INTERNATIONAL RADIO CONSULTATIVE COMMITTEE

C.C.I.R.

GENEVA, 1972

REPORT 440-1

GENERAL GRAPHICAL SYMBOLS

FOR RADIOCOMMUNICATIONS

Published by the

INTERNATIONAL TELECOMMUNICATION UNION

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CONTENTS

INTRODUCTION

This Report contains the graphical symbols adopted as C.C.I.R. symbols when the Report 440 was revised at the interim meeting in Geneva, 1972.

The symbols were devised by the Joint Working Group on graphical symbols for telecommunications consisting of representatives of the International Electrotechnical Commission (IEC), the International Telephone and Telegraph Consultative Committee (C.C.I.T.T.) and the International Radio Consultative Committee (C.C.I.R.). The agreement of the C.C.I.R. to take part in this Joint Working Group appears in C.C.I.R. Resolution 23 (Volume III, XIIth Plenary Assembly, New Delhi 1970).

In view of the length of this Report, the XIIth Plenary Assembly asked that it form a separate publication. The Geneva 1972 edition is therefore also published separately.

Since the 1970 edition of this Report has been considerably amplified and the additions affect its various chapters, it was thought more practical to recast the Report entirely. This 1972 edition contains all the symbols approved to date in their proper place within the different chapters.

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ELEMENTS OF ELECTRONIC TUBES,

VALVES AND RECTIFIERS*

SYMBOLS TAKEN FROM AMENDMENT No. 1

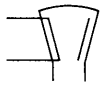
TO PUBLICATION 117-6 OF THE IEC

(Variability, examples of resistors, elements of electronic tubes, valves and rectifiers)

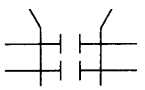
* IEC Publication 117-6 can be consulted for symbols relating to elements of electronic tubes, valves and rectifiers.

IEC Publication 117-7 can be consulted for symbols relating to semiconductor devices.

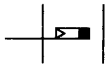
ENVELOPES

No.	Symbol	Description
524 A		Envelope with internal conductive coating.
524 B		Envelope with internal conductive coating with graded potential.
524 C		Envelope with external screen (U.S.A.: external shield).

GRIDS, DEFLECTING, FOCUSING AND MISCELLANEOUS DEVICES

No.	Symbol	Description
543 A		Beam-splitting electrode, shown in the example as internally connected to the final focusing electrode of the electron gun.
546 A		Electrostatic deflecting system. *Note.* – The pairs of deflecting plates may be labelled e.g. X horizontal and Y vertical.

ELEMENTS OF TELEVISION CAMERA TUBES

No.	Symbol	Description
553		Photo-emissive electrode, e.g., for a television camera tube.
554		Storage electrode, e.g., of a television camera tube or of a storage tube.
555		Photo-emissive storage electrode, e.g., of a television camera tube or of a storage tube.
556		Storage electrode with secondary emission in the direction of the arrow, e.g., of a television camera tube or of a storage tube.
557		Photo-conductive storage electrode, e.g., of a television camera tube.

EXAMPLES OF ELECTRONIC TUBES,

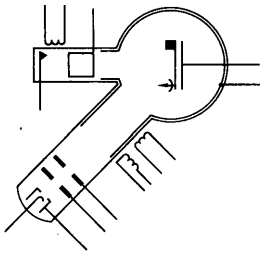
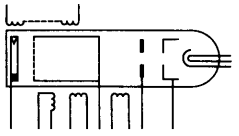
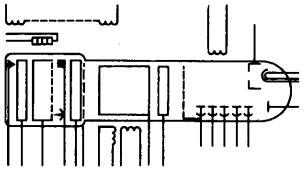
VALVES AND RECTIFIERS

SYMBOLS TAKEN FROM AMENDMENT No. 2

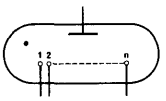
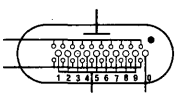
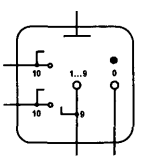
TO PUBLICATION 117-6 OF THE IEC

(Variability, examples of resistors, elements of electronic tubes, valves and rectifiers)

EXAMPLES OF ELECTRONIC TUBES

No.	Symbol	Description
567 A		Image iconoscope with: *a) Image section,* consisting of: – photocathode, – electromagnetic lens; *b) Storage section,* consisting of: – target with secondary emission with associated capacitive signal plate, – internal conductive coating; *c) Scanning section,* consisting of: – electron gun, – two pairs of deflecting coils.
567 B		Vidicon with: *a) Photoconductive image storage target;* *b) Scanning section,* consisting of: – electron gun, – beam alignment coil, – cylindrical focusing electrode with grid, – long focusing coil, – two pairs of deflecting coils.
567 C		Image orthicon with: *a) Image section,* consisting of: – photocathode, – electrostatic lens with associated preheater; *b) Storage section,* consisting of: – storage target with secondary emission and collector grid (stabilizer mesh); *c) Scanning system,* consisting of: – electron gun, – beam alignment coil, – cylindrical focusing electrode with grid, – long focusing coil, – two pairs of deflecting coils; *d) Electron multiplying section,* consisting of: – five dynodes, – collecting anode.

EXAMPLES OF VALVES AND RECTIFIERS

No.	Symbol	Description
576A		Multi cold-cathode gasfilled discharge tube: there are many possible electrode arrangements for this type of tube and two typical examples are shown.
576A.1		Character display tube: the characters displayed may be indicated above the cathodes as shown.
576A.2.1		Multi-cathode tube for pulse counting with: – one set of main cathodes, – two sets of guide cathodes, – one output electrode. If desired, the direction of rotation of the discharge may be shown by an arrow.
576A.2.2		Abridged symbol for symbol No. 576A.2.1.

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TRANSDUCERS

(Microphones, earphones, loudspeakers, recording,

reproducing and erasing heads,

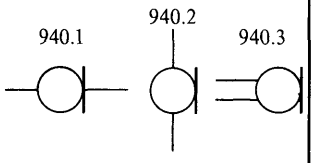
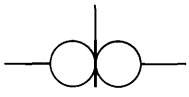
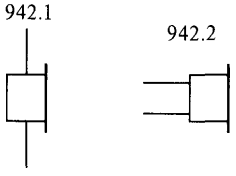
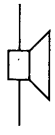
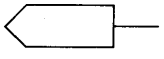
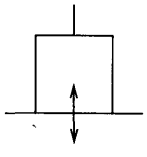
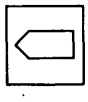
hydrophones and recorders and/or reproducers)

SYMBOLS TAKEN FROM CHAPTER V OF PUBLICATION 117-9

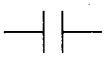
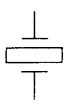
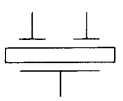
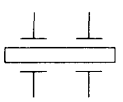
AND FROM PUBLICATIONS 117-9A AND 117-9B OF THE IEC

(Telephony, telegraphy and transducers)

GENERAL SYMBOLS

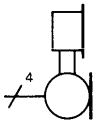
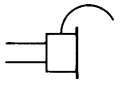
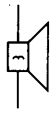
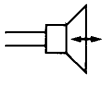
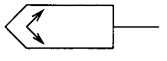
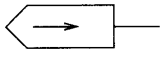
No.	Symbol	Description
940		Microphone.
941		Microphone, push-pull.
942		Earphone (receiver).
943		Loudspeaker.
944		Transducer head, monophonic head.
945		Hydrophone (supersonic transmitter-receiver).
946		Recorder and/or reproducer. *General symbol.*

