

SCHEMATIC CONVENTIONS

WIRING AND CABLING

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2. SYMBOL COMPONENTS

1. GENERAL

1.01 This section describes the principal apparatus and wiring conventions used on schematic drawings. Each convention shown in this section is typical for a type of apparatus and is approximately the size actually used on schematic drawings. An exception to the above is that, due to the size of all crossbar and program transmission schematic drawings, reduced prints (approximately 38.5 per cent reduction) are made and distributed for these drawings.

1.02 The requirements covered in this section shall be followed except as modified by applicable specifications and drawings.

1.03 The conventions shown herein include all of the ASA standards which are applicable to Bell System apparatus and wiring.

1.04 All schematic conventions are set up to indicate the electrical function of the apparatus. No definite attempt is made to show the actual physical relation of the parts of the piece of apparatus.

1.05 In general, terminals of hinged parts and apparatus terminals that have number or letter designations printed or stamped on the apparatus are represented by a small circle. In other cases, no terminal is shown and the circuit wiring is brought directly to the convention.

1.06 In most cases, apparatus conventions may be rotated or reversed in order to simplify the circuit layout. Exceptions to this are made in the case of conventions which require a definite position in order to identify the top, bottom, left, or right side of the apparatus. In such cases, convention is considered as looking at the wiring side.

1.07 Functional designations of apparatus are placed at some point near the apparatus. Code designations include the apparatus name only when required to insure complete understanding.

1.08 Changes in requirements which have been made with this issue are explained under "Reasons for Reissue" at the end of the section. Revised and added information introduced by this issue is of such magnitude that the use of arrows to indicate changed and added items is not practicable.

2.01 The symbol components listed herein show the general methods of representing particular features of a piece of apparatus and as such may be applied to the primary conventions for indicating the presence of these features.

2.02 Anode

(a) Anode or plate



(b) Target or x-ray anode



2.03 Cathode

(a) Cold cathode



(b) Directly heated cathode (filament type) or heater



(c) Indirectly heated cathode

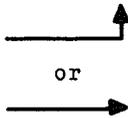


(d) Photoelectric cathode



2.04 Contact

(a) Adjustable or sliding contact or regular contact for relays, keys, jacks, etc.



(b) Moving contact or armature for relays, nonlocking keys, etc. (circle indicates pivot point and is always shown on moving contacts)



(c) Moving contact for locking keys, jacks, etc.



(d) Normally closed and normally open contact

(1) Normally closed contact (NC)



(2) Normally open contact (NO)



Note: Whether a contact is normally open (NO) or normally closed (NC) depends on the position of the contact when the actuating device is in the de-energized or nonoperated position.

2.05 Core

(a) Magnetic core (general)



(b) Core for relays, magnets, etc.



2.06 Dynode

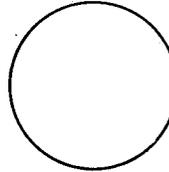


2.07 Electrode - Deflecting, Reflecting, or Repelling

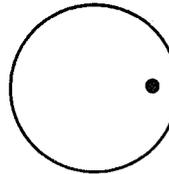


2.08 Envelopes

(a) Envelope (shell) for electronic devices



(b) Gas-filled envelope



2.09 Grid (Including Beam-confining or Beam-forming Electrodes)



2.10 Heater Element



2.11 Inductance (Repeating Coil, Retardation Coil, Transformer, etc.)



2.12 Loop Coupling (Electromagnetic Type)



2.13 Shield (General)

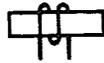


2.14 Variable



2.15 Winding

(a) Inductive winding for relays, electromagnets etc.



(b) Noninductive winding



(c) Inner end for windings of relays, electromagnets, etc.



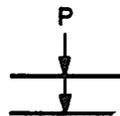
3. PRIMARY WIRING CONVENTIONS

3.01 Line Conventions

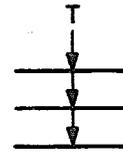
- Jumper
- Leads for Showing the Details of One Circuit on Another Circuit (Dotted Leads)
- Talking, Transmission, Bus Bar, Charge, and Discharge
- Fundamental Circuit
- Off-normal Ground
- Off-normal Battery
- Sequence Switch Rotary Magnet Feed
- Signaling and Power Control
- Apparatus
- Mechanical Connections

3.02 Methods of Wiring

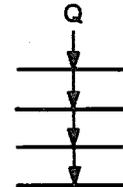
(a) Paired twisted wires



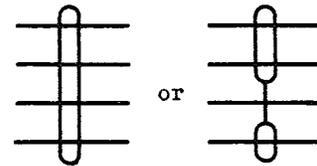
(b) Triple twisted wires



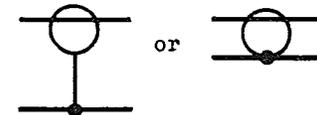
(c) Quadruple twisted wires



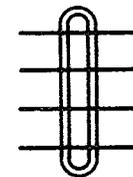
(d) Switchboard cable



(e) Coaxial cable



(f) Duplex or quadded cable



(g) Local cable or loose wiring



(h) Leads run in separate switchboard cable

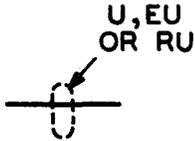


(i) Leads run from terminal to terminal

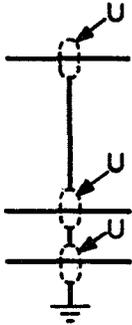


3.03 Methods of Shielding

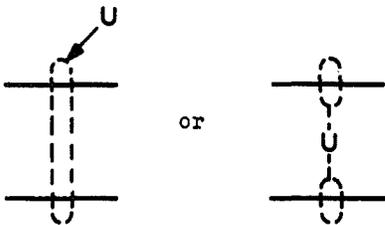
(a) Single shielded wire



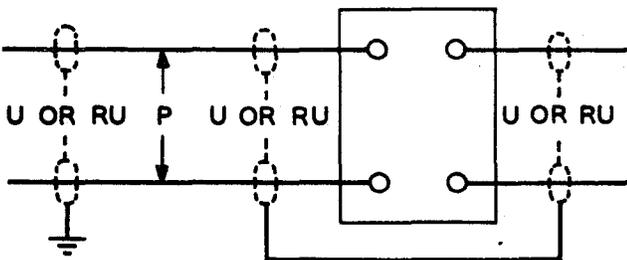
(b) Individually shielded wires with the shields connected together to ground



(c) Wires in same shield

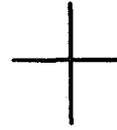


(d) Typical paired and shielded wiring

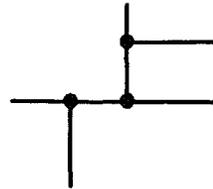


3.04 Methods of Showing Leads

(a) Crossed wires



(b) Joined wires



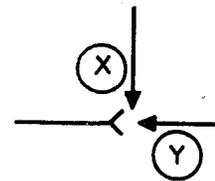
(c) Spliced wires



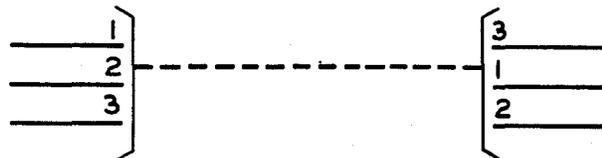
(d) Strap indicating multiple connection



