 832, IEC	Temperature meter, thermometer with contact closed at temperature higher than a predetermined value.
7.5.3	X846	832	Salinity meter.
7.5.4	X851	833	Recording temperature meter.
7.5.5	X855	834	Volume meter based on time integration of flow rate. EXAMPLE: Water meter.

8 COUNTING DEVICES AND CLOCKS

8.1 Symbols of a Basic Nature

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
8.1.1	841		Counter.
8.1.2	842		Clock.
8.1.3	843		Master clock.

8.2 Application Rule for the Symbols in Para. 8.1
None.

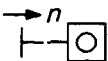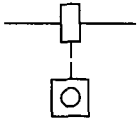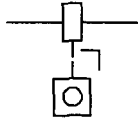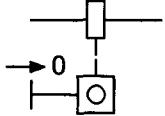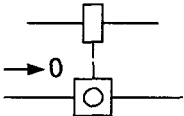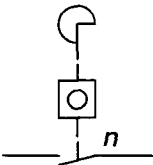## 8.3 Symbol Giving Supplementary Information
None.

8.4 Application Rule for the Symbol in Para 8.3
None.

8.5 Application Examples

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
8.5.1	X871	241, 404, 681, 841	Counter with reset to 0.

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Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
8.5.2	X872	241, 404, 681, 841	Counter counting downwards with preset to n events.
8.5.3	X873	404, 841, IEC	Electromechanical counter.
8.5.4	X874	129, 404, 841, IEC	Electromechanical counter indicating a new event when the electrical pulse disappears (postponed action).
8.5.5	X875	241, 404, 681, 841, IEC	Electromechanical counter with manual reset to 0.
8.5.6	X876	241, 404, 841, IEC	Electromechanical counter with electrical reset to 0.
8.5.7	X877	404, 714, 841, IEC	Cam-driven mechanical counter with output closing at each n events.

9 DISPLAYS

9.1 Symbols of a Basic Nature

NOTE: For binary logic display elements, see IEC 60617-12: 1997, Section 52.

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
9.1.1	851	DPY	Display unit.

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9.2 Application Rule for the Symbols in Para. 9.1
None.

9.3 Symbol Giving Supplementary Information
None.

9.4 Application Rule for the Symbol in Para. 9.3
None.

9.5 Application Example
None.

10 SIGNALLING DEVICES

10.1 Symbols of a Basic Nature

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
10.1.1	863		Mechanical indicator. See R862 (10.2.1).
10.1.2	864		Electromechanical indicator. See R862 (10.2.1).
10.1.3	865		Electromechanical position indicator with one de-energized and two operated positions. See R863 (10.2.2).
10.1.4	866		Acoustic signalling device.

10.2 Application Rules for the Symbols in Para. 10.1

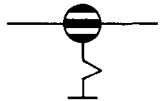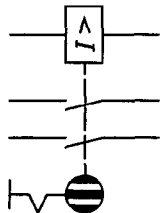| Reference Number	Registration Number	Application Rules
10.2.1	R862	The symbol represents an indicator with automatic return. If an indicator has non-automatic return, symbol 655 (4-4.1.11) shall be shown adjacent to the symbol for the indicator. For examples, see X894 (10.5.2) and X895 (10.5.3).
10.2.2	R863	The symbol may also be used for an electrical position indicator in the form of a unit with a number of signal lamps or light-emitting diodes with the same indication function.

10.3 Symbol Giving Supplementary Information
None.

10.4 Application Rule for the Symbol in Para. 10.3
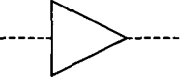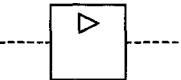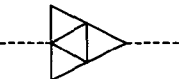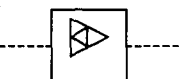None.

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10.5 Application Examples

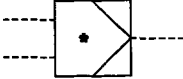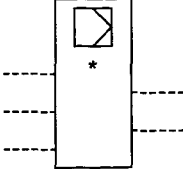| Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
10.5.1	X893	 864	Electromechanical indicator with automatic return.
10.5.2	X894	 403, 655, 681, 864	Electromechanical indicator without automatic return (manual reset).
10.5.3	X895	 171, 403, 404, 655, 681, 733, 863, IEC	Overcurrent relay with mechanical indicator without automatic return (manual reset).

11 BINARY LOGIC ELEMENTS

See IEC 60617-12.

12 DEVICES FOR ANALOG SIGNAL PROCESSING

12.1 Symbols of a Basic Nature

NOTE: See also IEC 60617-13.

