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Revision of Y32.2-1967

A Canadian Standard

IEEE Standard
and
American National Standard
GRAPHIC SYMBOLS
for
ELECTRICAL AND ELECTRONICS DIAGRAMS

(Including Reference Designation Class Designation Letters)

Secretariat for American National Standards Committee Y32
The Institute of Electrical and Electronics Engineers
The American Society of Mechanical Engineers

Approved November 17, 1970 by the
American National Standards Institute

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Approved as ANSI Standard by the
American National Standards Institute
November 17, 1970

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Foreword

(This Foreword is not a part of American National Standard Graphic Symbols for Electrical and Electronics Diagrams, Y32.2-1970.)

This American National Standard is a revision and expansion of USA Standard Graphic Symbols for Electrical and Electronics Diagrams, Y32.2-1967.

A large number of new symbols has been added. While the major additions are in the areas of antennas, transmission path, thermal relays, VHF/UHF/SHF circuit devices, and semiconductor devices, all sections have some new or revised items. New sections have been added to cover graphic symbols for special-purpose maintenance diagrams, analog computer symbols (formerly in IEEE Standard 166), also equipment and station symbols for system diagrams, maps and charts. For convenience of users, the class letters used to form reference designations (formerly in ANSI Y32.16) have now been included in a new section of Y32.2. In this revision the symbols are slightly larger than in Y32.2-1967 edition, resulting in improved readability. A revised edition of the large symbol chart included with the Y32.2-1967 edition will be available separately to complement the new edition.

All of the symbols are designed so that their connection points fall on a modular grid. This should help those who use a grid basis for the preparation of diagrams. By proper enlargement of the symbol the usual coordinate-grid sizes can be matched.

A substantial effort has been made to have this American National Standard more compatible with approved International Electrotechnical Commission (IEC) Recommendations (IEC Publication 117, in various parts). Electrical diagrams are a factor in international trade; the use of *one* common symbol language ensures a clear presentation and economical diagram preparation for a variety of users. Members of the preparing committee have been active in transmitting USA viewpoints to the cognizant IEC Technical Committee.

Alternative symbols are shown only in those cases where agreement on a common symbol could not be attained at this time. It is hoped that the number of alternative symbols will be reduced in future editions.

The symbols in this standard represent the best consensus that can be attained at this time. Standardization, however, must be dynamic, not static, and any solution of a problem should be tested through use and revised if necessary. It is anticipated that the contents of this standard will be modified as future needs dictate; such modifications will be made available through the issuance of approved supplements. Suggestions for improvement are welcomed. They should be addressed to:

Secretary, IEEE Standards Committee
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This standard has been prepared by the Institute of Electrical and Electronics Engineers (IEEE) Standards Coordinating Committee for Letter and Graphic Symbols (SCC 11), acting for the Y32.2 Task Group on Graphic Symbols for Electrical and Electronics Diagrams of the American National Standards Committee Y32, Graphic Symbols and Designations. There has been close cooperation between the industry and DOD representatives to provide one standard that can be universally used, rather than separate documents with their tendency to differ in various respects. While credit for this accomplishment is due all participants and the organizations they represent, particular mention is given to the U.S. Department of Defense, without whose strong support in reaching the objective—standard symbols acceptable to both industry and the military departments—the effort would not have succeeded.

This standard is complemented by a number of related standards listed in Section 23.

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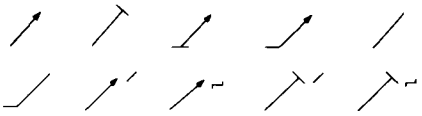
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Quick Reference to Symbols

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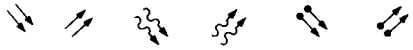
1.1 Adjustability
Variability



1.2 Special-Property Indicators



1.3 Radiation Indicators

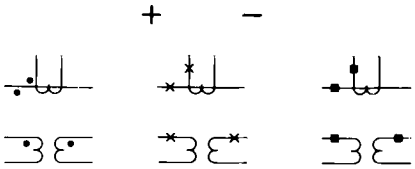


1.4 Physical State Recognition Symbols

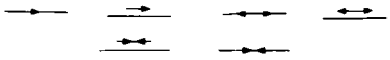


1.5 Test-Point Recognition Symbol

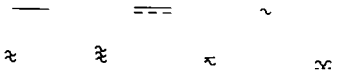
1.6 Polarity Markings



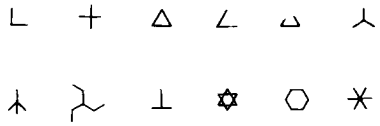
1.7 Direction of Flow of Power, Signal, or Information



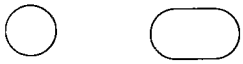
1.8 Kind of Current



1.9 Connection Symbols



1.10 Envelope
Enclosure

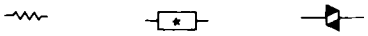


1.11 Shield
Shielding



2. Fundamental Items

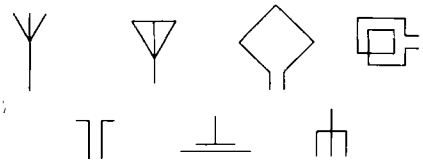
2.1 Resistor



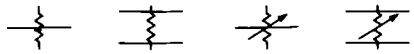
2.2 Capacitor



2.3 Antenna



2.4 Attenuator



2.5 Battery

2.6 Delay Function
Delay Line
Slow-Wave Structure

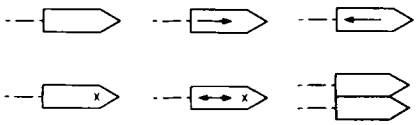


2.7 Oscillator
Generalized Alternating-Current Source



2.8 Permanent Magnet

2.9 Pickup
Head



2.10 Piezoelectric Crystal Unit



2.11 Primary Detector
Measuring Transducer



2.12 Squib, Electrical



2.13 Thermocouple

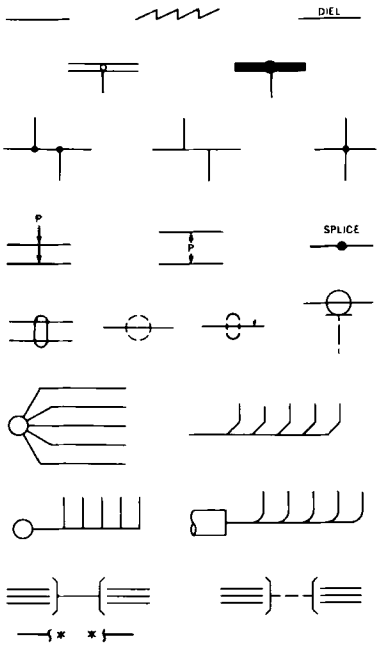


2.14 Thermal Element
Thermomechanical Transducer

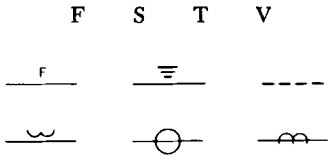
2.15 Spark gap
Igniter gap

3. Transmission Path

3.1 Transmission Path
Conductor
Cable
Wiring



3.2 Distribution lines
Transmission lines



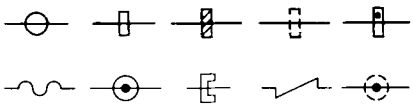
3.3 Alternative or Conditioned Wiring



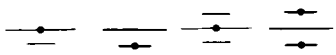
3.4 Associated or Future

3.5 Intentional Isolation of Direct-Current Path in Coaxial or Waveguide Applications

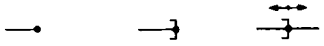
3.6 Waveguide



3.7 Strip-Type Transmission Line



3.8 Termination



3.9 Circuit Return



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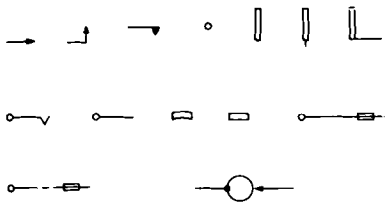
Full document details: 315 -1971 - IEEE Standard and American National Standard for Electrical and Electronics Diagrams (Including Reference Designation cl...