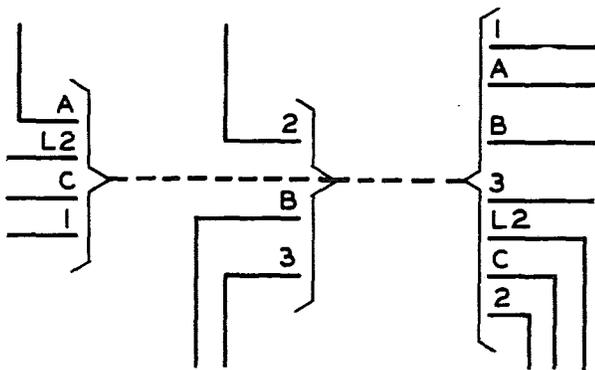
(e) Optional wiring connection



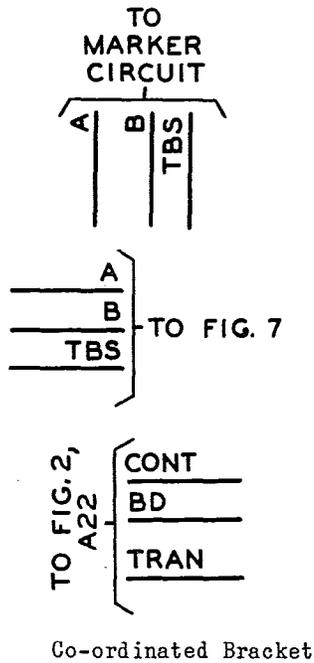
(f) Point-to-point connection



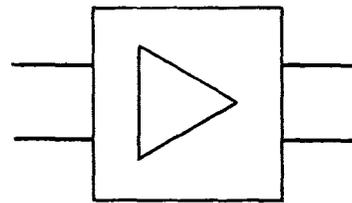
(g) Highway connection



(h) Lead connections to another figure or drawing



(b) Where more leads are shown



4.02 Antenna

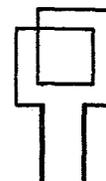
(a) Aerial



(b) Counterpoise



(c) Loop

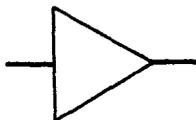


3.05 Cross-connection Diagram (See BSP AA610.004)

4. PRIMARY APPARATUS CONVENTIONS

4.01 Amplifier

(a) Single-line diagrams



4.03 Autotransformer (See Inductors)

4.04 Batteries

(a) Dry cell



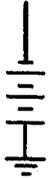
(b) CEMF cells



(c) 24-volt battery



(d) 38-volt battery



(e) 48-volt battery



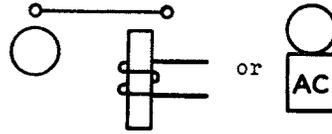
(f) Battery over 48 volts



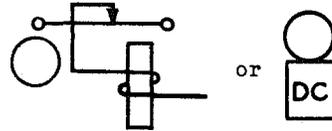
Note: The above (c) to (f) indicate positive side grounded. To indicate negative side grounded, interchange long and short lines.

4.05 Bells

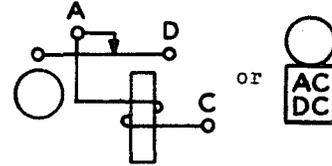
(a) A-C bell



(b) D-C bell



(c) AC-DC bell

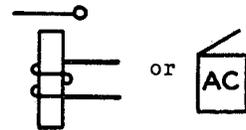


4.06 Binding Post

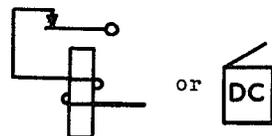


4.07 Buzzers

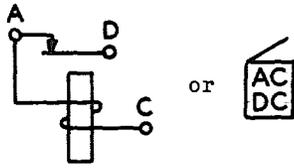
(a) A-C buzzer



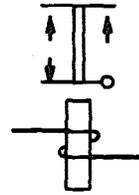
(b) D-C buzzer



(c) AC-DC buzzer

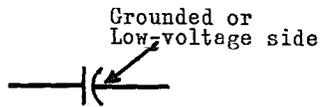


4.12 Contactor



4.08 Capacitors

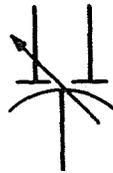
(a) Fixed capacitor



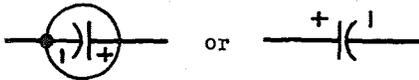
(b) Variable or adjustable capacitor



(c) Differential variable capacitor



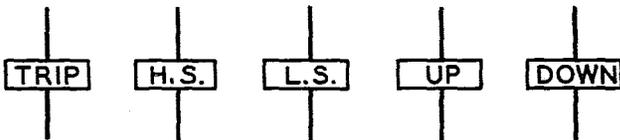
(d) Electrolytic capacitor



4.09 Circuit Breaker



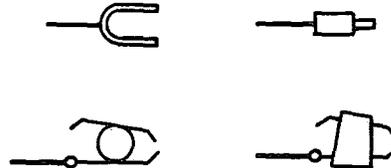
4.10 Clutch Magnets



H.S. - High Speed  
L.S. - Low Speed

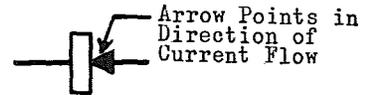
4.11 Connecting Block (See Terminal Strip)