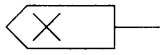
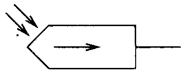
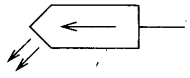
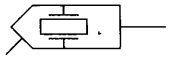
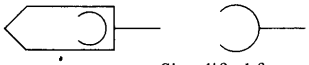
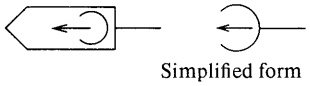
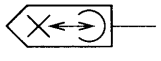
QUALIFYING SYMBOLS

No.	Symbol	Description
		Note 1. – If it is essential to indicate the different types of microphones, loudspeakers, recording heads etc., the following symbols may be drawn inside or adjacent to the general symbols.
606.2		Light dependent type (arrows towards the symbol), light generating and/or modulating type (arrows away from symbol).
602.4		Capacitor type.
950		Magnetic type.
951		Piezoelectric crystal having two electrodes.
951 A		Piezoelectric crystal having three electrodes.
951 B		Piezoelectric crystal having two pairs of electrodes.
952		Magneto-striction type.
953		Moving coil or ribbon type.
954		Moving iron type.
955		Stereo type.

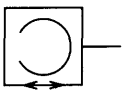
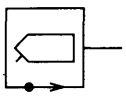
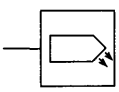
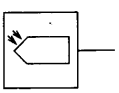
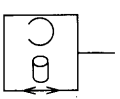
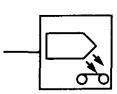
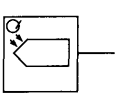
No.	Symbol	Description
956		Low audio-frequencies.
957		High audio-frequencies.
958		Recording or reproducing (the arrow points in the direction of energy transfer).
959		Recording and reproducing.
960		Erasing.
961		Disc.
962		Tape or film.
963		Drum.

EXAMPLES OF TRANSDUCERS

No.	Symbol	Description
970		Electrostatic (capacitor) microphone.
971		Handset.
972		Headgear receiver, single.
973		Moving-coil loudspeaker.
974		Loudspeaker-microphone.
		Note 2. – Symbols No. 975 to 987 are shown in single-line representation.
975		Stereophonic head.
976		Stylus-operated head, monophonic.
977		Recording (writing) head, monophonic.
978		Reproducing (reading, playback) head, monophonic.

No.	Symbol	Description
979		Erasing head.
980		Light-sensitive reading head, monophonic.
981		Writing head producing modulated light, monophonic.
982		Piezoelectric recording or reproducing stylus-operated head.
983	983.1 983.2  Simplified form	Head for magnetic-track.
984	984.1 984.2  Simplified form	Head for *n* magnetic tracks.
985	985.1 985.2  Simplified form	Head for magnetic writing, monophonic.
986	986.1 986.2  Simplified form	Magnetic erasing head.
987		Magnetic head for writing, reading and erasing, monophonic.

EXAMPLES OF RECORDERS AND/OR REPRODUCERS

No.	Symbol	Description
990		Recorder and reproducer using magnetic tracks.
991		Reproducer with a stylus operated head.
992		Recorder using a head producing modulated light.
993		Reproducer using a light-operated head.
994		Recorder and reproducer, magnetic drum type.
995		Recorder film-type, with a head producing modulated light.
996		Reproducer, disc-type, with a light-operated head.

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ANTENNAE AND RADIO STATIONS

SYMBOLS TAKEN FROM PUBLICATIONS 117-10

AND 117-10 A OF THE IEC

(Antennae and radio stations)

ANTENNAE* – GENERAL SYMBOL

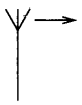
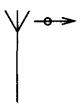
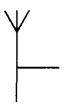
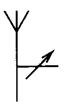
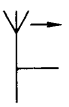
No.	Symbol	Description
1000		Antenna. *General symbol.* *General note:* This symbol may be used to represent any type of antenna or antenna array. The stem of the symbol may represent any type of balanced or unbalanced feeder including a single conductor. Qualifying symbols may be added to the antenna symbol to indicate polarization or direction of radiation. * The IEC uses the terms "aerial" or "antenna" with plurals "aerials" and "antennas", respectively.

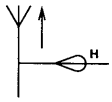
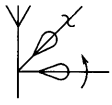
QUALIFYING SYMBOLS

No.	Symbol	Description
		For polarization:
1005		Plane polarization. *Note 1.* – To indicate horizontal polarization, the arrow should be drawn at 90° to the stem of the antenna symbol. To indicate vertical polarization, the arrow should be drawn parallel to the stem of the antenna symbol.
1006		Circular polarization.
		For direction of radiation:
1007		Fixed in azimuth.
1008		Variable in azimuth.
1009		Fixed in elevation.
1010		Variable in elevation.
1011		Fixed in azimuth and elevation.

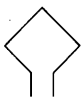
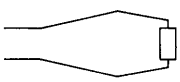
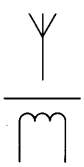
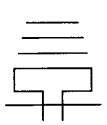
No.	Symbol	Description
1012		Direction finder or beacon.
1013		Rotating or capable of rotation in one direction.
1014		Capable of rotation in either of two directions.
1015		Reciprocating.
		Note 2. – Any other appropriate qualifying symbols for variability may be used.

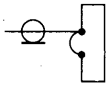
EXAMPLES OF GENERAL ANTENNA SYMBOL WITH QUALIFYING SYMBOLS

No.	Symbol	Description
1020		Antenna with horizontal polarization.
1021		Antenna with vertical polarization.
1022		Antenna with circular polarization.
1023		Antenna with direction of radiation fixed in azimuth.
1024		Antenna with direction of radiation variable in azimuth.
1025		Directional antenna, fixed in azimuth, horizontal polarization.
1026		Antenna with direction of radiation variable in elevation.
1027		Direction finding antenna (radio goniometric or marker beacon).
		Note 3. – If required, a drawing of the general shapes of the main lobes of the polar diagrams of an antenna may be given adjacent to antenna symbol; further information may be added to show the direction and/or the rate of movement of the lobes.

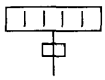
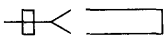
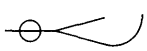
No.	Symbol	Description
1028		Directional antenna fixed in azimuth, vertically polarized, with horizontal polar diagram.
1029	 1 s-1 0°... 57°... 0° 4/min	Radar antenna, rotating four times per minute in azimuth and reciprocating in elevation between 0°... 57°... 0° in 1 s.
		Note 4. – Supplementary references in figures or letter symbols may be taken from the current Radio Regulations published by the International Telecommunication Union, Geneva. [1]Alternatively a name or a reference may be written adjacent to the general antenna symbol.
1030	 Turnstile	Turnstile antenna.

SPECIFIC TYPES OF ANTENNAE AND PARTS OF ANTENNAE

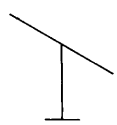
No.	Symbol	Description
1035		Loop (or frame) antenna.
1036		Rhombic antenna. Example shows termination by a resistor.
1037		Counterpoise.
1038		Magnetic rod antenna, e.g. ferrite. *Note 5.* – If there is no risk of confusion the general antenna symbol may be omitted.
1039		Dipole.
1040		Folded dipole.
1041		Reflector or director for dipole.
1041.1		*Example:* Folded dipole with three directors and one reflector.