4. Contacts, Switches, Contactors, and Relays

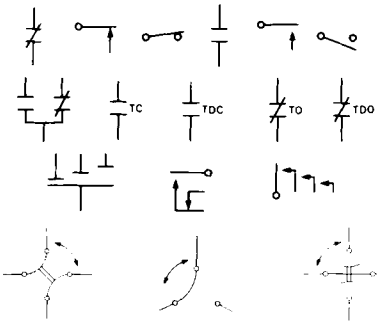
4.1 Switching Function



4.2 Electrical Contact



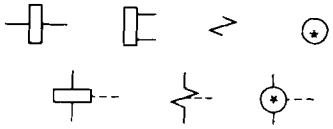
4.3 Basic Contact Assemblies



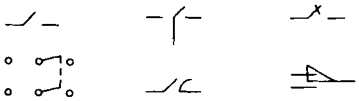
4.4 Magnetic Blowout Coil



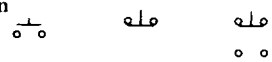
4.5 Operating Coil
Relay Coil



4.6 Switch



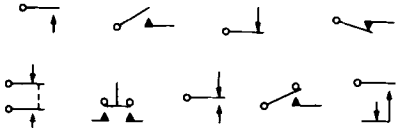
4.7 Pushbutton, Momentary or Spring-Return



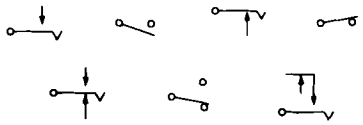
4.8 Two-Circuit, Maintained or Not Spring-Return



4.9 Nonlocking Switch, Momentary or Spring-Return



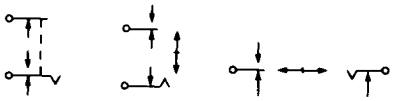
4.10 Locking Switch



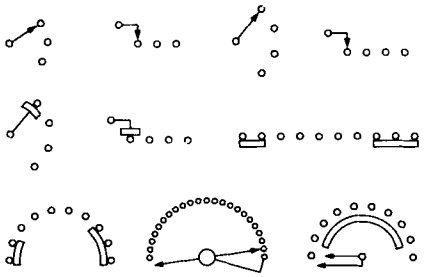
4.11 Combination Locking and Nonlocking Switch

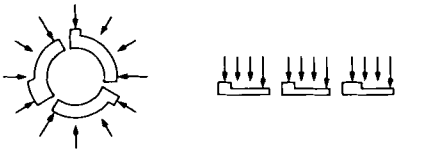


4.12 Key-Type Switch
Lever Switch

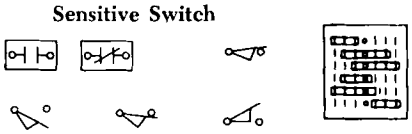


4.13 Selector or Multiposition Switch





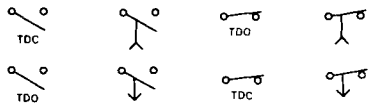
4.14 Limit Switch
Sensitive Switch



4.15 Safety Interlock



4.16 Switches with Time-Delay Feature



4.17 Flow-Actuated Switch



4.18 Liquid-Level-Actuated Switch



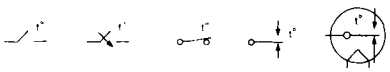
4.19 Pressure- or Vacuum-Actuated Switch



4.20 Temperature-Actuated Switch



4.21 Thermostat



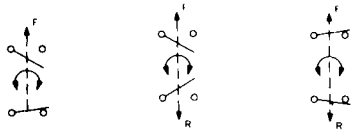
4.22 Flasher
Self-interrupting switch



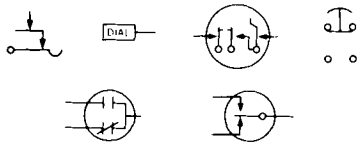
4.23 Foot-Operated Switch
Foot Switch



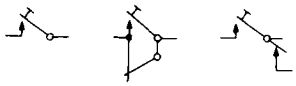
4.24 Switch Operated by Shaft Rotation and Responsive to Speed or Direction



4.25 Switches with Specific Features



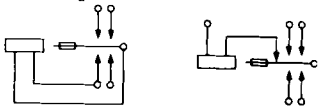
4.26 Telegraph Key



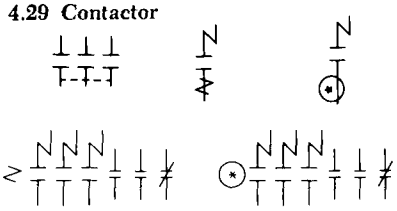
4.27 Governor
Speed Regulator



4.28 Vibrator
Interrupter

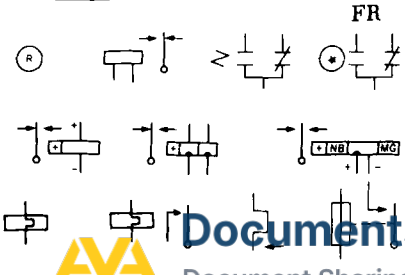


4.29 Contactor



4.30 Relay

AC	D	DP	MG
P	DB	EP	NB
SO	SA	SW	NR
SR	L	ML	FO
			FR

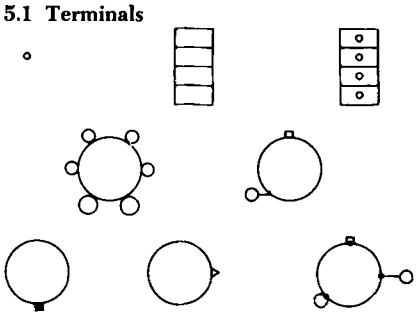


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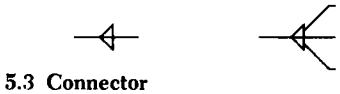
Full document details: 315 -1971 - IEEE Standard and American National Standard for Electrical and Electronics Diagrams (Including Reference Designation cl...

5. Terminals and Connectors

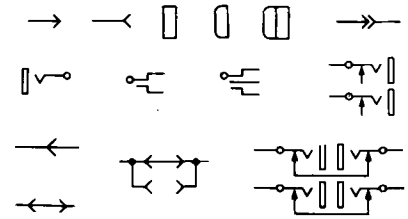
5.1 Terminals



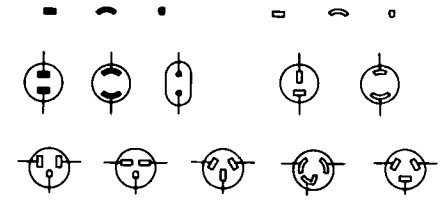
5.2 Cable Termination



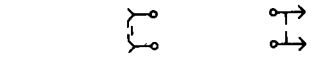
5.3 Connector
Disconnecting Device



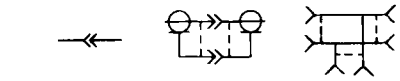
5.4 Connectors of the Type Commonly Used for Power-Supply Purposes



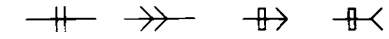
5.5 Test Blocks



5.6 Coaxial Connector



5.7 Waveguide Flanges
Waveguide junction

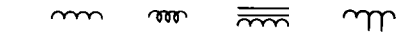


6. Transformers, Inductors, and Windings

6.1 Core



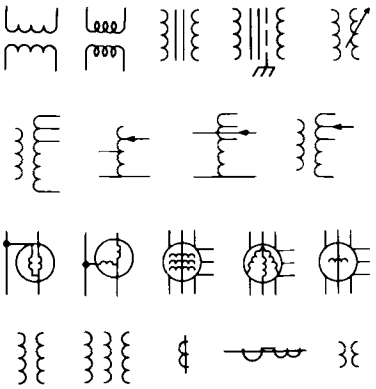
6.2 Inductor
Winding
Reactor
Radio frequency coil
Telephone retardation coil



6.3 Transductor



6.4 Transformer
Telephone induction coil
Telephone repeating coil

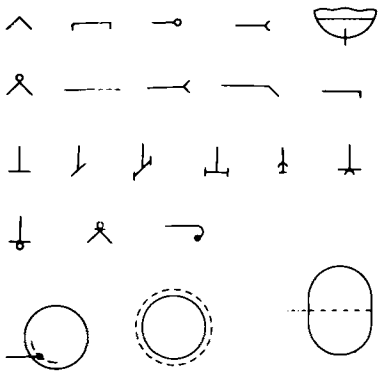


6.5 Linear Coupler



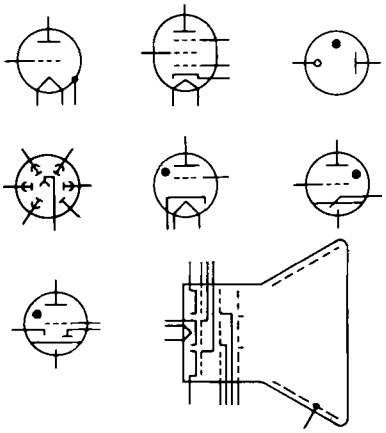
7. Electron Tubes and Related Devices

7.1 Electron Tube

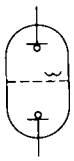


7.2 General Notes

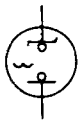
7.3 Typical Applications



7.4 Solion
Ion-Diffusion Device



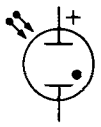
7.5 Coulomb Accumulator
Electrochemical Step-Function Device



7.6 Conductivity cell



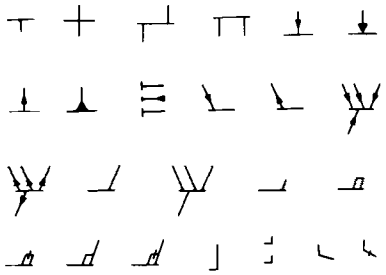
7.7 Nuclear-Radiation Detector
Ionization Chamber
Proportional Counter Tube
Geiger-Müller Counter Tube