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
12.1.1	891	Form 1	Amplifier. See R891 (12.2.1).
12.1.2	892	Form 2	
12.1.3	893	Form 1	Amplifier with return channel. See R891 (12.2.1).
12.1.4	894	Form 2	

12

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
12.1.5	895	Form 1	Feedback controller. See R891 (12.2.1) and R892 (12.2.2).
12.1.6	896	Form 2	

12.2 Application Rules for the Symbols in Para. 12.1

Reference Number	Registration Number	Application Rules
12.2.1	R891	The symbol may be supplemented with the mathematical signs + and − as input and output labels with the following meaning:
		An increase or decrease in a quantity at an input labelled with + or − causes an increase or decrease in both a quantity at an output labelled with the same sign and in a quantity at an output labelled with the opposite sign.
		The symbols may also be supplemented with a letter code or a graph indicating the behavior of the amplifier or controller (see IEC 60050-351).
12.2.2	R892	The asterisk shall be replaced with the letter symbol for the quantity being controlled, for example, θ for temperature, or a graph or mnemonic indicating the behavior of the controller, or else shall be omitted.

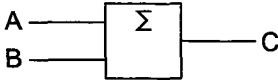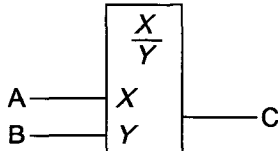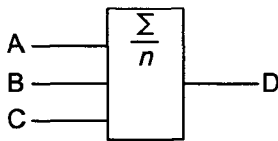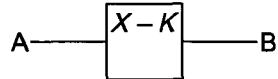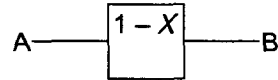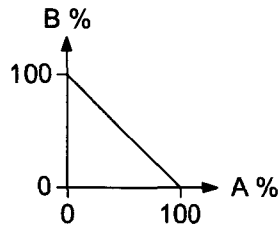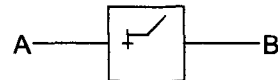## 12.3 Symbols Giving Supplementary Information
NOTE: See also ASME Y14.40.2, para. 4.3.2.
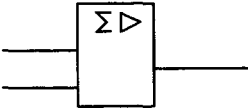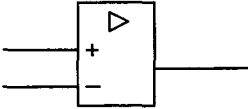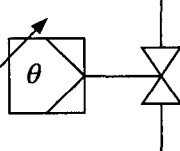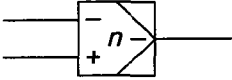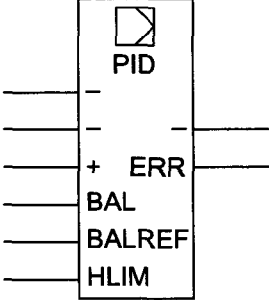
Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
12.3.1	133	Form 1 HLIM	High limitation.
12.3.2	134	Form 2	
12.3.3	135	Form 1 LLIM	Low limitation.
12.3.4	136	Form 2	
12.3.5	137		Dead band; threshold.

12.4 Application Rule for the Symbols in Para. 12.3
None.

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12.5 Application Examples

Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
12.5.1	X901	A ── [Σ] ── C B ── 101	Device for summing. $C = A + B$
12.5.2	X902	$\frac{X}{Y}$ A ── X B ── Y ── C 101, 106, 161	Device for division. $C = \dfrac{A}{B}$
12.5.3	X903	$\frac{\Sigma}{n}$ A ── B ── ── D C ── 101, 161	Device for averaging. $D = \dfrac{A + B + C}{3}$
12.5.4	X904	A ── $\boxed{X - K}$ ── B 101, 162	Device for bias. $B = A - K$
12.5.5	X905	A ── $\boxed{1 - X}$ ── B 101, 163	Device for reverse function. If $A = 0$ then $B = 100\%$. If $A = 100\%$ then $B = 0$.
12.5.6	X906	A ── [╱] ── B 101, 134	Device for high limitation. When A is less than or equal to a predetermined value, A_M, then $B = A$. When $A > A_M$, then $B = B_M$.
12.5.7	X907	A ── [╱] ── B 101, 136	Device for low limitation. When A greater than or equal to a predetermined value A_M, then $B = A$. When $A < A_M$, then $B = B_M$.

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Reference Number	Registration Number	Symbol Form/Shape	Symbol Description
12.5.8	X908	A —☐— B 101, 134	Device for high limitation, where input value can be negative.
12.5.9	X909	Σ▷ 892	Summing amplifier.
12.5.10	X910	▷ + − 106, 892	Differential amplifier.
12.5.11	X911	θ 201, 403, 895, 2101	Feedback controller with internal set point adjustability controlling ambient temperature by means of valve in pipe.
12.5.12	X912	− n + ▷ 106, 895	Feedback controller for rotational speed.
12.5.13	X913	PID − − − + ERR BAL BALREF HLIM 106, 896	Feedback controller with PID (proportional, integral and derivative action) characteristic and many inputs.

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