No.	Symbol	Description
1042		Paraboloidal or cylindrical reflector.
1043		Cheese reflector (U.S.A.: cheese-box reflector).
1044		Balun.
1045		Coaxial pair feeding a folded dipole through a balun.

MICROWAVE ANTENNAE

No.	Symbol	Description
1050		Slot antenna shown with rectangular waveguide feeder.
1051		Horn antenna or horn feed.
1052		Cheese reflector with horn feed and rectangular waveguide feeder.
1053		Paraboloidal antenna with rectangular waveguide feed.
1054		Horn-reflector antenna with circular waveguide feed.

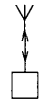
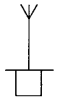
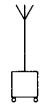
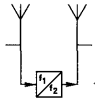
RADIO STATIONS – GENERAL SYMBOL

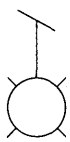
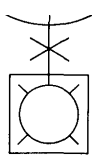
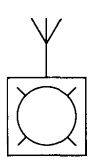
No.	Symbol	Description
1060		Radio station. *General symbol.* Any appropriate symbol for an antenna may be used. *Note 1.* – A suitable symbol may be inserted in the square to indicate the character of the station e.g. *T* – Telegraph.
1060 A		Space-station. *General symbol.*
1061		Passive relay station.

QUALIFYING SYMBOLS INDICATING TRANSMISSION AND/OR RECEPTION

No.	Symbol	Description
1065		Transmission.
1066		Reception.
1067		Alternate transmission and reception.
1068		Simultaneous transmission and reception.

EXAMPLES OF RADIO STATIONS

No.	Symbol	Description
1075		Transmitting and receiving radio station (simultaneous transmission and reception on the same antenna).
1076		Transmitting and receiving radio station (alternate transmission and reception on the same antenna).
1077		Portable radio station.
1078		Direction finding radio station.
1079		Radio beacon station.
1080		Controlling radio station.
1081		Mobile radio station.
1082		(One-way) radio relay station, directional antennae fixed in azimuth, reception and transmission on different frequencies f_1 and f_2.

No.	Symbol	Description
1085		Active space-station.
1086		Passive space-station.
1087		Earth station only, for tracking a space-station; example showing a parabolic antenna.
1088		Earth-station of a communication service.

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MICROWAVE TECHNOLOGY

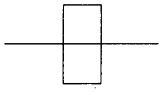
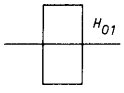
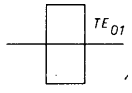
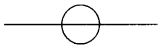
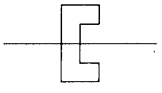
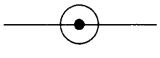
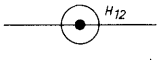
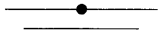
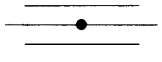
SYMBOLS TAKEN FROM PUBLICATIONS 117-11

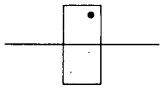
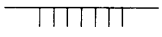
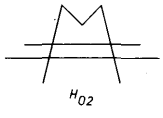
AND 117-11 A OF THE IEC

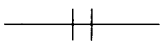
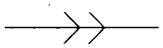
(Microwave technology)

ELEMENTS OF MICROWAVE TECHNOLOGY – TRANSMISSION PATHS

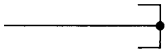
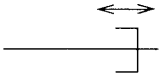
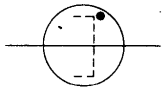
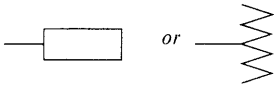
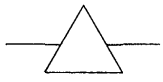
No.	Symbol	Description
1100		Transmission path. *General symbol.* *Note 1.* – A single line represents the entire group of conductors, or the transmission path, needed to guide the power or the signal. For coaxial and waveguide work, the recognition symbol is used at the beginning and end of each kind of transmission path and at intermediate points as needed for clarity. When required, the length between two significant points may be indicated, e.g. $\lambda/4$. When required, details of structure (e.g. elbows), type, impedance, ratings, etc. may be added adjacent to or within any symbol or in a note. *Note 2.* – A solid line indicates a metallic boundary; a dashed line shows the boundary of a solid dielectric. A hatched area (Symbol No. 94, IEC Publication 117-1) may equally be used for a solid dielectric if desired, e.g. if there is the possibility of confusion with a screen.

No.	Symbol	Description
1101		Rectangular waveguide.
		Note3. – The mode of propagation may be shown at the side of the waveguide symbol.
	 1101.1  1101.2	*Examples:* Rectangular waveguide with indication of mode of propagation H_{01} or TE_{01}.
1102		Circular waveguide.
1103		Ridge (U.S.A.: ridged) waveguide.
1104		Coaxial waveguide.
1104.1		*Example:* Coaxial waveguide showing H_{12} mode of propagation.
1105	1105.1 	Stripline with two conductors.
	1105.2 	Stripline with three conductors.

No.	Symbol	Description
1106		Goubau line (single wire transmission line within solid dielectric).
1107		Gas-filled rectangular waveguide.
1108		Slow-wave structure.
1109		Transmission paths crossing without interconnection.
1110		Flexible waveguide.
1111		Twisted waveguide.
1112		Mode suppression. *General symbol.*
1112.1		*Example:* Showing suppression of H_{02} mode.

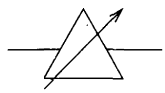
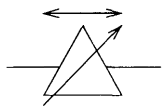
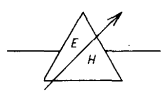
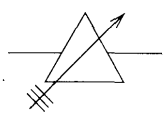
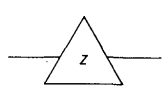
No.	Symbol	Description
1113		Pair of symmetrical waveguide connectors.
1114		Pair of asymmetric waveguide connectors. *Note 4.* – The line is not interrupted at the junction regardless of the type of connector.
1115		Rotatable joint, with symmetrical connectors.

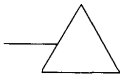
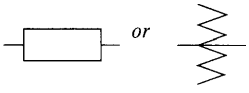
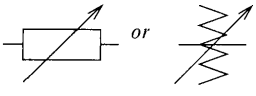
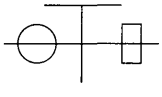
ONE- AND TWO-PORTS*

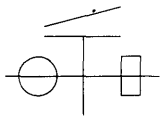
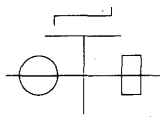
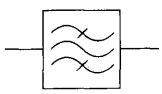
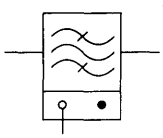
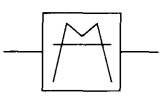
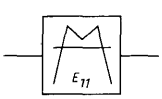
No.	Symbol	Description
1120		Short-circuit (the dot is optional).
1121		Sliding short-circuit.
1122		T-R tube.
1123	 1123.1 *or* 1123.2	Matched termination.
1124		Discontinuity (introducing intentional wave reflection). *General symbol.*

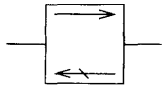
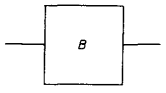
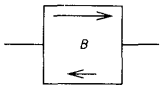
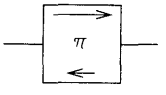
* Antennae, see Symbols Nos. 1050 to 1054.