8. Semiconductor Devices

8.1 Semiconductor Device
Transistor
Diode

8.2 Element Symbols

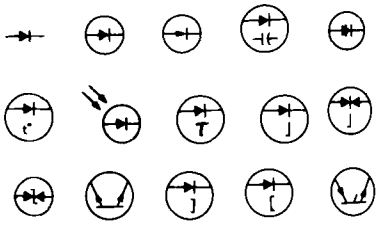


8.3 Special Property Indicators



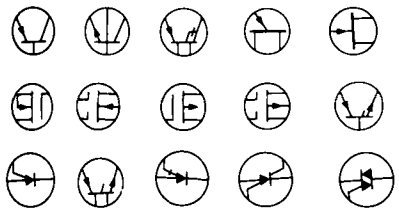
8.4 Rules for Drawing Style 1 Symbols

8.5 Typical Applications: Two-Terminal Devices



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8.6 Typical Applications: Three- (or More) Terminal Devices



8.7 Photosensitive Cell



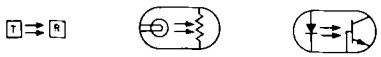
8.8 Semiconductor Thermocouple



8.9 Hall Element
Hall Generator



8.10 Photon-coupled isolator

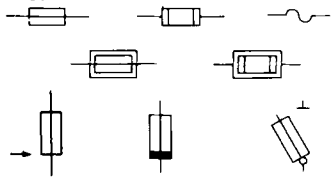


8.11 Solid-state-thyratron



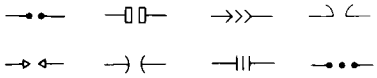
9. Circuit Protectors

9.1 Fuse

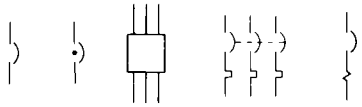


9.2 Current Arrester

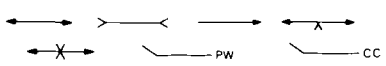
9.3 Lightning Arrester
Arrester
Gap



9.4 Circuit Breaker



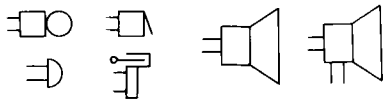
9.5 Protective Relay



C	F	ϕ	S	V
Z	GP	W	T	

10. Acoustic Devices

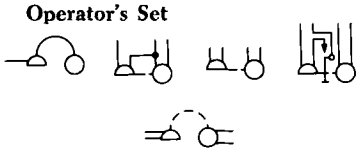
10.1 Audible-Signaling Device



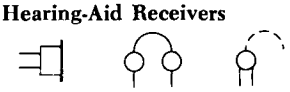
10.2 Microphone



10.3 Handset
Operator's Set

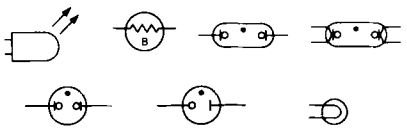


10.4 Telephone Receiver
Earphone
Hearing-Aid Receivers

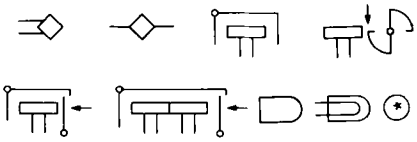


11. Lamps and Visual-Signaling Devices

11.1 Lamp



11.2 Visual-Signaling Device



12. Readout Devices

12.1 Meter
Instrument



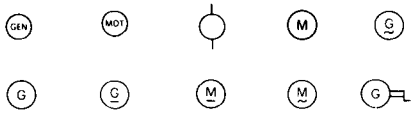
A	DB	I	OP	RF	VA
AH	DBM	INT	OSCG	SY	VAR
C	DM	μA	PH	TLM	VARH
CMA	DTR	UA	PI	t°	VI
CMC	F	MA	PF	THC	VU
CMV	G	NM	RD	TT	W
CRO	GD	OHM	REC	V	WH

12.2 Electromagnetically Operated
Counter
Message Register



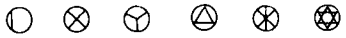
13. Rotating Machinery

13.1 Rotating Machine

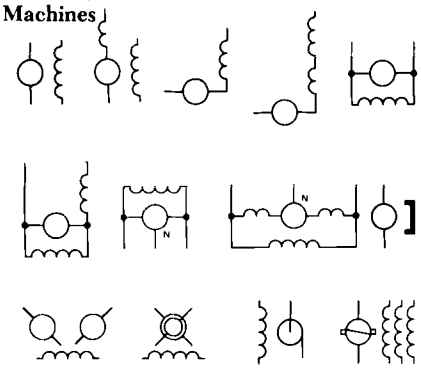


13.2 Field, Generator or Motor

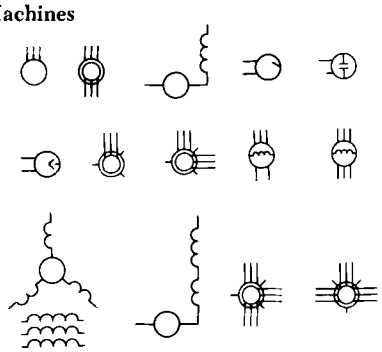
13.3 Winding Connection Symbols



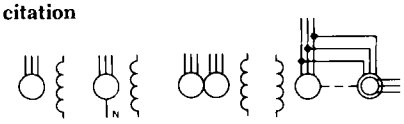
13.4 Applications: Direct-Current Machines



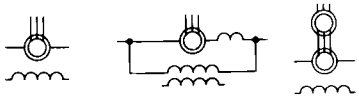
13.5 Applications: Alternating-Current Machines



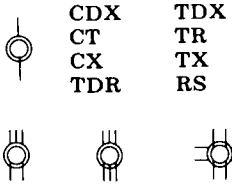
13.6 Applications: Alternating-Current Machines with Direct-Current Field Excitation



13.7 Applications: Alternating- and Direct-Current Composite



13.8 Synchro

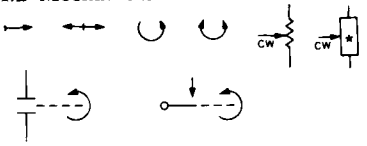


CDX	TDX
CT	TR
CX	TX
TDR	RS

14. Mechanical Functions

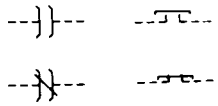
14.1 Mechanical Connection
Mechanical Interlock

14.2 Mechanical Motion



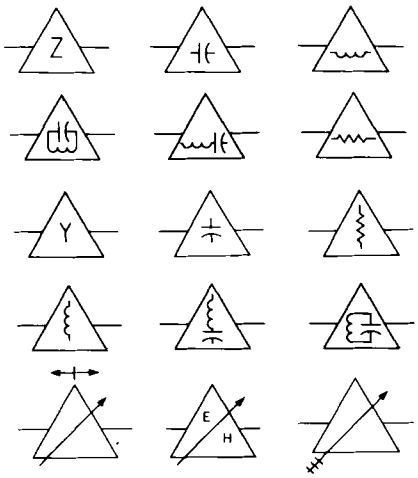
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14.3 Clutch
Brake

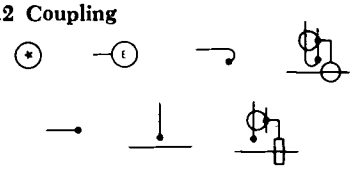


15. Commonly Used in Connection with VHF, UHF, SHF Circuits

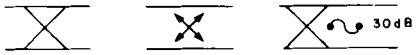
15.1 Discontinuity



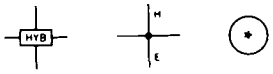
15.2 Coupling



15.3 Directional Coupler



15.4 Hybrid
Directionally Selective
Transmission Devices



15.5 Mode Transducer

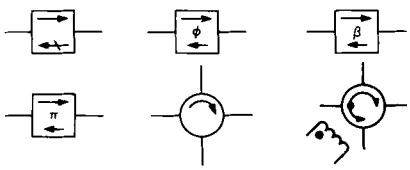


15.6 Mode Suppression

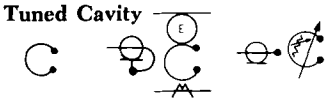
15.7 Rotary Joint



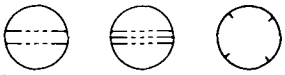
15.8 Non-reciprocal devices



15.9 Resonator
Tuned Cavity



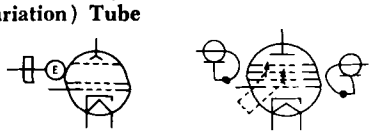
15.10 Resonator (Cavity Type) Tube



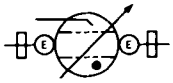
15.11 Magnetron



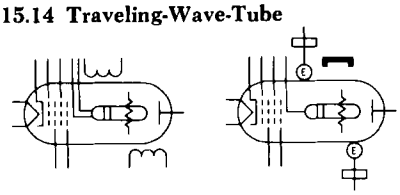
15.12 Velocity-Modulation (Velocity-Variation) Tube