4.13 Cord Tips

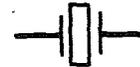


4.14 Crystals

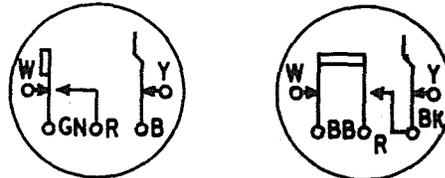
(a) Detector crystal



(b) Piezoelectric crystal

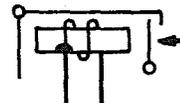


4.15 Dials



4.16 Drops

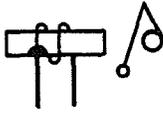
(a) Manually restored drop



(b) Electrically restored drop



4.17 Electric Clock

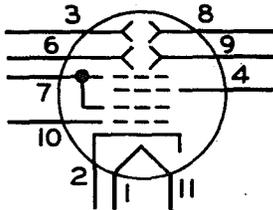


4.18 Electromagnet

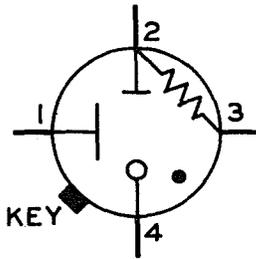


4.19 Electron Tubes

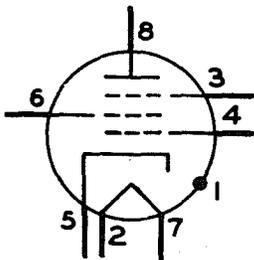
(a) Cathode-ray tube



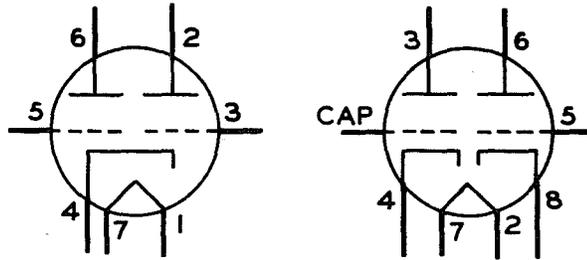
(b) Cold cathode tube



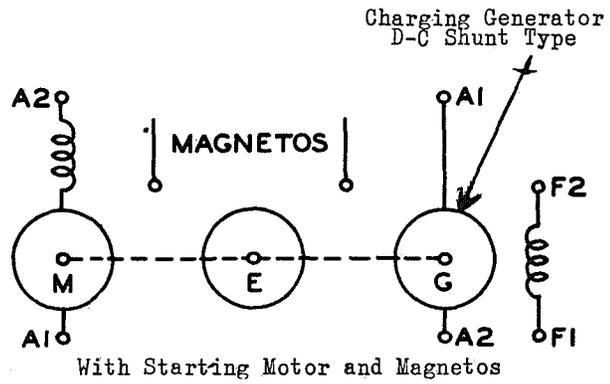
(c) Pentode tube



(d) Twin-triode tubes



4.20 Engine-Generator Set



4.21 Fuses

(a) Plain-type fuse



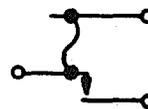
(b) Alarm-type fuse



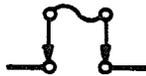
(c) Alarm-type fuse on bus bar



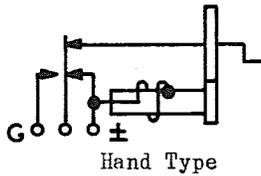
(d) Alarm-type fuse on protector mounting



(e) Safety-type fuse



4.22 Generator

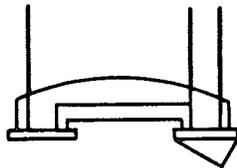


4.23 Ground

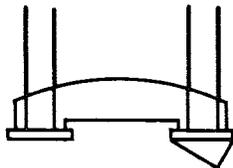


4.24 Hand Sets

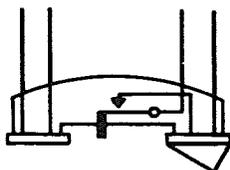
(a) 3-conductor hand set



(b) 4-conductor hand set



(c) 4-conductor hand set with transmitter cut-off key



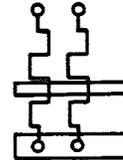
4.25 Head Set (See Receivers)

4.26 Heat Coils

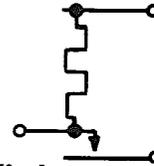
(a) Plain heat coil



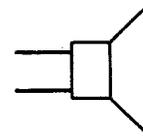
(b) Alarm-type heat coil on bus bar



(c) Alarm-type heat coil on protector mounting



4.27 Horn or Howler

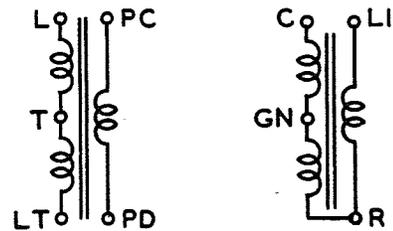


4.28 Induction Coil (See Inductors)

4.29 Inductors

(a) Induction Coils

(1) Regular-type induction coils

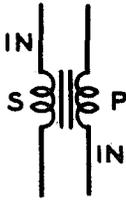


(2) Variable-type induction coil

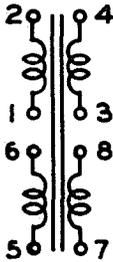


(b) Repeating Coils

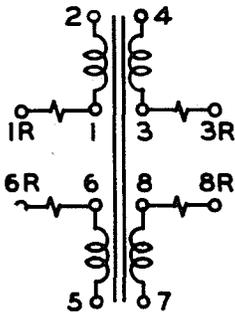
(1) Relay spool-type repeating coil



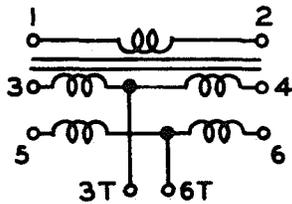
(2) Regular-type repeating coil



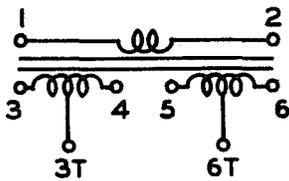
(3) Repeating coil with noninductive windings



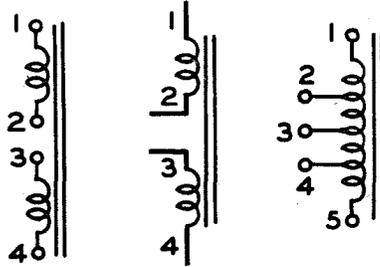
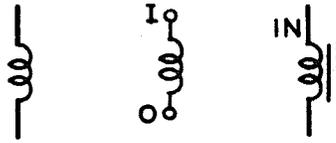
(4) Hybrid-type repeating coil



or

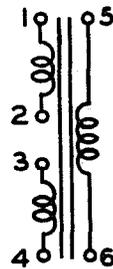
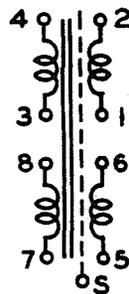
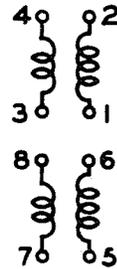


(c) Retardation Coils

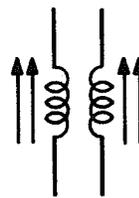


(d) Transformers

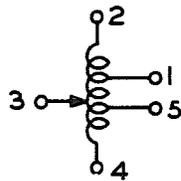
(1) Regular-type transformers



(2) Variable core-type transformer



(3) Variable tap-type autotransformer



(c) Test-type jack



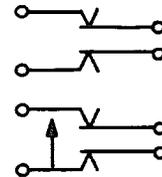
4.30 Instruments and Meters



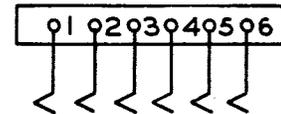
\*Show abbreviations to identify the specific type of instrument or meter. For example:

- A - Ammeter
- AH - Ampere-hour
- F - Frequency
- G - Galvanometer
- MA - Milliammeter
- PF - Power factor
- TT - Total time
- V - Voltmeter
- VA - Volt-ammeter
- VO - Volt-ohm
- W - Watt
- WH - Watt-hour
- μA - Microammeter