EXAMPLES OF TYPES OF DISCONTINUITY

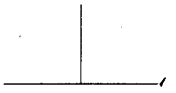
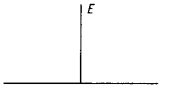
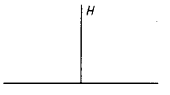
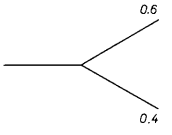
No.	Symbol	Description
		Examples:
1124.1		Variable (U.S.A.: adjustable) discontinuity or matching device.
1124.2		Slide screw tuner.
1124.3		E-H tuner.
1124.4		Multi-stub tuner (e.g. 3 stubs).
1124.5		Shunt type discontinuity.
1124.6		Series type discontinuity.
		Note 5. – Y and Z may be replaced by the appropriate lumped-constant circuit symbol.
1124.7		*Example:* Shunt capacity discontinuity.

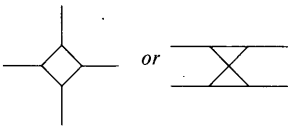
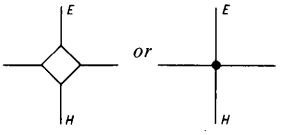
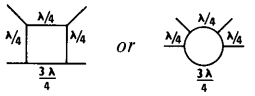
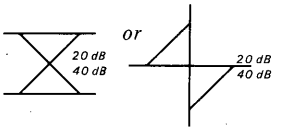
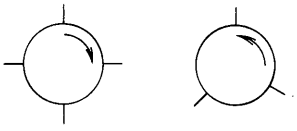
No.	Symbol	Description
1125		Terminal discontinuity.
1126	 1126.1 1126.2	Fixed attenuator.
1127	 1127.1 1127.2	Variable (U.S.A.: adjustable) attenuator.
1128		Transition. *General symbol.* *Note 6.* – If it is desired to specify the type of transition, appropriate indications may be added. *Examples:*
1128.1		Transition from circular to rectangular waveguide.

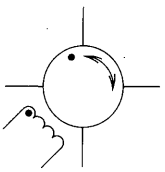
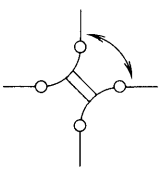
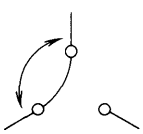
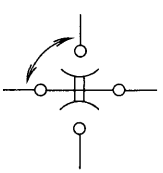
No.	Symbol	Description
1128.2		Taper transition from circular to rectangular waveguide.
1128.3		Stepped transition from circular to rectangular waveguide.
1129		Cavity resonator.
1130		Frequency filter, e.g.band-pass.
1131		Band-pass filter switched by gas discharge.
1132		Mode filter.
1132.1		*Example:* Mode filter suppressing E_{11} mode.

No.	Symbol	Description
1133		Isolator.
1134		Phase changer.
1135		Directional phase changer. *Note 7.* – *B* may be replaced by φ. *Note 8.* – The longer arrow indicates the direction of propagation in which the required phase change occurs.
1136		Gyrator.

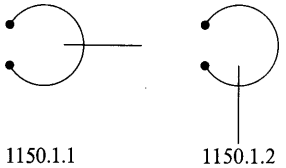
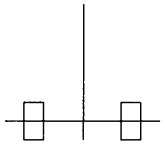
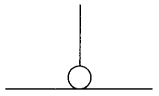
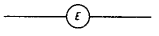
MULTI-PORTS

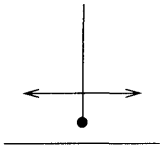
No.	Symbol	Description
1140		Three-port junction. *Note 9.* – The type of coupling, power division proportions, reflection coefficients, etc. may be indicated if desired. The angles between the ports may be drawn at any convenient values. *Examples:*
1140.1		Series T, E-plane T.
1140.2		Shunt T, H-plane T.
1140.3		Power divider: Power divided in ratio 6 : 4.

No.	Symbol	Description
1141	 or 1141.0.1 1141.0.2	Four-port junction. *Note 10.* – The symbol is chosen to suit the presentation. The convention of the symbol is that the power entering at one junction is conveyed only to the two directly connected junctions and thence away from the device.
		Examples:
1141.1	 1141.1.1 1141.1.2	Hybrid junction (magic T).
1141.2	 1141.2.1 1141.2.2	Hybrid ring.
1141.3	 1141.3.1 1141.3.2	Directional coupler, cross coupler. *Note 11.* – First value: coupling loss. Second value: directivity.
1142	 1142.1 1142.2	Circulator. 1142.1 four-port. 1142.2 three-port.

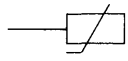
No.	Symbol	Description
1143		Reversible direction of circulation. *Note 12.* – Current entering the coil at the end marked with the dot causes the energy in the circulator to flow in the direction of the arrow-head marked with a dot.
1144		Two-position switch (90° step).
1145		Three-position switch (120° step).
1146		Four-position switch (45° step).

COUPLINGS AND PROBES

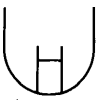
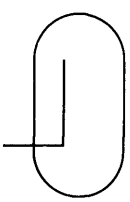
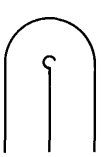
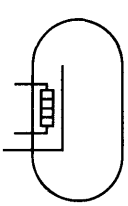
No.	Symbol	Description
1150		Coupler (or feed) type unspecified.
		Examples:
1150.1		Coupler to a cavity resonator.
	1150.1.1 1150.1.2	
1150.2		Coupler to a rectangular waveguide.
1151		Window (aperture) coupler. *General symbol.*
1152		Window (aperture) coupler at a junction.
1153		E-plane window (aperture) coupler.
1154		Loop coupler.

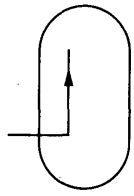
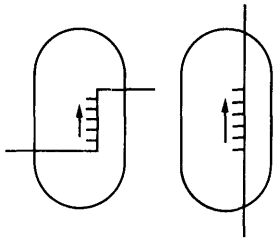
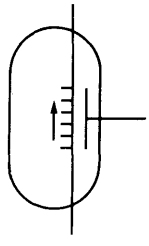
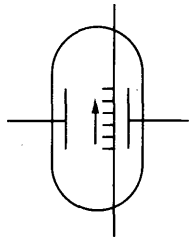
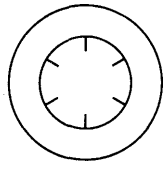
No.	Symbol	Description
1155		Probe.
1156		Sliding probe coupled to transmission path.

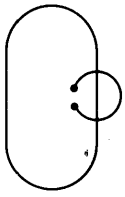
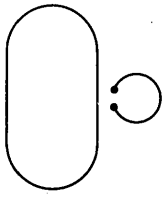
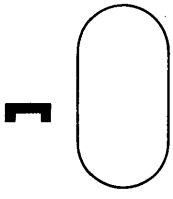
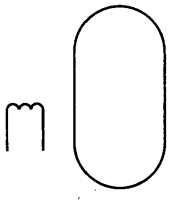
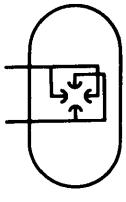
MEASURING DEVICES

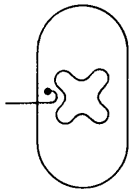
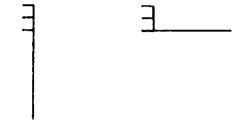
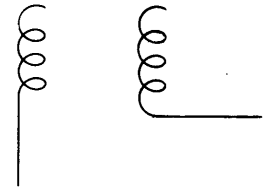
No.	Symbol	Description
1160		Bolometer element.
1161		Bolometer-type wattmeter.