15.13 Transmit-Receive (TR) Tube



15.14 Traveling-Wave-Tube



15.15 Balun



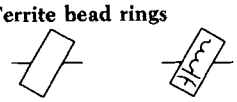
15.16 Filter



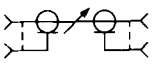
15.17 Phase shifter



15.18 Ferrite bead rings



15.19 Line stretcher



16. Composite Assemblies

16.1 Circuit assembly
Circuit subassembly
Circuit element

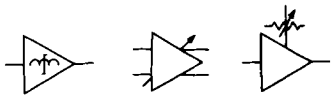


EQ	FL-BP	RG	TPR
FAX	FL-HP	RU	TTY
FL	FL-LP	DIAL	CLK
FL-BE	PS	TEL	IND
ST-INV			

16.2 Amplifier



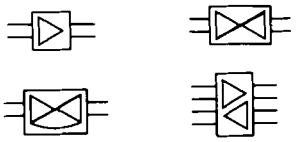
BDG	EXP	PRE
BST	LIM	PWR
CMP	MON	TRQ
DC	PGM	



16.3 Rectifier



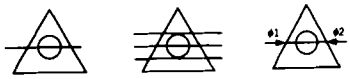
16.4 Repeater



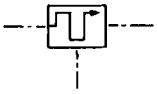
16.5 Network



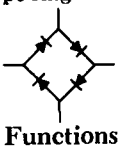
16.6 Phase Shifter
Phase-Changing Network



16.7 Chopper

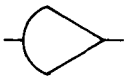


16.8 Diode-type ring demodulator
Diode-type ring modulator

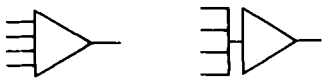


17. Analog Functions

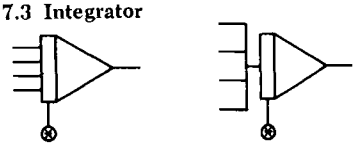
17.1 Operational Amplifier



17.2 Summing Amplifier



17.3 Integrator



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17.4 Electronic Multiplier



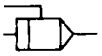
17.5 Electronic Divider



17.6 Electronic Function Generator



17.7 Generalized Integrator



17.8 Positional Servo-mechanism



17.9 Function Potentiometer

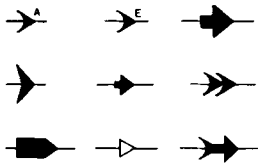


18. Digital Logic Functions

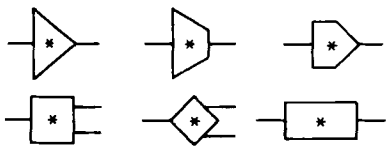
18.1 Digital Logic Functions
(See cross references)

19. Special Purpose Maintenance Diagrams

19.1 Data flow code signals

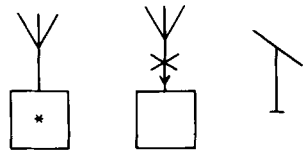


19.2 Functional symbols

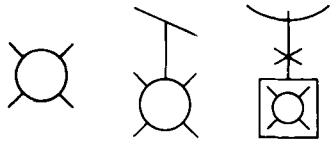


20. System Diagrams, Maps and Charts

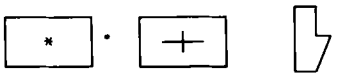
20.1 Radio station



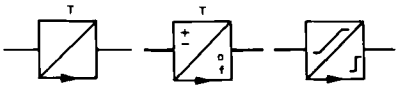
20.2 Space station



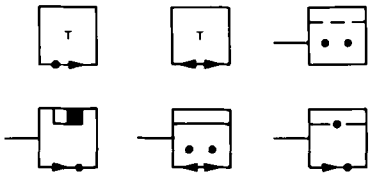
20.3 Exchange equipment



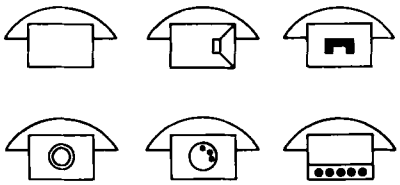
20.4 Telegraph repeater



20.5 Telegraph equipment



20.6 Telephone set

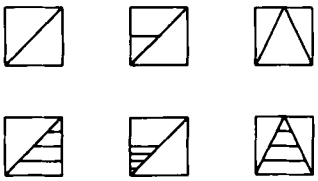


21. System Diagrams, Maps and Charts

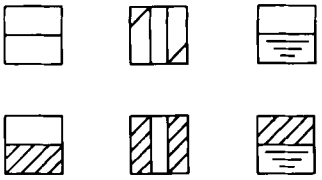
21.1 Generating station



21.2 Hydroelectric generating station



21.3 Thermoelectric generating station



21.4 Prime mover



21.5 Substation



22. Class Designation Letters

A	E	K	Q	TR
AR	EQ	L	R	U
AT	F	LS	RE	V
B	FL	M	RT	VR
BT	G	MG	RV	W
C	H	MK	S	WT
CB	HP	MP	SQ	X
CP	HR	MT	SR	Y
CR	HS	N	T	Z
DC	HT	P	TB	
DL	HY	PS	TC	
DS	J	PU	TP	

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Introduction

INTRODUCTION
A1.1 to
A4.1.2

A1. Scope

A1.1 Purpose. This standard provides a list of graphic symbols and class designation letters for use on electrical and electronics diagrams.

A1.2 Definition and Use. Graphic symbols for electrical engineering are a shorthand used to show graphically the functioning or interconnections of a circuit. A graphic symbol represents the *function* of a part in the circuit.[1] Graphic symbols are used on single-line (one-line) diagrams, on schematic or elementary diagrams, or, as applicable, on connection or wiring diagrams. Graphic symbols are correlated with parts lists, descriptions, or instructions by means of designations.

The class designation letter portion of a reference designation is for the purpose of identifying an item by category or class, using a class letter as defined in Section 22 of this standard. The assignment of the reference designation should be in accordance with American National Standard Reference Designations for Electrical and Electronics Parts and Equipment, Y32.16-1968 and Supplement No. 1.

A2. Arrangement

A2.1 Indexing, Grouping, and Standard Item Names. All terms appear in the Index. In the index, "Item" refers to a numbered paragraph in the list of symbols. Items are arranged sectionally in family groups by general type. Terms in preferred usage and current alternatives are listed. [F] indicates item names from the Federal Item Identification Guide, Cataloging Handbook H6-1 (published by the Defense Supply Agency, Defense Logistics Services Center, Battle Creek, Michigan).

A2.2 Significance of Columnar Placement of Symbols. In the list, graphic symbols appear under their respective family names. Symbols for single-line (one-line) diagrams appear at the left in each column; symbols for complete diagrams appear at the right. Symbols suitable for all types of diagrams appear in the center.

Symbols appearing only at the right may be used on one-line diagrams provided connections are restricted to main signal paths. Symbols appearing at the left may be used for other diagrams provided all connections are shown and adequate notations are included, if needed.

[1] For example, when a lamp is employed as a nonlinear resistor, the nonlinear resistor symbol is used. For reference designation information, see Section 22 of this standard.

A2.3 IEC Identification. Symbols and buildups using symbols that have been recommended by the International Electrotechnical Commission are indicated by [IEC].

A2.4 Alternative Symbols. When alternative symbols are shown, the relative position of the symbols does not imply a preference; however, alternative symbols identified as [IEC] are recommended.

A3. Application

A3.1 Generation of Symbols Not Shown (Buildups). An application is an example of a combination of symbols in the list. No attempt has been made to list all possible applications (buildups); typical applications usually have been shown using only one of the possible alternatives. Additional applications may be devised using basic symbols in the list to complete the buildup, provided they are a reasonable and intelligible use of the symbols. If a specific symbol appears in this standard for an item, however, it shall be used in lieu of buildup symbols of the individual elements unless a clarification of the internal operation of the item is necessary.

A3.2 Qualifying Symbols (Section 1). Qualifying symbols may be added to symbols if the special characteristic is important to the function of the device and aids in the understanding of the over-all function performed. When the special characteristic represented by the qualifying symbol is not important to the over-all function performed, the qualifying symbol may be omitted from the buildup symbols which appear in this standard, provided the absence of the qualifying symbol will not change the identity of the item. For example, see symbol 2.1.12.1.1.

A3.3 Application Data Reference. For application of these symbols on electrical diagrams, see American National Standard Drafting Practices (Electrical and Electronics Diagrams), Y14.15-1966.

A4. Drafting Practices Applicable to Graphic Symbols

A4.1 Definitions

A4.1.1 ***Single-Line (One-Line) Diagram.*** A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

A4.1.2 ***Schematic or Elementary Diagram.*** A diagram which shows, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. The schematic

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INTRODUCTION
A4.1.3 to
A4.12

diagram facilitates tracing the circuit and its functions without regard to the actual physical size, shape, or location of the component device or parts.

A4.1.3 ***Symbol.*** A symbol shall be considered as the aggregate of all its parts.

A4.2 Orientation. Except where noted, the orientation of a symbol on a drawing, including a mirror-image presentation, does not alter the meaning of the symbol. Letters and numbers that constitute a part of a symbol shall not be presented in mirror-image form.