(d) Spring-type jack



(e) Gang-type jack



(f) Coaxial-type jack



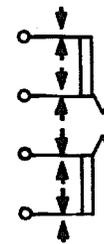
4.31 Interrupters



Motor-driven Type

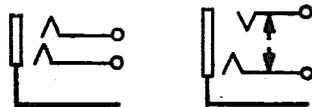
4.33 Keys

(a) Locking lever-type key

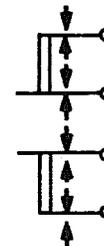


4.32 Jacks

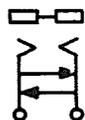
(a) Regular-type jacks



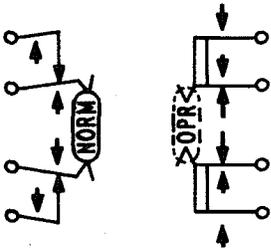
(b) Nonlocking lever-type key



(b) Twin-type jack

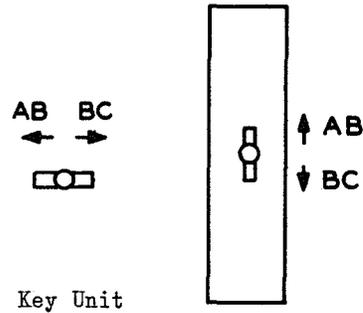


(c) Half of lever-type key normally operated

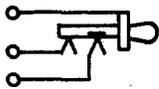


4.34 Key Top Diagrams

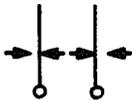
(a) Lever-type key top diagrams



(d) Jack-type key



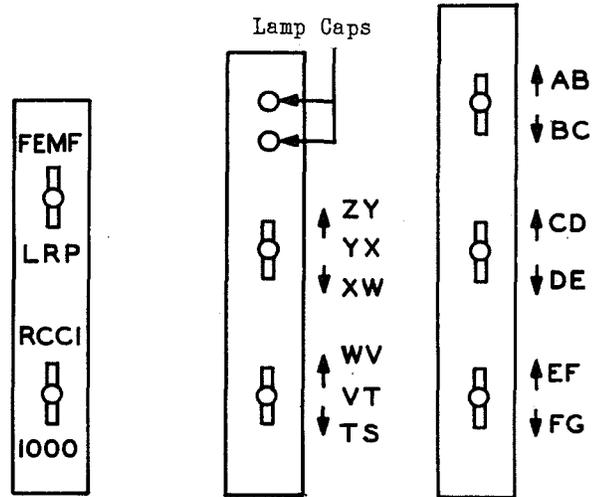
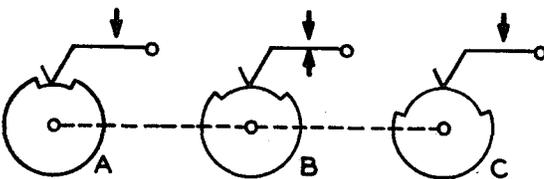
(e) Plunger-type key



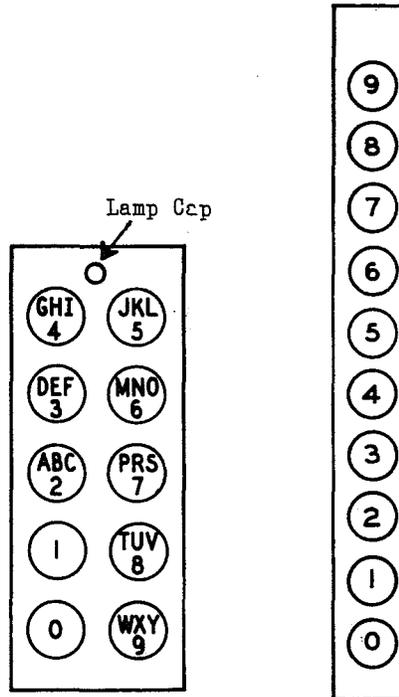
(f) Telegraph-type key



(g) Selector-type key

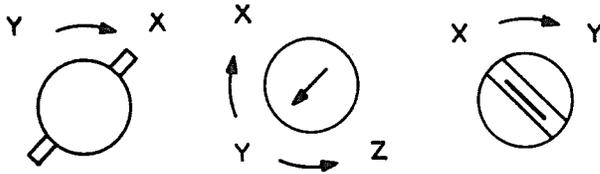


(b) Push-button type key top diagrams



Note: Show designations within key tops only when engraved.

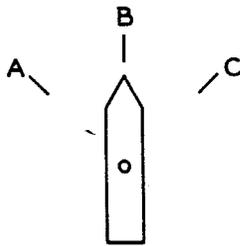
(c) Turn button-type key top diagrams



(e) Glow-type lamp

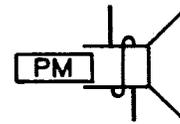


(d) Selector switch-type key top diagram  
(other than Western Electric Co. keys)

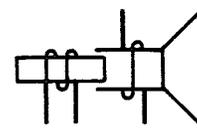


4.36 Loud Speakers

(a) Permanent magnet loud speaker



(b) Electromagnetic moving coil-type  
loud speaker



4.35 Lamps

(a) Single-filament ballast or resistance  
lamp



(b) Double-filament ballast or resistance  
lamp



(c) Illuminating-type lamp



(d) Switchboard-type lamp



4.37 Message Register



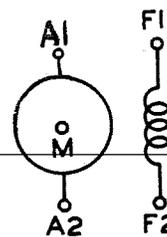
4.38 Meters (See Instruments)