MICROWAVE TUBES – PARTICULAR ELEMENTS FOR TUBES

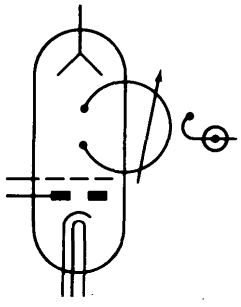
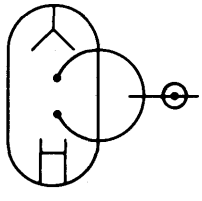
No.	Symbol	Description
1165		Electron gun assembly (set of electrodes forming an electron gun assembly, used in simplified representations).
1166		Reflector.
1167		Non-emitting sole, to be used in conjunction with open slow-wave structure.
1168		Non-emitting sole, to be used in conjunction with closed slow-wave structure.
1169		Preheated non-emitting sole.

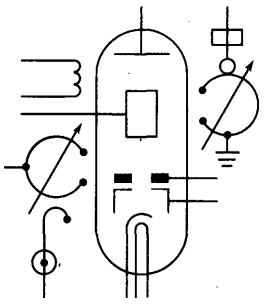
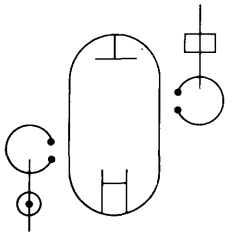
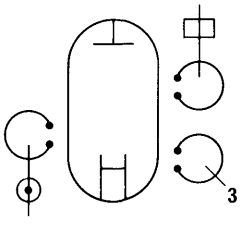
No.	Symbol	Description
1170		Emitting sole (arrow indicates direction of electron flow).
1171	 1171.1 1171.2	Open slow-wave structure (arrow indicates direction of energy flow).
1172		Electrode for electrostatic focusing along open slow-wave structure.
1173		Pair of electrodes for electrostatic focusing along open slow-wave structure.
1174		Closed slow-wave structure.

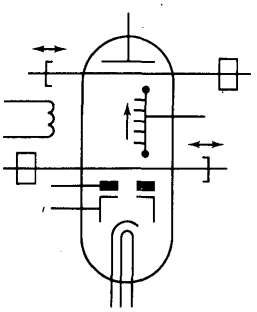
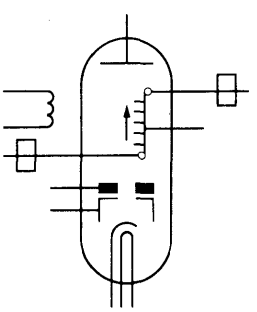
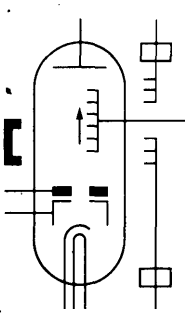
No.	Symbol	Description
1175		Resonator, forming an integral part of tube.
1176		Resonator, partly or wholly external to tube.
1177		Permanent magnet producing a transverse field (crossed field or magnetron type tube).
1178		Electromagnet producing a transverse field (crossed field or magnetron type tube).
1179		Tetrapole.

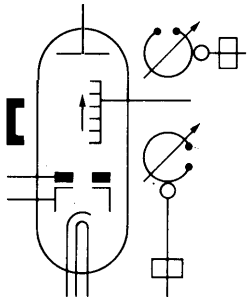
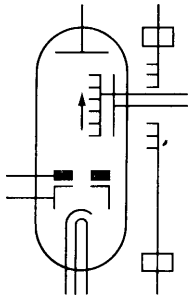
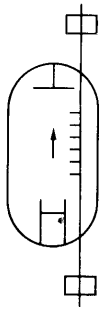
No.	Symbol	Description
1180		Tetrapole with loop coupler.
1181	 1181.1 1181.2	Slow-wave coupler.
1182	 1182.1 1182.2	Helical coupler.

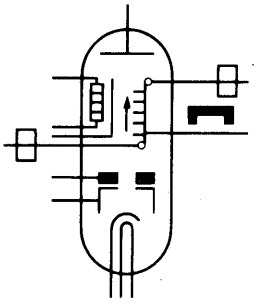
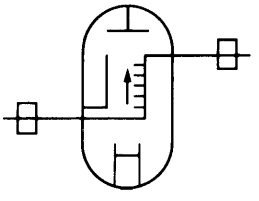
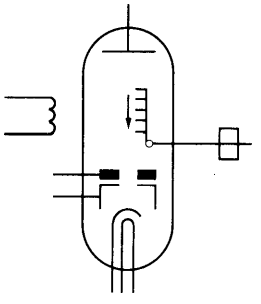
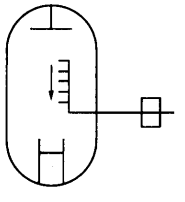
EXAMPLES OF TUBES

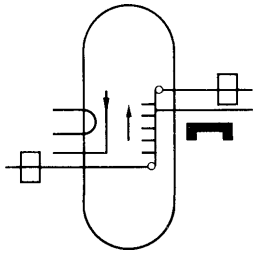
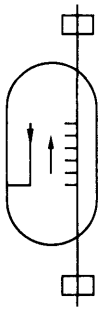
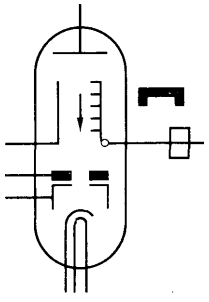
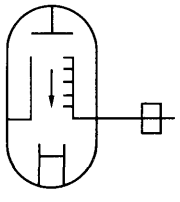
No.	Symbol	Description
		General note: The graphical representation of any one tube need show only those elements and details which are, for the purpose of the drawing or diagram, relevant to a correct interpretation and/or necessary for showing circuit connections. The relative position of the various tube element symbols is no indication of the geometry of the tube structure.
1185		Reflex klystron with: – indirectly heated cathode; – beam-forming plate; – grid; – tunable integral cavity resonator; – reflector; – loop coupler to coaxial output.
1185.1	*Simplified form* 	

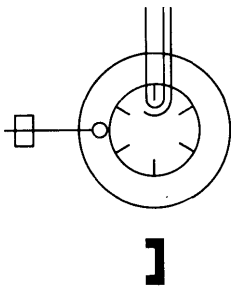
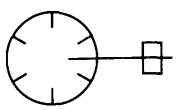
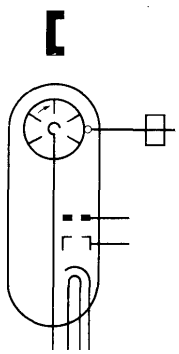
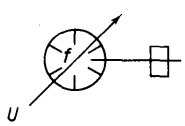
No.	Symbol	Description
1186		Klystron with: – indirectly heated cathode; – intensity modulating electrode; – beam-forming plate; – external tunable input cavity resonator; – drift space electrode; – external tunable output cavity resonator with d.c. connection; – collector; – focusing coil; – input loop coupler to coaxial waveguide; – output window coupler to rectangular waveguide.
1186.1	*Simplified form* 	
1186.2		*Example:* Simplified representation of a klystron with five external cavity resonators. The figure (e.g. 3) indicates the number of cavity resonators represented by only one cavity resonator symbol.