A4.3 Line Width. The width of a line does not affect the meaning of the symbol. In specific cases, a wider (heavier) line may be used for emphasis.

A4.4 Enlargement or Reduction. A symbol may be drawn to any proportional size that suits a particular drawing, depending on reduction or enlargement anticipated. If essential for purposes of contrast, some symbols may be drawn relatively smaller than the other symbols on a diagram. It is recommended that only two sizes be used on any one diagram.

A4.5 Relative Symbol Size.[2] The symbols shown in this edition of the standard are in their correct relative size. This relationship shall be maintained as nearly as possible on any particular drawing, regardless of the size of the symbol used.

A4.6 Arrowheads. The arrowhead of a symbol may be closed → or open → unless otherwise noted in this standard.

A4.7 Terminal Symbols. The standard symbol for a TERMINAL (o) may be added to each point of attachment of connecting lines to any one of the graphic symbols. Such added terminal symbols should not be considered as part of the individual graphic symbol, unless the terminal symbol is included in the symbol shown in this standard.

A4.8 Correlation of Symbol Parts. For simplification of a diagram, parts of a symbol for a device, such as a relay or contactor, may be separated. If this is done, provide suitable designations to show proper correlation of the parts.

A4.9 Angle of Connecting Lines. In general, the angle at which a connecting line is brought to a graphic symbol has no particular significance unless otherwise noted or shown in this standard.

A4.10 Future or Associated Paths and Equipment. Associated or future paths and equipment shall be shown by lines composed of short dashes:– – –. For example:



A4.11 Envelope or Enclosure.

A4.11.1 The envelope or enclosure symbol shall be used:

(a) If the enclosure has an essential operating function, as in an electron tube, solion, switch in an evacuated envelope, etc.

(b) If the device envelope is electrically connected to one of the device elements and this is an essential (not merely incidental) functional property of the device.

A4.11.2 The envelope or enclosure symbol should be used:

(a) To emphasize that certain symbols having nonconnected lines are a single assembly (for example, see symbol 8.6.10.5).

(b) If it is desired to distinguish a class of devices, such as transistors or semiconductor controlled rectifiers, from other devices (but this should be consistent for all devices of the same class on any one diagram).

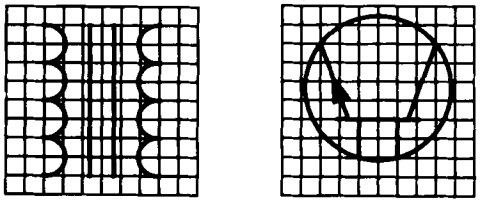
(c) To associate the parts of symbols having adjacent characteristic qualifiers (for example: t°, τ, ω, ×).

A4.11.3 The envelope or enclosure symbol may be omitted:

From a symbol referencing this paragraph, where confusion would not result (but this should be consistently applied to all symbols of the same class in any one diagram).

A4.12 Addition of Supplementary Data. Details of type, impedance, rating, etc, may be added adjacent to any symbol, when required. If used, abbreviations should be from American National Standard Abbreviations for Use on Drawings, Z32.13-1950. For military applications, see Section 23. Letter combinations used as parts of graphic symbols are not abbreviations or designations.

[2] The symbols shown in this edition of the standard are larger in size than those shown in the 1967 edition. All of the symbols have been prepared so that the connection points are located at intersections of a modular (incremental) grid.



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INFORMATION
REQUEST

Recommendations for corrections and additions to or deletions from this standard should be sent to the Secretary, IEEE Standards Committee, Institute of Electrical and Electronics Engineers, 345 East 47 Street, New York, N.Y. 10017, and should include the following:

(1) Requestor (name, address, affiliation)

(2) Reason for (and urgency of) request

(3) Item name—list all known names for the item, including tradenames (include Federal Item Identification Guide, Handbook H6-1, listing if applicable)

(4) Item definition (list source documents)

(5) Symbols currently in use or known to be used (single-line/schematic/both)

(6) Proposed symbol

(7) Reference designation class designation letter

(8) Areas of application (military/industry/commercial)

(9) Fields of application (computer/power/radio, etc)

(10) Circuit application (amplifier/rectifier/flip-flop, etc)

(11) Hardware characteristics (microcircuit/conventional, etc)

(12) Present and anticipated frequency of use (per circuit/per equipment/in general)

(13) Copy of drawing showing use of symbol

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Qualifying Symbols

SECTION 1
1.1 to
1.5.2

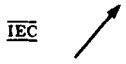
1.1 Adjustability Variability

These recognition symbols shall be drawn at about 45 degrees across the body of the symbol to which they are applied. For typical applications, see symbols 2.1.5, 2.2.4, 2.4.4, and 16.2.5.

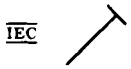
Use only if essential to indicate special property.

1.1.1 Adjustability (extrinsic adjustability)

1.1.1.1 General



1.1.1.2 Preset, general



1.1.1.3 Linear (shown applied to 1.1.1.1)

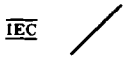


1.1.1.4 Nonlinear (shown applied to 1.1.1.1)

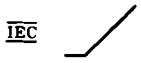


1.1.2 Inherent variability (intrinsic variability)

1.1.2.1 Linear



1.1.2.2 Nonlinear



1.1.3 Special features (shown applied to the general adjustability symbol)

1.1.3.1 Continuous

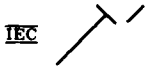


1.1.3.2 In steps

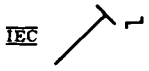


1.1.4 Special features (shown applied to the general preset symbol)

1.1.4.1 Continuous



1.1.4.2 In steps



1.2 Special-Property Indicators

A special function or property essential to circuit operation shall be indicated by a supplementary symbol placed within the envelope or adjacent to the symbol.

NOTE 1.2A: Basic symbols (such as resistor, capacitor, inductor, piezoelectric crystal, etc) may be used as qualifying symbols to other symbols for purposes of indicating special properties of the device.

1.2.1 Temperature dependence



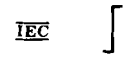
1.2.2 Magnetic-field dependence



1.2.3 Storage (Greek letter tau)

1.2.4 Saturable properties (general)

May be drawn between or across two or more windings (see symbol 6.3.1) which are magnetically coupled by a saturable core.



1.3 Radiation Indicators (Electromagnetic and Particulate)

Use only if essential to indicate special property.

NOTE 1.3A: Sensitivity indicator—If the arrows point toward the associated symbol, the principal characteristic of that element is designed to vary primarily under the influence specified.

NOTE 1.3B: Emissivity indicator—If the arrows point away from the associated symbol, the principal characteristic of that element is emission of the radiation specified.

1.3.1 Nonionizing electromagnetic radiation (such as radio waves, infrared, visible, or ultraviolet light)

1.3.1.1 Sensitivity indicator



1.3.1.2 Emissivity indicator



1.3.2 Ionizing electromagnetic radiation (such as X-rays and gamma rays)

1.3.2.1 Sensitivity indicator



1.3.2.2 Emissivity indicator



1.3.3 Ionizing particulate radiation

This radiation includes charged particles such as high-energy electrons (for example, beta rays), alpha rays, and protons; also neutral particles, such as neutrons and neutral mesons.

1.3.3.1 Sensitivity indicator



1.3.3.2 Emissivity indicator



1.4 Physical-State Recognition Symbols

NOTE 1.4A: The rectangle is not part of the symbol.

1.4.1 Gas (air); pneumatic



See Note 1.4A

1.4.2 Liquid



See Note 1.4A

1.4.3 Solid



See Note 1.4A

1.4.4 Showing two or more states

Use only if essential to indicate special condition.

NOTE 1.4.4A: A combination of physical state recognition symbols indicates a material in more than one state. The relative sizes and locations of the recognition symbols indicate the normal or predominant state of the device.

NOTE 1.4.4B: Do not rotate or show in mirror-image form.

1.4.4.1 Application: Gaseous liquid



See Notes 1.4.4A and B

1.4.4.2 Application: Steam (or moist gas)



See Notes 1.4.4.A and B

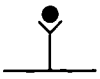
1.5 Test-Point Recognition Symbol

Used if necessary to emphasize test points.

1.5.1 General



1.5.2 Application: test-point recognition for a test jack



NOTES: 1. See Introduction for general information (note especially A3.1). 2. Symbols for single-line (one-line) diagrams appear at the left, symbols for complete diagrams at the right, and symbols suitable for both purposes are centered in each column.

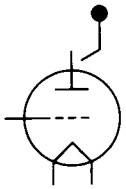
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Qualifying Symbols

SECTION 1
1.5.3 to
1.8.5

1.5.3 Application: test-point recognition for the plate of a triode



1.5.4 Application: test-point recognition for a circuit terminal



1.6 Polarity Markings

1.6.1 Positive

IEC +

1.6.2 Negative

IEC −

1.6.3 Instantaneous polarity markings

These polarity marks shall be used only when it is necessary to show the relative polarity of the windings.