4.39 Microphone

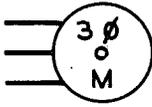


4.40 Motors

(a) D-C shunt motor

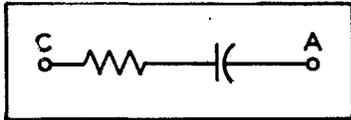


(b) A-C 3 $\phi$  induction-type motor



4.41 Networks

(a) Typical networks



(b) Networks when used as contact protection



4.42 Plugs

(a) 1-conductor plug



(b) 2-conductor plug



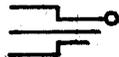
(c) 3-conductor plug



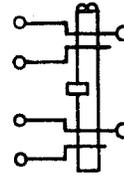
(d) Make busy plugs



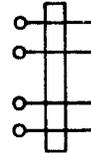
(e) Dummy plug



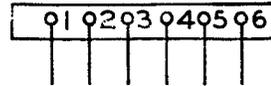
(f) Twin plug



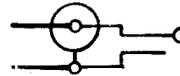
(g) Test plug



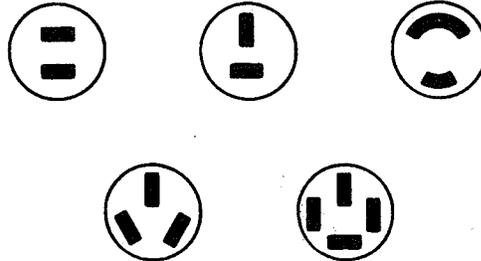
(h) Gang plug



(i) Coaxial plug



(j) Service-type plugs



4.43 Potentiometers



4.44 Protector Blocks



4.45 Punching (See Terminals)

4.46 Receivers

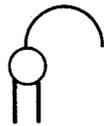
(a) Hand-type receiver



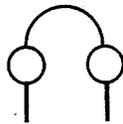
(b) Receiver unit



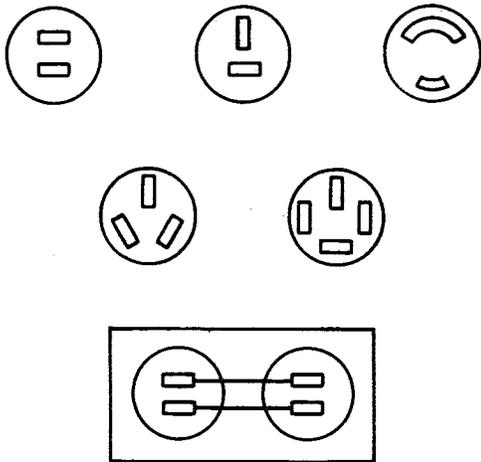
(c) Single headset receiver



(d) Double headset receiver

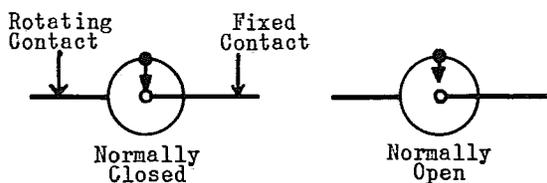


4.47 Receptacles



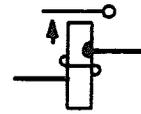
4.48 Rectifier (See Varistors)

4.49 Regulator

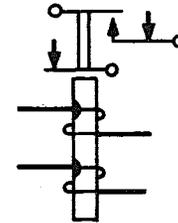


4.50 Relays

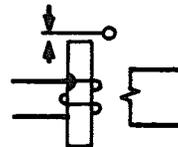
(a) Single-wound relay with make contact



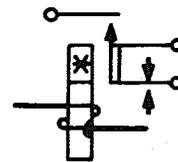
(b) Double-wound relay with break and make-before-break contacts



(c) Relay with noninductive winding and transfer contacts



(d) Relay with preliminary make contacts

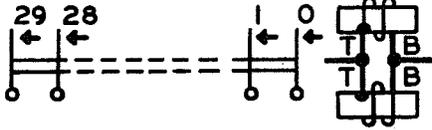


\*Show abbreviations as follows for specific operating features if required. On polarized relays used in telegraph circuits, the designations "S" and "M" indicate the "spacing" and "marking" contacts, respectively.

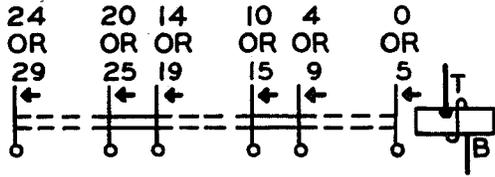
- AC - Alternating current
- D - Differential
- DB - Double-biased - biased in both directions
- DP - Dashpot
- EP - Electrically polarized
- FO - Fast operate
- FR - Fast release
- MG - Marginal
- NB - No bias
- NR - Nonreactance
- P - Magnetically polarized using biasing spring or having magnetic bias
- SA - Slow acting
- SO - Slow operate
- SR - Slow release
- TS - Two-step

(e) Multicontact relay

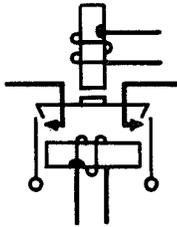
(1) Nonsplit multicontact relay



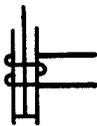
(2) Split multicontact relay



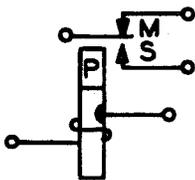
(f) Mechanically locking and electrically releasing relay



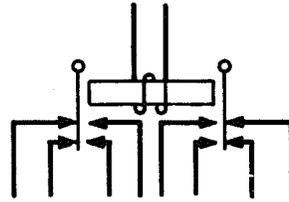
(g) Solenoid-type relay



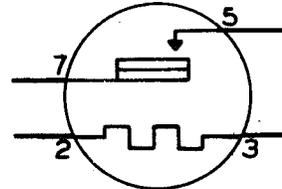
(h) Polarized telegraph-type relay



(i) Double contact-type relay



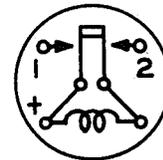
(j) Thermal delay relay



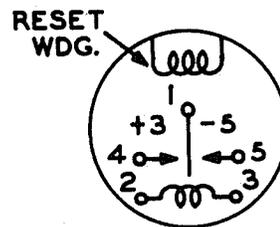
(k) Thermostat-type relay



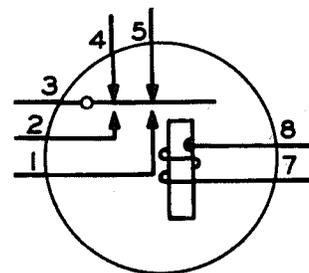
(l) Ammeter-type relay



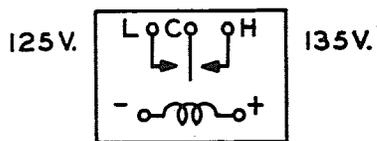
(m) Sensitrol-type relay



(n) Mercury contact-type relay



(o) Voltage-type relay



4.51 Repeating Coil (See Inductors)

4.52 Resistors

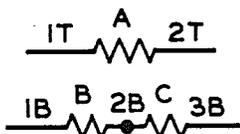
(a) Resistor with one winding



(b) Resistor with two windings and having one terminal common to both windings



(c) Relay spool-type resistor



4.53 Retardation Coil (See Inductors)

4.54 Rheostat

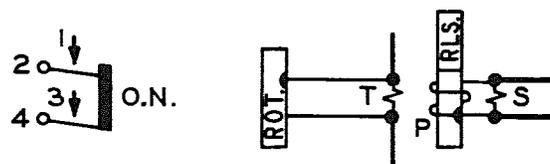
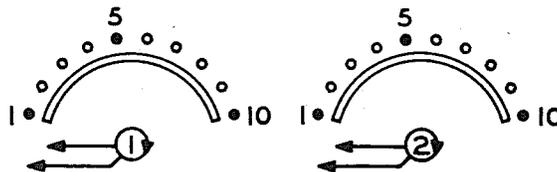