No.	Symbol	Description
1187		O-type forward travelling wave amplifier tube with: – indirectly heated cathode; – intensity modulating electrode; – beam-forming plate; – slow wave structure with d.c. connection; – collector; – focusing coil; – probe-couplers to rectangular waveguides each with sliding short. Simplified representation, see Symbol No. 1192.
1188		O-type forward travelling wave amplifier tube with: – indirectly heated cathode; – intensity modulating electrode; – beam-forming plate; – slow-wave structure with d.c. connection; – collector; – focusing coil; – window couplers to rectangular waveguides. Simplified representation, see Symbol No. 1192.
1189		O-type forward travelling wave amplifier tube with: – indirectly heated cathode; – intensity modulating electrode; – beam-forming plate; – slow-wave structure with d.c. connection; – collector; – permanent focusing-magnet; – slow-wave couplers to rectangular waveguides. Simplified representation, see Symbol No. 1192.

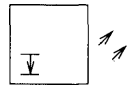
No.	Symbol	Description
1190		O-type forward travelling wave amplifier tube with: – indirectly heated cathode; – intensity modulating electrode; – beam-forming plate; – slow-wave structure with d.c. connection; – collector; – permanent focusing magnet; – window couplers between external tunable cavity resonators and rectangular waveguides. Simplified representation, see Symbol No. 1192.
1191		O-type forward travelling wave amplifier tube with: – indirectly heated cathode; – intensity modulation electrode; – beam-forming plate; – slow-wave structure with d.c. connection; – electrostatic focusing electrode; – collector; – slow-wave couplers to rectangular waveguides. Simplified representation, see Symbol No. 1192.
1192		Simplified representation of forward travelling wave amplifier tube.

No.	Symbol	Description
1193		M-type forward travelling wave amplifier tube with: – indirectly heated cathode; – intensity modulating electrode; – beam-forming plate; – preheated non-emitting sole; – slow-wave structure with d.c. connection; – collector; – permanent transverse field magnet; – window couplers to rectangular waveguides.
1193.1	*Simplified form* 	
1194		O-type backward (travelling) wave oscillator tube with: – indirectly heated cathode; – intensity modulating electrode; – beam-forming plate; – slow-wave structure with d.c. connection via waveguide; – collector; – focusing coil; – window-coupler to rectangular waveguide.
1194.1	*Simplified form* 	

No.	Symbol	Description
1195		M-type backward (travelling) wave amplifier tube with: – filament-heated emitting sole; – slow-wave structure with d.c. connection; – permanent transverse field magnet; – window-couplers to rectangular waveguides.
1195.1	*Simplified form* 	
1196		M-type backward (travelling) wave oscillator tube with: – indirectly heated cathode; – intensity modulating electrode; – beam-forming plate; – non-emitting sole; – slow-wave structure with d.c. connection via waveguide; – collector; – permanent transverse field magnet; – window-coupler to rectangular waveguide.
1196.1	*Simplified form* 	

No.	Symbol	Description
1197		Magnetron oscillator tube with: – indirectly heated cathode; – closed slow-wave structure with d.c. connection via waveguide; – permanent field magnet; – window-coupler to rectangular waveguide.
1197.1	*Simplified form* 	
1198		Backward (travelling) wave oscillator tube (voltage tunable magnetron) with: – indirectly heated cathode; – intensity modulating electrode; – beam-forming plate; – closed slow-wave structure with d.c. connection via waveguide; – non-emitting sole; – permanent field magnet; – window-coupler to rectangular waveguide.
1198.1	*Simplified form* 	

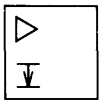
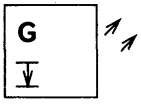
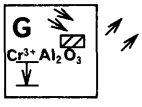
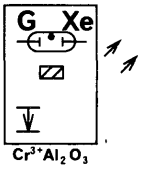
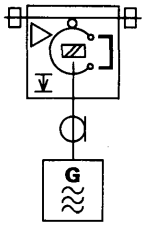
MASERS AND LASERS – GENERAL SYMBOLS

No.	Symbol	Description
1199		Maser. *Note 1.* – The symbol ⊤↓ represents the transition from one energy level to a lower one. It is drawn preferably in the lower left hand quarter of the square.
1199 A		Laser (optical maser).

QUALIFYING SYMBOLS

No.	Symbol	Description
1199B.1		Unspecified material.
1199B.2		Solid.
1199B.3		Liquid.
1199B.4		Gas.
1199B.5		Semiconductor.
		Note 2. – Pumping by light may be shown by placing symbol No. 606.2 above symbols No. 1199B.1 to 1199B.5.
		*Example:* Pumping by light, material unspecified.

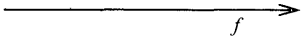
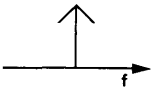
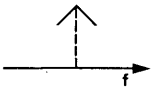
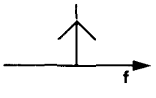
EXAMPLES

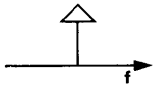
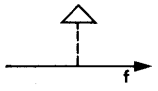
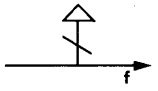
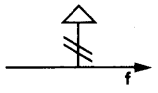
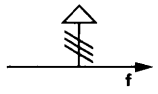
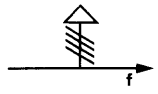
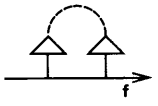
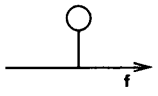
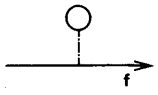
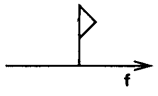
No.	Symbol	Description
1199C		Maser used as an amplifier.
1199D		Laser used as a generator.
1199E	1199E.1 	Ruby laser generator.
	1199E.2 	Ruby laser generator shown with xenon lamp as pumping source.
1199F		Maser used as an amplifier with crystal in a cavity resonator and with an external permanent magnet. The cavity resonator is window-coupled to rectangular waveguide and loop-coupled to a pump generator via a coaxial cable.

FREQUENCY SPECTRUM DIAGRAMS

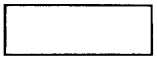
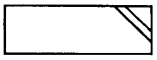
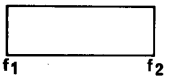
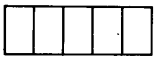
SYMBOLS TAKEN FROM PUBLICATION 117-12 OF THE IEC

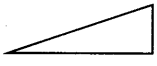
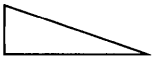
(Frequency spectrum diagrams)

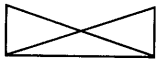
No.	Symbol	Description
		General note: A frequency spectrum may be represented on a diagram by means of symbols on a horizontal frequency axis showing the function of the various frequencies and frequency bands used in the transmission system as well as their relative position in the spectrum. The various frequencies used can be designated by letters with subscripts (for example, f_1, f_2, f_3, etc.) or by their numerical values.
1200		 This frequency axis is shown on symbols 1201 to 1213 for clarity.
		PARTICULAR FREQUENCIES
1201		Carrier frequency. *General symbol.*
1202		Suppressed-carrier frequency.
1203		Reduced-carrier frequency.