NOTE 1.6.3A: Instantaneous polarity of voltage across windings corresponds at points indicated by polarity marks. Instantaneous direction of current into (or out of) one polarity mark corresponds to current out of (or into) the other polarity mark. If instantaneous currents enter the windings at the marked points, they will produce aiding fluxes.

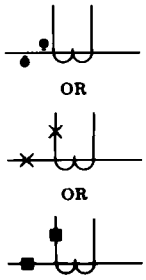
IEC ●
OR
×
OR
■

1.6.3.1 Application: instantaneous polarity markings with current transformer shown

NOTE 1.6.3.1A: The dots shall be placed near one end of each coil or winding symbol. The exact location is immaterial as long as they are unambiguously placed, especially where other windings are drawn nearby. There shall be only one polarity mark per winding, even if the winding is tapped. The following is NOT permitted:



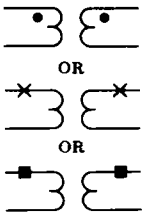
See Note 1.6.3.1A IEC



Avoid conflict with symbol 4.1 if used on the same diagram

1.6.3.2 Application: instantaneous polarity markings with potential transformer shown

See Note 1.6.3.1.A IEC



Avoid conflict with symbol 4.1 if used on the same diagram

1.7 Direction of Flow of Power, Signal, or Information

Avoid conflict with symbols 9.5, 9.5.2, and 9.5.4 if used on the same diagram

1.7.1 One-way

NOTE 1.7.1A: The lower symbol is used if it is necessary to conserve space. The arrowhead in the lower symbol shall be filled.

IEC →
OR
IEC →

See Note 1.7.1A

1.7.2 Either way (but not simultaneously)

IEC ↔
OR
IEC ↔

See Note 1.7.1A

1.7.3 Both ways, simultaneously

IEC
OR
IEC

See Note 1.7.1.A

Avoid conflict with symbol 9.2 if used on the same diagram

1.7.4 Application: one-way, general

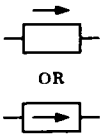
NOTE 1.7.4A: The "n" is not part of the symbol. A significant waveform, frequency, or frequency range shall be substituted for "n."

n →
OR
→ n
OR
n

See Note 1.7.4A

1.7.5 Application: one-way circuit element, general

NOTE 1.7.5A: In all cases, indicate the type of apparatus by appropriate words or letters in the rectangle.



See Note 1.7.5A

1.8 Kind of Current (General)

NOTE 1.8A: Use only if necessary for clarity.

1.8.1 Direct current

IEC —
OR
IEC ⎓

To be used in cases when other symbol is not suitable

1.8.2 Alternating current

IEC ∼

1.8.3 Alternating current, frequency ranges

Use only if necessary to distinguish among different frequency bands.

NOTE 1.8.3A: The "n" is not part of the symbol. The frequency range shall be substituted for "n."

NOTE 1.8.3B: Only one name for the unit of frequency (hertz or cycle per second) should be used on any one diagram.

1.8.3.1 Power frequencies

IEC ∼
OR
IEC ∼ n

See Notes 1.8.3.A and B

1.8.3.2 Audio frequencies

IEC ≈
OR
IEC ∼ n

See Notes 1.8.3A and B

1.8.3.3 Superaudio, carrier, and radio frequencies

IEC ≋
OR
IEC ∼ n

See Notes 1.8.3A and B

1.8.4 Direct or alternating current (universal)

IEC ≂

1.8.5 Undulating or rectified current

IEC ∿

NOTES: 1. See Introduction for general information (note especially A3.1). 2. Symbols for single-line (one-line) diagrams appear at the left, symbols for complete diagrams at the right, and symbols suitable for both purposes are centered in each column.

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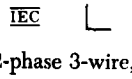
Qualifying Symbols

SECTION 1
1.9 to
1.11.2

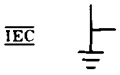
1.9 Connection Symbols

For use adjacent to the symbols; e.g., see **symbol 6.4**

1.9.1 2-phase 3-wire, ungrounded



1.9.1.1 2-phase 3-wire, grounded



1.9.2 2-phase 4-wire



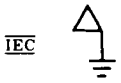
1.9.2.1 2-phase 5-wire, grounded



1.9.3 3-phase 3-wire, delta or mesh



1.9.3.1 3-phase 3-wire, delta, grounded



1.9.4 3-phase 4-wire, delta, ungrounded



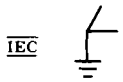
1.9.4.1 3-phase 4-wire, delta, grounded



1.9.5 3-phase, open-delta



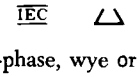
1.9.5.1 3-phase, open-delta, grounded at common point



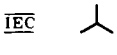
1.9.5.2 3-phase, open-delta, grounded at middle point of one winding



1.9.6 3-phase, broken-delta

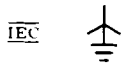


1.9.7 3-phase, wye or star, ungrounded



1.9.7.1 3-phase, wye, grounded neutral

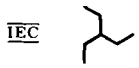
The direction of the stroke representing the neutral can be chosen arbitrarily.



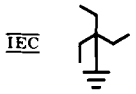
1.9.8 3-phase 4-wire, ungrounded



1.9.9 3-phase, zigzag, ungrounded



1.9.9.1 3-phase, zigzag, grounded



1.9.10 3-phase, Scott or T



1.9.11 6-phase, double-delta



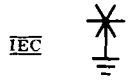
1.9.12 6-phase, hexagonal (or chordal)



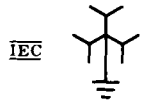
1.9.13 6-phase, star (or diametrical)



1.9.13.1 6-phase, star, with grounded neutral



1.9.14 6-phase, double zigzag with neutral brought out and grounded



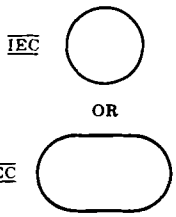
1.10 Envelope Enclosure

The general envelope symbol identifies the envelope or enclosure regardless of evacuation or pressure. When used with electron-tube component symbols, the general envelope symbol indicates a vacuum enclosure unless otherwise specified. A gas-filled device may be indicated by a dot within the envelope symbol.

See paragraph A4.11.1 of the Introduction

NOTE 1.10A: The shape of the envelope symbol may be modified to approximate the distinctive shape of a device if the shape will aid in recognition of the device, or in depicting the device function, e.g., cathode-ray tube, iconoscope, image orthicon, vidicon, X-ray tube, etc. For typical applications, see symbols 7.3.6.1 and 7.3.6.2.2.

1.10.1 General



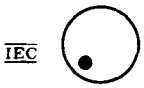
1.10.2 Split envelope

If necessary, envelope may be split.



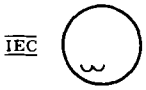
1.10.3 Application: gas-filled envelope

The gas-recognition symbol (dot) may be located as convenient. See symbol 1.4.1



1.10.4 Application: liquid-filled envelope

The liquid-recognition symbol may be located as convenient. See symbol 1.4.2



1.11 Shield Shielding

Normally used for electric or magnetic shielding.

When used for other shielding, a note should so indicate. For typical applications see

CAPACITOR (symbol 2.2.3)
TRANSMISSION PATH (symbols 3.1.8.1, 3.1.8.2, and 3.1.8.3)
TRANSFORMER (symbols 6.4.2.2 and 6.4.2.3)

1.11.1 General

These are long dashes.

1.11.2 Optical

Cross References

See also Section 19.

NOTES: 1. See Introduction for general information (note especially A3.1). 2. Symbols for single-line (one-line) diagrams appear at the left, symbols for complete diagrams at the right, and symbols suitable for both purposes are centered in each column.

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Graphic Symbols for Fundamental Items (not included in other sections)

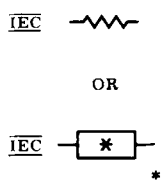
SECTION 2
2.1 to
2.2.1

2.1 Resistor

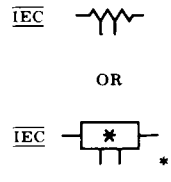
For resistors with nonlinear characteristics, see also BALLAST LAMP (symbol 11.1.5)

NOTE 2.1A: The asterisk is not part of the symbol. Always add identification within or adjacent to the rectangle.

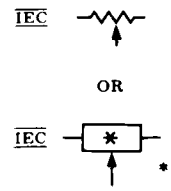
2.1.1 General



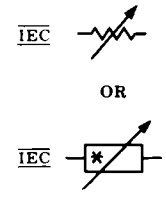
2.1.2 Tapped resistor



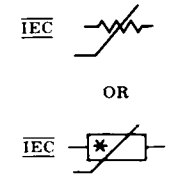
2.1.3 Application: with adjustable contact. See also symbol 14.2.5



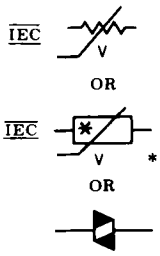
2.1.4 Application: adjustable or continuously adjustable (variable) resistor F ; rheostat



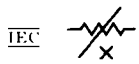
2.1.5 Nonlinear resistor (intrinsic)



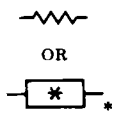
2.1.6 Symmetrical varistor (intrinsic); voltage-sensitive resistor F (silicon carbide, etc)



2.1.7 Magnetoresistor (intrinsic) (linear type shown)



2.1.8 Heating resistor

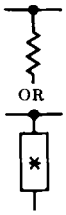


2.1.9 Instrument or relay shunt

Connect instrument or relay to terminals in the rectangle

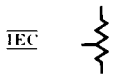


2.1.10 Shunt resistor



2.1.11 Resistive termination

Commonly used in coaxial and waveguide diagrams.