4.55 Ringer

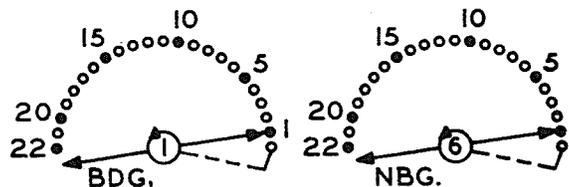


4.56 Selectors

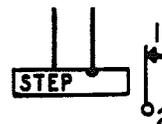
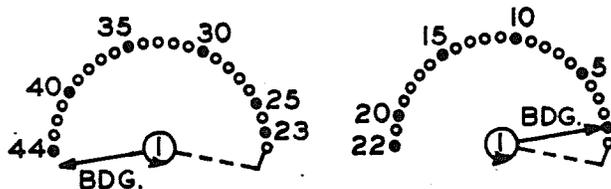
(a) 10-terminal rotary-type selector



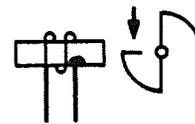
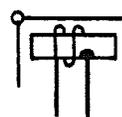
(b) 22-terminal rotary-type selector



(c) 44-terminal rotary-type selector

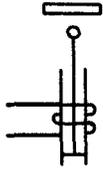


4.57 Signals

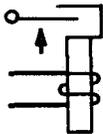


4.58 Sounders

(a) Chime, tone bar, etc., type sounder



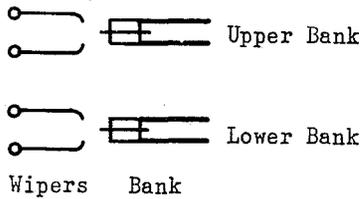
(b) Telegraph-type sounder



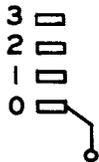
4.59 Switches

(a) Step-by-step system selector-type switches

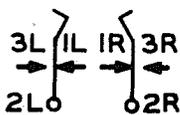
(1) Wipers and banks



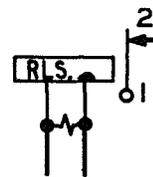
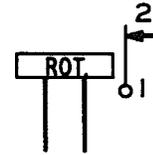
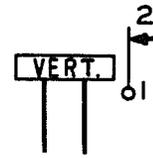
(2) Vertical commutator and wiper



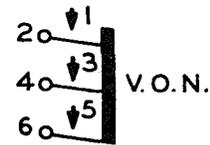
(3) Normal post springs



(4) Magnets



(5) Vertical off-normal springs



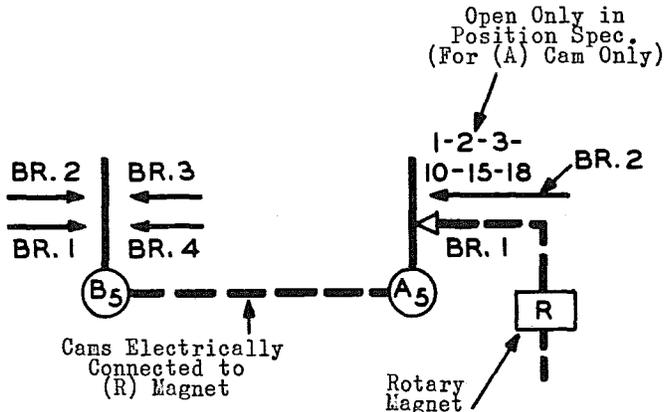
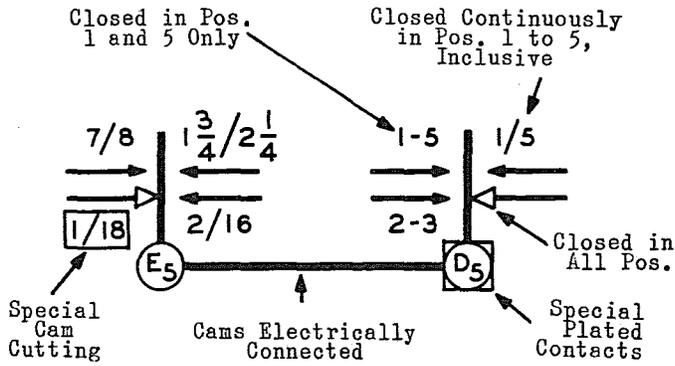
(6) Rotary off-normal springs



(7) 11th rotary step springs



(b) Sequence-type switches



(c) Knife, rotary, snap, toggle, or tumbler-type switches

- (1) Single-pole, single-throw switch



- (2) Single-pole, double-throw switch



- (3) Double-pole, single-throw switch



- (4) Double-pole, double-throw switch



(d) Cover or door-type switches

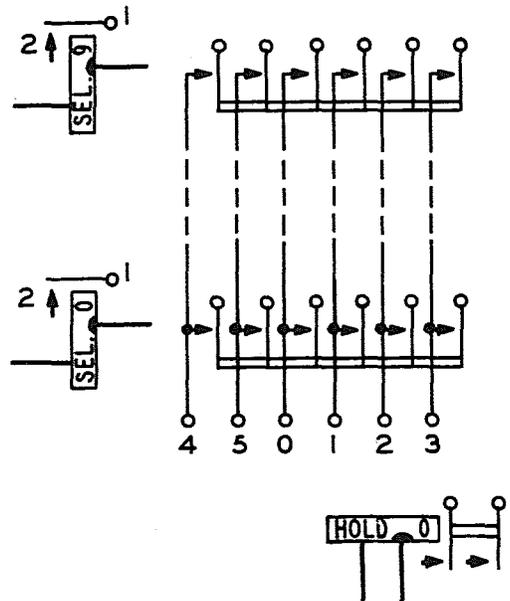
- (1) Cover or door closed, switch opens when cover or door opens



- (2) Cover or door closed, switch closes when cover or door opens



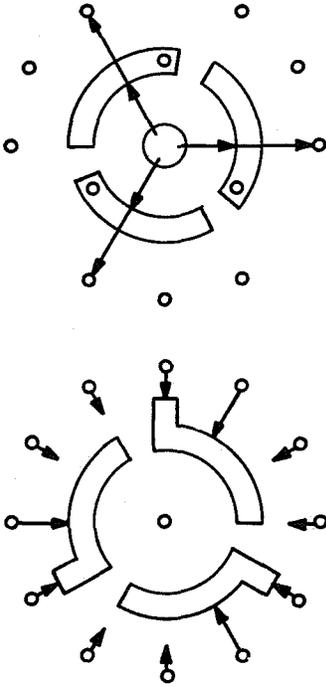
(e) Crossbar selector-type switch



Notes

- A. SEL magnets may be placed on right or left of contacts as best suits wiring condition.
- B. Contacts on SEL or HOLD magnets may be shown at either end of magnet core to suit schematic conditions.
- C. HOLD magnets may be shown under SEL magnets where wiring from contact terminals is run vertically.