No.	Symbol	Description
1204		Pilot frequency. *General symbol.*
1205		Suppressed pilot frequency.
1206		Group pilot frequency.
1207		Supergroup pilot frequency.
1208		Mastergroup pilot frequency.
1209		Supermastergroup pilot frequency.
1210		Two pilot frequencies of which one or the other is transmitted.
1211		Additional measuring frequency. *General symbol.*
1212		Additional measuring frequency, transmitted or measured on request.
1213		Signalling frequency.

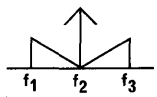
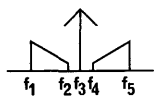
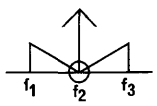
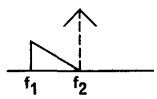
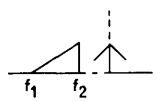
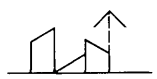
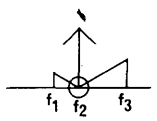
FREQUENCY BANDS

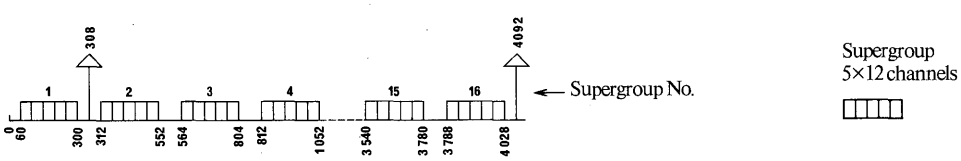
No.	Symbol	Description
1220		Frequency band. *General symbol.* *Note 1.* – Further information may be added as below: The order of the group may be shown by the number of oblique strokes (according to symbols 1206 to 1209). *Examples:*
1220.1		Supergroup.
1220.2		Frequency band from f_1 to f_2.
1220.3		Division of band into channels, groups, etc.
1221		Erect band of frequencies. *General symbol.* *Note 2.* – At any point in a transmission system and following any number of stages of modulation, a frequency band is said to be erect (with respect to the modulating signal applied to the first stage of modulation) if an increase of frequency at the input of the first modulation stage produces an increase in frequency in the band considered. *Note 3.* – In any stage of modulation involving one channel, the frequency corresponding to the vertical side of the triangle corresponds to the highest frequency of the original speech or equivalent (e.g. video) channel. For a group of channels, one triangle may be drawn for each channel, but if all the channels are erect, the group may be represented by one single triangle. *Note 4.* – This general symbol does not indicate how much of the bandwidth shown by the symbol is used.

No.	Symbol	Description
1222		Inverted band of frequencies. *General symbol.* *Note 5.* – At any point in a transmission system and following any number of stages of modulation, a frequency band is said to be inverted (with respect to the modulating signal applied to the first stage of modulation) if an increase of frequency at the input of the first modulation stage produces a decrease in frequency in the band considered. *Note 6.* – In any stage of modulation involving one channel, the frequency corresponding to the vertical side of the triangle corresponds to the highest frequency of the original speech or equivalent (e.g. video) channel. For a group of channels, one triangle may be drawn for each channel, but if all the channels are inverted the group may be represented by one single triangle. *Note 7.* – This general symbol does not indicate how much of the bandwidth shown by the symbol is used.
1223		Channels, groups, etc. in band.
1223.1		All erect.
1223.1.1		All erect (simplified symbol).
1223.2		All inverted.
1223.2.1		All inverted (simplified symbol).

No.	Symbol	Description
1223.3		Mixed (some erect, remainder inverted).
		Examples:
1223.3.1		
1223.3.2		
1223.3.3		Mixed (some erect, remainder inverted) (simplified symbol).

EXAMPLES OF FREQUENCY SPECTRUM DIAGRAMS

No.	Symbol	Description
1230		Carrier with both its sidebands.
1231		Carrier with both its sidebands where it is desired to show that the lower frequencies of the original modulating signal are not transmitted.
1232		Carrier with both its sidebands where it is desired to show that the lower frequencies, down to zero, of the original modulating signal are transmitted.
1233		Single-sideband, suppressed-carrier, first stage of modulation (lower only transmitted).
1234		Single-sideband reduced-carrier of the final stage of modulation (lower erect sideband only transmitted).
1235		Single-sideband suppressed-carrier, divided into three parts, scrambled for secrecy.
1236		Modulation showing upper sideband and vestigial lower sideband, the lower frequencies down to zero being transmitted.
1237		4 MHz transmission system (60 - 4092 kHz) arranged to carry 960 circuits and showing supergroups and pilot frequencies. Each supergroup is made up of five groups, each of twelve channels at 4 kHz spacing.



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BLOCK SYMBOLS FOR TRANSMISSION

AND MISCELLANEOUS APPLICATIONS

SYMBOLS TAKEN FROM PUBLICATION 117-13 OF THE IEC

(Block symbols for transmission and miscellaneous applications)

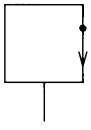
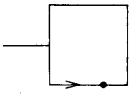
BASIC SYMBOLS

No.	Symbol	Description
1300	 1300.1  1300.2	Equipment or functional unit. *Note 1.* – A suitable symbol or legend shall be inserted in or added to the square or rectangle to indicate the equipment or function.
1301	———	Signal path.

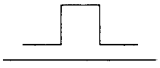
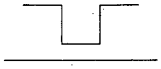
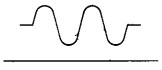
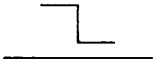
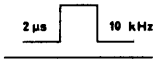
QUALIFYING SYMBOLS TO INDICATE DIRECTION OF WORKING OR PROPAGATION

No.	Symbol	Description
1302		One-way.
1303		Both ways, not simultaneously.
1304		Both ways, simultaneously.
		Note 2. – The arrows may be shown on an appropriate side of a block symbol or on a signal path.

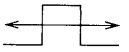
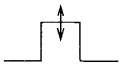
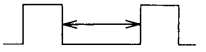
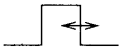
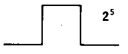
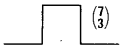
QUALIFYING SYMBOLS TO INDICATE TRANSMITTING (SENDING) OR RECEIVING

No.	Symbol	Description
1305		Transmitting (sending).
1306		Receiving.
		Note 3. – Such symbols may be shown on an appropriate side of a block symbol.
		Examples:
1307		Transmitter (sender).
1308		Receiver.

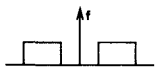
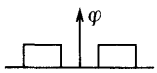
QUALIFYING SYMBOLS TO INDICATE SIGNAL WAVEFORM

No.	Symbol	Description
		Note 4. – The qualifying symbol may indicate the approximate shape of the waveform. In the following examples the symbol is shown above a signal path.
		Examples:
1310		Positive-going pulse.
1311		Negative-going pulse.
1312		Pulse of alternating current.
1313		Positive-going step function.
1314		Negative-going step function.
		Note 5. – Further information may be given.
		Example:
1315		Positive-going pulse with a pulse duration of 2 µs and a pulse repetition frequency of 10 kHz.