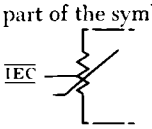
2.1.11.1 Application: series resistor and path open



2.1.11.2 Application: series resistor and path short-circuited



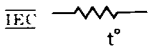
2.1.11.3 Bolometer element (– — – lines indicate direct-current connections and are not part of the symbol)



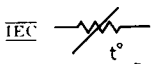
2.1.12 Thermistor; thermal resistor F; temperature-sensing element

NOTE 2.1.12A: Use only if essential to indicate special property.

2.1.12.1 General

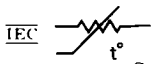


2.1.12.1.1 Linear



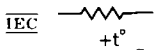
See Note 2.1.12A

2.1.12.1.2 Nonlinear



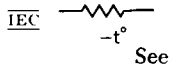
See Note 2.1.12A

2.1.12.1.3 Positive temperature coefficient



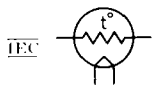
See Note 2.1.12A

2.1.12.1.4 Negative temperature coefficient

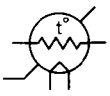


See Note 2.1.12A

2.1.12.2 With independent integral heater

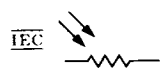


2.1.12.2.1 Nonlinear



See Note 2.1.12A

2.1.13 Symmetrical photoconductive transducer (resistive)



2.2 Capacitor

2.2.1 General

If it is necessary to identify the capacitor electrodes, the curved element shall represent the outside electrode in fixed paper-dielectric and ceramic-dielectric ca-

NOTES: 1. See Introduction for general information (note especially A3.1). 2. Symbols for single-line (one-line) diagrams appear at the left, symbols for complete diagrams at the right, and symbols suitable for both purposes are centered in each column.

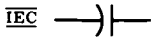
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Full document details: 315 -1971 - IEEE Standard and American National Standard for Electrical and Electronics Diagrams (Including Reference Designation cl...

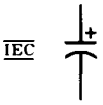
Graphic Symbols for Fundamental Items (not included in other sections)

SECTION 2
2.2.2 to
2.3.2

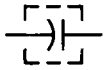
pacitors, the moving element in adjustable and variable capacitors, and the low-potential element in feed-through capacitors.



2.2.2 Polarized capacitor

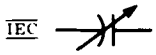


2.2.3 Shielded capacitor

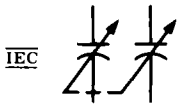


2.2.4 Adjustable or variable capacitor

If it is necessary to identify trimmer capacitors, the letter T should appear adjacent to the symbol.

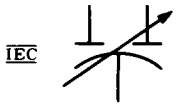


2.2.5 Application: adjustable or variable capacitors with mechanical linkage of units

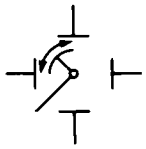


2.2.6 Continuously adjustable or variable differential capacitor

The capacitance of one part increases as the capacitance of the other part decreases.

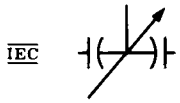


2.2.7 Phase-shifter capacitor



2.2.8 Split-stator capacitor

The capacitances of both parts increase simultaneously.



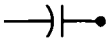
2.2.9 Shunt capacitor



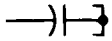
2.2.10 Capacitive termination

Commonly used on coaxial and waveguide diagrams.

2.2.10.1 Application: series capacitor and path open



2.2.10.2 Application: series capacitor and path short-circuited



2.2.11 Coupling capacitor (for power-line carrier)

NOTE 2.2.11A: The asterisk is not part of the symbol. If specific identification is desired, the asterisk is to be replaced by one of the following letter combinations:

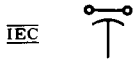
COM	Carrier communication
LC	Carrier load control
REL	Carrier relaying
SUP	Carrier supervisory
TLM	Carrier telemetering
TT	Carrier transferred trip



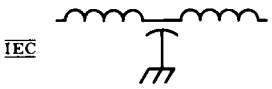
*See Note 2.2.11A

2.2.12 Feed-through capacitor (with terminals shown on feed-through element for clarity)

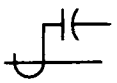
Commonly used for bypassing high-frequency currents to chassis.



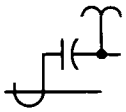
2.2.13 Application: feed-through capacitor between 2 inductors with third lead connected to chassis



2.2.14 Capacitor bushing for circuit breaker or transformer

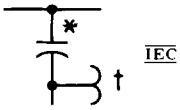


2.2.15 Application: capacitor-bushing potential device



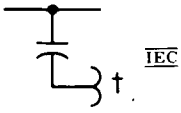
2.2.16 Application: carrier-coupling capacitor potential device (used to provide a power-system-frequency voltage and also coupling for carrier signals)

NOTE 2.2.16A: The dagger is not part of the symbol. If specific indication is desired, the dagger is to be replaced by a letter combination from item 12.1, Note 12.1A.



*See Note 2.2.11A
†See Note 2.2.16A

2.2.17 Application: coupling capacitor potential device (used only to provide a power-system-frequency voltage)



†See Note 2.2.16A

2.3 Antenna

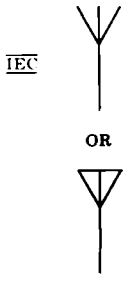
2.3.1 General

Types or functions may be indicated by words or abbreviations adjacent to the symbol.

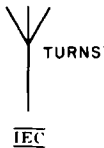
Qualifying symbols may be added to the antenna symbol to indicate polarization, direction of radiation, or special application.

If required, the general shape of the main lobes of the antenna polar diagrams may be shown adjacent to the symbol. Notes may be added to show the direction and rate of lobe movement.

The stem of the symbol may represent any type of balanced or unbalanced feeder, including a single conductor.



2.3.1.1 Application: turnstile antenna



2.3.2 Dipole



NOTES: 1. See Introduction for general information (note especially A3.1). 2. Symbols for single-line (one-line) diagrams appear at the left, symbols for complete diagrams at the right, and symbols suitable for both purposes are centered in each column.

Documents
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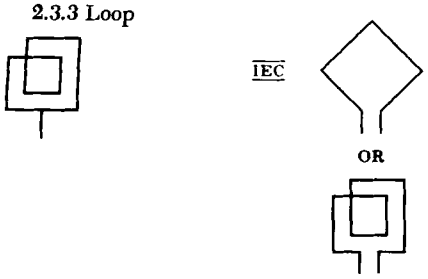
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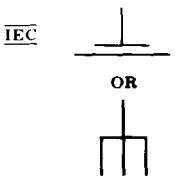
Graphic Symbols for Fundamental Items (not included in other sections)

SECTION 2
2.3.3 to
2.4.6

2.3.3 Loop



2.3.4 Antenna counterpoise F



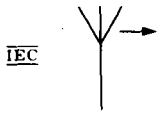
2.3.5 Qualifying symbols to indicate polarization

Use only if essential to indicate special property of an antenna.

2.3.5.1 Plane polarization



2.3.5.2 Application: antenna with horizontal polarization



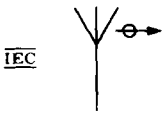
2.3.5.3 Application: antenna with vertical polarization



2.3.5.4 Circular polarization



2.3.5.5 Application: antenna with circular polarization



2.3.6 Qualifying symbols to indicate direction of radiation

Use only if essential to indicate special property of an antenna.

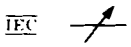
NOTE 2.3.6A: Any applicable adjustability symbol (item 1.1) may be used to supplement a qualifying symbol.

NOTE 2.3.6B: Antenna rotation can be accomplished by electromechanical or electronic means.