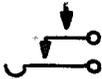
(f) Selector-type switches



4.62 Terminal Strip



4.60 Switchhook



4.63 Test Point



4.61 Terminals

(a) Apparatus terminal



(b) Terminal strip or terminal punching



(c) Cross-connecting terminal



4.64 Thermistors

(a) Directly heated thermistor

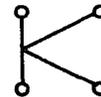


(b) Indirectly heated thermistor

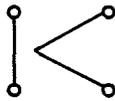


4.65 Thermocouples

(a) Directly heated thermocouple

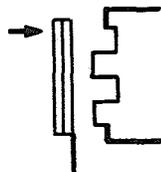


(b) Indirectly heated thermocouple

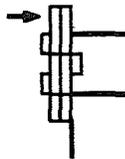


4.66 Thermo-cutout

(a) External heater unit



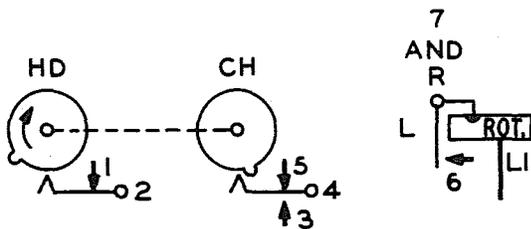
(b) Integral heater unit



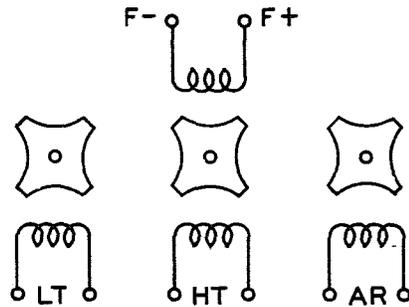
(c) Self-heated unit



4.67 Timer

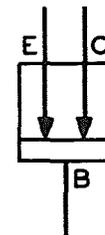


4.68 Tone Alternator



4.69 Transformer (See Inductors)

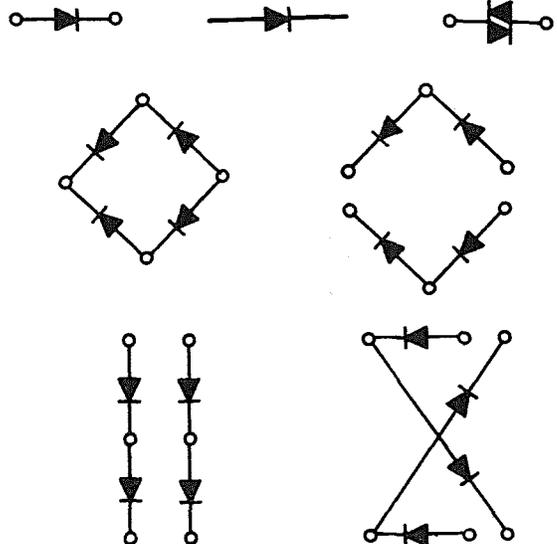
4.70 Transistor



4.71 Transmitters

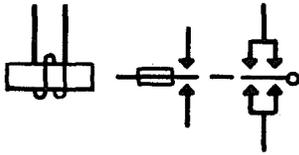


4.72 Varistors or Metallic Rectifiers

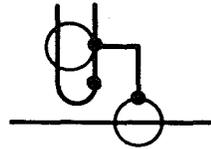


Note: Arrow indicates the direction of low resistance to current flow.

4.73 Vibrator



(c) Application: Coupling by loop from coaxial to circular waveguide with d-c grounds connected.

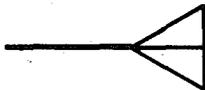


5. COAXIAL AND WAVEGUIDE CONVENTIONS

5.01 General Notes

- (a) Single-line schematics are standard for coaxial and waveguide circuits.
- (b) A recognition convention is to be used at the beginning and the end of each kind of transmission path. Recognition conventions may be used at intermediate points if needed for clarity. The recognition conventions are shown in paragraph 5.21.

5.02 Antenna - General



5.03 Attenuator



5.04 Coupling By Loop

(a) Coupling by loop to space



(b) Coupling by loop to guided transmission path



5.05 Coupling by Aperture With An Opening Of Less Than Full Waveguide Size

(a) Designate E, H, or HE.

- (1) "E" indicates that the physical plane of the aperture is perpendicular to the transverse component of the major E lines.
- (2) "H" indicates that the physical plane of the aperture is parallel to the transverse component of the major E lines.
- (3) "HE" indicates coupling by all other kinds of apertures.
- (4) Transmission loss may be indicated.

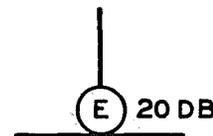
(b) Coupling by aperture to space



(c) Four ends of transmission path available



(d) Three ends of transmission path available



(e) Two ends of transmission path available

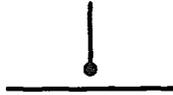


5.06 Coupling By Probe (See Open)

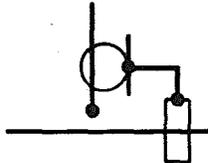
(a) Coupling by probe to space



(b) Coupling by probe to a guided transmission path



(c) Application: Coupling by probe from coaxial to rectangular waveguide with grounds connected



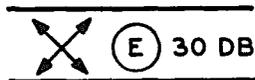
5.07 Directional Coupler

(a) General

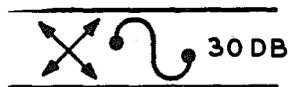


- (1) Arrows indicate direction of power flow.
- (2) Number of coupling paths may be indicated.
- (3) Transmission loss may be indicated.

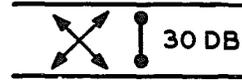
(b) Aperture coupling, designate E, H, or HE



(c) Coaxial loop coupling, 30-db attenuation



(d) Coaxial probe coupling, 30-db attenuation



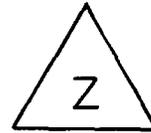
(e) Resistance coupling



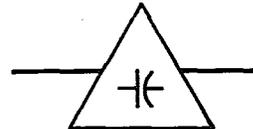
5.08 Discontinuity

(a) To be drawn for a component that exhibits the properties of one of the kinds of circuit elements throughout the frequency range of interest.