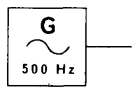
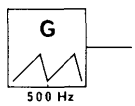
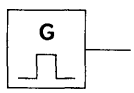
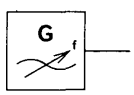
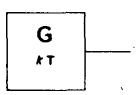
QUALIFYING SYMBOLS INDICATING THE TYPE OF PULSE-MODULATION

No.	Symbol	Description
1320		Pulse-position or pulse-phase modulation.
1321		Pulse-frequency modulation.
1322		Pulse-amplitude modulation.
1323		Pulse-interval modulation.
1324		Pulse-duration modulation.
1325		Pulse-code modulation. Details of the code must be shown.
		Examples:
1325.1		5-unit binary code.
1325.2		3-out-of-7 code.

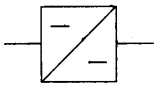
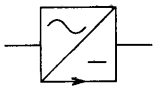
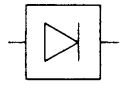
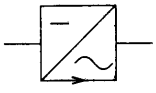
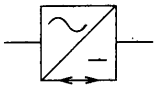
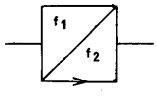
QUALIFYING SYMBOLS TO INDICATE CARRIERS AND THEIR SIDEBANDS

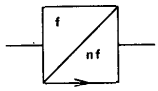
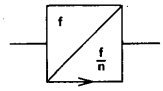
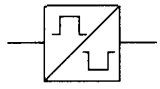
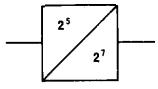
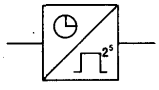
No.	Symbol	Description
1327		Frequency modulation.
1328		Phase modulation.
		Remark: For amplitude modulation, symbols of Publication 117-12 may be used as qualifying symbols.
		Note 6. – The arrowhead on the vertical line, indicating the carrier, may be omitted if no confusion will result.

NON-ROTATING GENERATORS

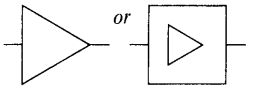
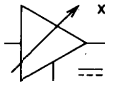
No.	Symbol	Description
1330		Non-rotating generator. *General symbol.*
1331		*Examples:* Sine-wave generator, 500 Hz.
1332		Saw-tooth generator, 500 Hz.
1333		Pulse generator.
1334		Variable frequency sine-wave generator.
1335		Noise generator. *Note 7.* – k: Boltzmann's constant. T: absolute temperature.

CHANGERS

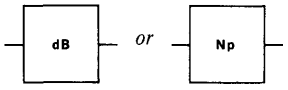
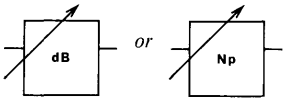
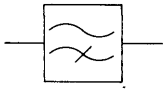
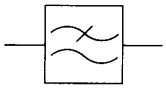
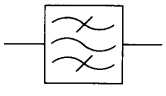
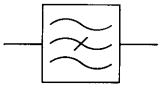
No.	Symbol	Description
1340		Changer. *General symbol.* *Note 8.* – The direction of changing may be indicated by an arrow. *Note 9.* – Appropriate symbols or legends should be associated with each half of the general symbol to indicate the nature of the change.
		Examples:
1341		D.C. converter.
1342		Rectifier equipment. Variant, see symbol No. 578: 
1343		Inverter.
1344		Rectifier/Inverter.
1345		Frequency changer, changing from f_1 to f_2.

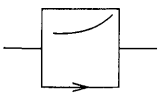
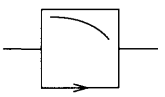
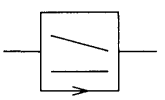
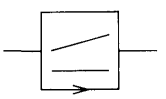
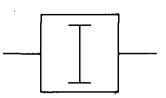
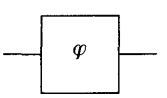
No.	Symbol	Description
1346		Frequency multiplier.
1347		Frequency divider.
1348		Pulse inverter.
1349		Code converter. 5-unit binary code to 7-unit binary code.
1350		Changer giving clock-time indication in 5-unit binary code.

AMPLIFIERS

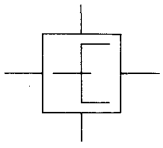
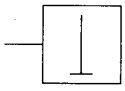
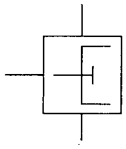
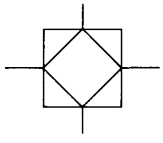
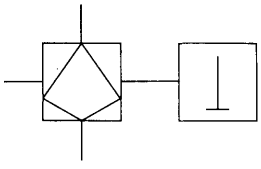
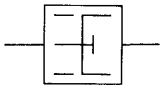
No.	Symbol	Description
1355	 1355.1 1355.2	Amplifier. *General symbol.* *Note 10.* – The triangle is pointed in the direction of transmission.
1356		Amplifier with external direct current control. *Replace x by the controlled quantity.*

NETWORKS WITH TWO PAIRS OF TERMINALS

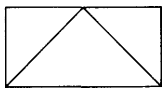
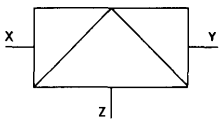
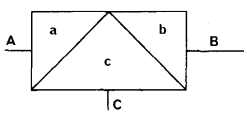
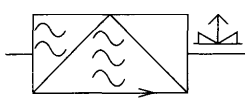
No.	Symbol	Description
1360	 1360.1 1360.2	Attenuator, fixed loss (Pad). *Note 11.* – The numerical value of the attenuation may be added.
1361	 1361.1 1361.2	Attenuator, variable loss.
1362		Filter. *General symbol.*
1363		High-pass filter.
1364		Low-pass filter.
1365		Band-pass filter.
1366		Band-stop filter.

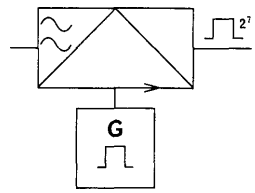
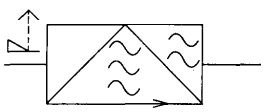
No.	Symbol	Description
1367		Device for pre-emphasis of higher frequencies.
1368		Device for de-emphasis of higher frequencies.
1369		Compressor.
1370		Expander.
1371		Artificial line.
1372		Phase-changing network. *Note 12.* – φ may be replaced by B if no confusion arises.

TERMINATING SETS AND HYBRID TRANSFORMERS

No.	Symbol	Description
1380		Terminating set.
1381		Balancing network.
1382		Terminating set with balancing network.
1383		Hybrid transformer.
1384		Asymmetric (skew) hybrid transformer, shown with balance.
1385		Equipment for connecting a 4-wire input to either a 2-wire output or a 4-wire output depending upon the receipt of a control signal.

MODULATORS, DEMODULATORS, DISCRIMINATORS

No.	Symbol	Description
1390		Modulator, demodulator or discriminator. *General symbol.*
1391		*Note 13.* – X and Y represent the modulating or modulated signal input and the modulated or demodulated signal output. Z represents the input of the carrier-wave if required. Qualifying symbols may be placed as shown below: For a *modulator* at: A or a : input modulating signal B or b : output modulated wave C or c : carrier input.
1392		For a *demodulator* or *discriminator* at: A or a : input modulated wave B or b : output signal C or c : carrier input.
		Examples:
1393		Modulator, double sideband output.

No.	Symbol	Description
1394		Pulse code modulator (7-unit binary code output).
1395		Demodulator, single sideband suppressed carrier to audio.

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