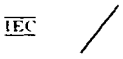
2.3.6.1 Fixed in azimuth



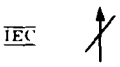
2.3.6.2 Adjustable in azimuth



2.3.6.3 Fixed in elevation



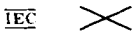
2.3.6.4 Adjustable in elevation



2.3.6.5 Fixed in azimuth and elevation



2.3.6.6 Direction finder, radio goniometer or beacon



2.3.6.7 Rotation

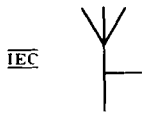
See symbols 14.2.3, 14.2.4; see Note 2.3.6.B

2.3.6.8 Alternating or reciprocating



2.3.7 Application: antenna with qualifying symbols and notes

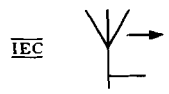
2.3.7.1 Antenna with direction of radiation fixed in azimuth



2.3.7.2 Antenna with direction of radiation adjustable in azimuth



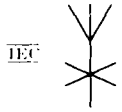
2.3.7.3 Antenna with direction of radiation fixed in azimuth, horizontal polarization



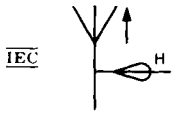
2.3.7.4 Antenna with adjustable directivity in elevation



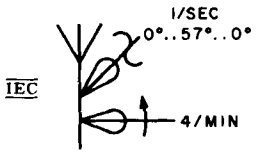
2.3.7.5 Direction finding, radio goniometer, or radio beacon antenna



2.3.7.6 Antenna with direction of radiation fixed in azimuth, vertically polarized, with horizontal polar diagram



2.3.7.7 Radar antenna, rotating 4 times per minute in azimuth and reciprocating in elevation, 0° to 57° to 0° in one second



See Note 2.3.6B

2.4 Attenuator

2.4.1 Fixed attenuator F ; pad (general)



2.4.2 Balanced, general



2.4.3 Unbalanced, general



2.4.4 Variable attenuator F (general)



2.4.5 Balanced, general



2.4.6 Unbalanced, general



NOTES: 1. See Introduction for general information (note especially A3.1). 2. Symbols for single-line (one-line) diagrams appear at the left, symbols for complete diagrams at the right, and symbols suitable for both purposes are centered in each column.

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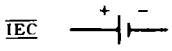
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Full document details: 315 -1971 - IEEE Standard and American National Standard for Electrical and Electronics Diagrams (Including Reference Designation cl...

Graphic Symbols for Fundamental Items (not included in other sections)

2.5 Battery

The long line is always positive, but polarity may be indicated in addition. Example:

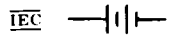


2.5.1 Generalized direct-current source

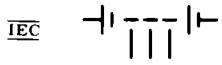
2.5.2 One cell



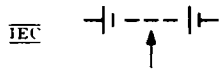
2.5.3 Multicell



2.5.4 Multicell battery with 3 taps



2.5.5 Multicell battery with adjustable tap

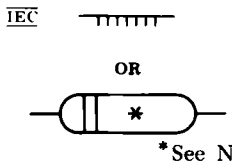


2.6 Delay Function
Delay Line F
Slow-Wave Structure

2.6.1 General

NOTE 2.6.1A: Length of delay may be indicated. Asterisk is not part of symbol.

NOTE 2.6.1B: The two vertical lines indicate input side.



*See Note 2.6.1A

2.6.2 Tapped delay function



*See Note 2.6.1A

2.6.3 Bifilar slow-wave structure

Commonly used in traveling-wave tubes.

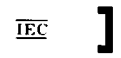


*See Note 2.6.1A

2.7 Oscillator
Generalized Alternating-Current Source

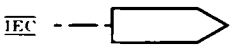


2.8 Permanent Magnet F

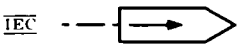


2.9 Pickup
Head

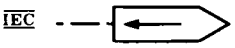
2.9.1‡ General



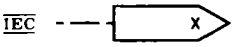
2.9.2‡ Writing; recording; head, sound-recorder F



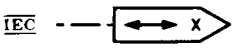
2.9.3‡ Reading; playback; head, sound-reproducer F



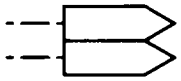
2.9.4‡ Erasing; magnetic eraser F



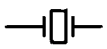
2.9.5‡ Application: writing, reading, and erasing



2.9.6‡ Stereo

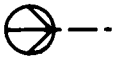


2.10 Piezoelectric Crystal Unit (including Crystal Unit, Quartz F **)**



2.11‡ Primary Detector
Measuring transducer

See also HALL GENERATOR (item 8.9) and THERMAL CONVERTER (item 12.1)



2.12 Squib, Electric F

2.12.1 Explosive



2.12.2 Igniter



2.12.3 Sensing link; fusible link, ambient-temperature operated

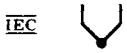
‡ The broken line - — - indicates where line connection to a symbol is made and is not part of the symbol.

Avoid conflict with symbol 3.6.4 if used on the same diagram



2.13 Thermocouple (dissimilar-metals device)

2.13.1 Temperature-measuring



2.13.2 Current-measuring

NOTE 2.13.2A: Explanatory words and arrows are not part of the symbols shown.

2.13.2.1 With integral heater internally connected



See Note 2.13.2A

2.13.2.2 With integral insulated heater

See paragraph A4.11 of the introduction



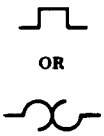
See Note 2.13.2A

2.13.3 Thermopile



2.14 Thermal Element
Thermomechanical Transducer

Actuating device, self-heating or with external heater. (Not operated primarily by ambient temperature.) See item 9.1 for fuses, one-time devices. See item 4.30.5 for thermally operated relay.



2.15 Spark Gap
Igniter Gap

USE SYMBOL 9.3.1

Cross References

Semiconductor Thermocouple (item 8.8)

NOTES: 1. See Introduction for general information (note especially A3.1). 2. Symbols for single-line (one-line) diagrams appear at the left, symbols for complete diagrams at the right, and symbols suitable for both purposes are centered in each column.

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Graphic Symbols for Transmission Path

SECTION 3
3.1 to
3.1.9

3.1 Transmission Path
Conductor
Cable
Wiring

3.1.1 Guided path, general

A single line represents the entire group of conductors or the transmission path needed to guide the power or signal. For coaxial and waveguide work, the recognition symbol is used at the beginning and end of each kind of transmission path and at intermediate points as needed for clarity. In waveguide work, mode may be indicated. IEC

When required, the length between two significant points may be indicated, e.g., $\lambda/4$. IEC

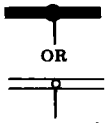
When required, details of structure (e.g., elbow), type, impedance, ratings, etc, may be added adjacent to or within any symbol or in a note. IEC

See also item 3.2.1

IEC

3.1.1.1 Bus bar (with connections shown)

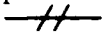
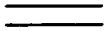
Use only if essential to distinguish bus from other circuit paths.



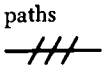
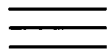
3.1.2 Conductive path or conductor; wire

IEC

3.1.2.1 Two conductors or conductive paths

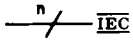
 IEC IEC 

3.1.2.2 Three conductors or conductive paths

 IEC IEC 

3.1.2.3 "n" conductors or conductive paths

NOTE 3.1.2.3A: The "n" is not part of the symbol. A number representing the actual number of paths shall be substituted for "n".



IEC "n" conductors
OR
Draw individual paths

See Note 3.1.2.3A

3.1.3 Air or space path

See also symbol 3.2.6



3.1.4 Dielectric path other than air

Commonly used for coaxial and waveguide transmission.

3.1.5 Crossing of paths or conductors not connected

The crossing is not necessarily at a 90-degree angle.

IEC 

3.1.6 Junction of paths or conductors

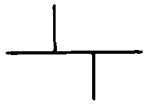
3.1.6.1 Junction (if desired)

IEC

3.1.6.2 Application: junction of paths, conductors, or cables. If desired, indicate path type, or size

IEC

3.1.6.3 Application: junction of connected paths, conductors, or wires

IEC 

OR

IEC 

OR ONLY IF REQUIRED
BY LAYOUT CONSIDERATIONS

IEC 

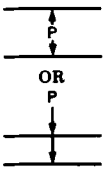
For microwave circuits, the type of coupling, power-division proportions, reflection coefficients, plane of junction, etc., may be indicated if desired.

3.1.6.4 Splice (if desired) of same size cables. Junction of conductors of same size or different size cables. If desired, indicate sizes of conductors

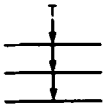


3.1.7 Associated conductors

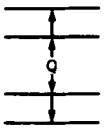
3.1.7.1 Pair (twisted unless otherwise specified)



3.1.7.2 Triple (twisted unless otherwise specified)



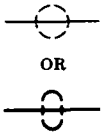
3.1.7.3 Quad



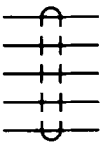
3.1.8 Assembled conductors; cable

Commonly used in communication diagrams.

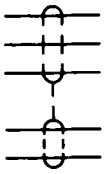
3.1.8.1 Shielded single conductor

IEC 

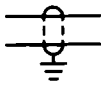
3.1.8.2 Application: shielded 5-conductor cable



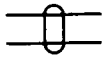
3.1.8.3 Application: shielded 5-conductor cable with conductors separated on the diagram for convenience



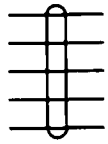
3.1.8.4 Application: shielded 2-conductor cable with shield grounded



3.1.8.5 2-conductor cable

IEC 

3.1.8.6 Application: 5-conductor cable

IEC 

3.1.9‡ Coaxial cable, recognition symbol; coaxial transmission path; radio-frequency cable F (coaxial)

‡ The broken line - — - indicates where the outer conductor connection to a symbol is made and is not part of the symbol.

NOTES: 1. See Introduction for general information (note especially A3.1). 2. Symbols for single-line (one-line) diagrams appear at the left, symbols for complete diagrams at the right, and symbols suitable for both purposes are centered in each column.

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