(b) Equivalent series element - general



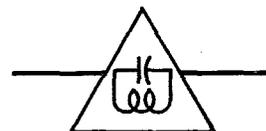
(1) Capacitive reactance



(2) Inductive reactance



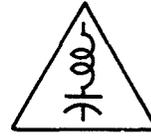
(3) L-C circuit with infinite reactance at resonance



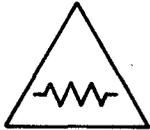
(4) L-C circuit with zero reactance at resonance



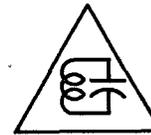
(4) L-C circuit with infinite susceptance at resonance



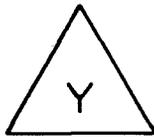
(5) Resistance



(5) L-C circuit with zero susceptance at resonance

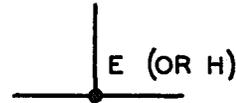


(c) Equivalent shunt element - general



5.09 Junction (Aperture Fully Open)

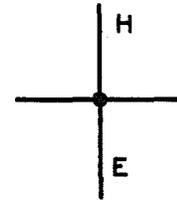
(a) Tee or wye



(1) Capacitive susceptance



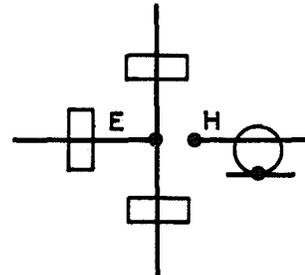
(b) Hybrid



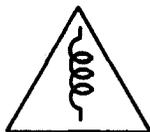
(2) Conductance



(c) Application: Waveguide and coaxial couplings



(3) Inductive susceptance

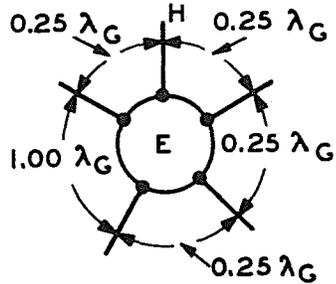


(d) Hybrid, circular

(1) Letter inside circle indicates plane of the field in the ring is normal to the axis of the ring.

- (2) If arm has coupling different from (1), it should be marked accordingly.
- (3) Critical distances should be labeled in terms of guide wavelengths.

(e) Application: 5-arm circular hybrid



5.10 Mode Suppression



5.11 Mode Transducer

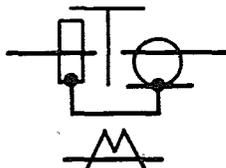


(a) Applications

- (1) Transducer from rectangular to circular waveguide



- (2) Transducer from rectangular waveguide to coaxial with d-c grounds connected and mode suppression



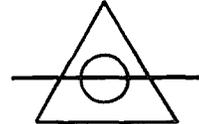
5.12 Movable



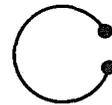
5.13 Open (See Coupling By Probe)



5.14 Phase Shifter

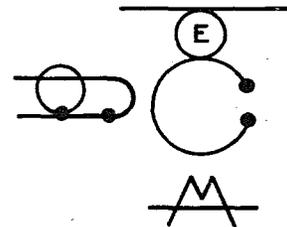


5.15 Resonator (Excluding Piezoelectric and Magnetostriction Devices)

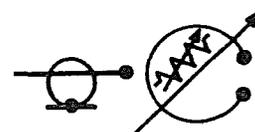


(a) Applications

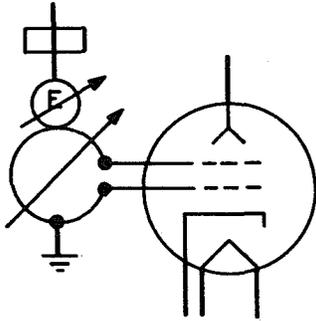
- (1) Resonator coupled by an aperture to a guided transmission path and by a loop to a coaxial. With mode suppression.



- (2) Resonator coupled by a probe to a coaxial. With tuning. Variable Q.



(3) Resonator, attached to an electron device, with variable coupling by an aperture to rectangular waveguide. With variable tuning and d-c ground connected.



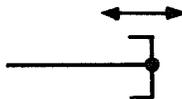
5.16 Rotation



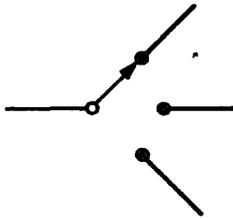
5.17 Short (Transmission Path Terminated in a Short)



(a) Movable short



5.18 Switch (Any Number of Transmission Paths May Be Used)



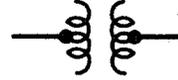
5.19 Test Point (Where It Is Intended That The Guided Transmission Path May Be Broken for Test or Measurement)



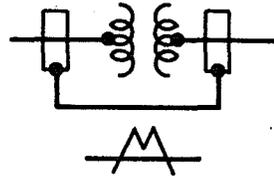
(a) If it is important that d-c paths be open, a note may be added.

(b) Connector types may be indicated.

5.20 Transformation For Tapers And Step Transformers Without Mode Change



(a) Application: Transformer with d-c ground connections and mode suppression



5.21 Transmission Path, Guided

(a) A single line represents a transmission path and extends for its entire length. The recognition convention is used at the beginning and the end of each kind of transmission path, and at intermediate points as needed for clarity. Mode may be indicated.

(b) Coaxial



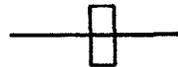
(c) Single conductor



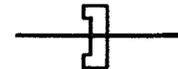
(d) Waveguide, circular



(e) Waveguide, rectangular



(f) Waveguide, ridged



REASONS FOR REISSUE

1. This section has been completely rearranged. In specific reasons for reissue, reference is made to paragraphs and corresponding subject matter and figures as arranged in this issue.
2. Paragraph 1.01 was changed to increase the size of schematic conventions from two-thirds to full size.
3. Paragraphs 1.02, 1.03, and 1.08 were added.
4. Paragraph 1.07 was changed to remove parenthesis from the functional designations of apparatus.
5. Paragraphs 2.02, 2.03, 2.04 (b), (c), and (d), 2.05 to 2.12, and 2.15 (a) and (b) were added.
6. In paragraph 3.01, line conventions for jumper, dotted leads, apparatus, and mechanical connections were added.
7. Paragraph 3.02 was added.
8. Paragraph 3.03 was expanded to cover "EU" shielding.
9. Paragraphs 3.04 (g) and (h) were added.
10. The figure was omitted from paragraph 3.05 and reference to BSP AA610.004 was added.
11. Paragraph 4.01 was added.
12. Paragraphs 4.02 (a) and (c) were changed.
13. In paragraphs 4.05 and 4.07, the convention was changed in (a) and (b), and (c) was added.
14. Paragraph 4.06 was added.
15. In paragraph 4.08, condensers was changed to capacitors and the conventions in (a) and (b) were changed and (c) and (d) were added.
16. In paragraph 4.09, the convention was changed.
17. In paragraphs 4.13, 4.14, and 4.15, additional conventions were added.
18. Paragraph 4.18 was added.
19. In paragraph 4.19, vacuum tubes were changed to electronic tubes and conventions were changed.
20. In paragraphs 4.22 and 4.26, conventions were changed.
21. In paragraph 4.29, induction coils, repeating coils, retardation coils, transformers, and autotransformers were brought under one heading "Inductors" and conventions were changed.
22. The heading of paragraph 4.30 was expanded to cover instruments and additional abbreviations were added.
23. In paragraphs 4.32 and 4.33, conventions were changed and additional figures were added.
24. In paragraph 4.34, additional conventions were added.
25. In paragraphs 4.35 and 4.36, conventions were changed and additional figures were added.
26. Paragraphs 4.39 and 4.41 were added.
27. In paragraphs 4.42, 4.43, 4.46, 4.47, 4.49, and 4.50, additional conventions were added.
28. Paragraph 4.44 was added.
29. In paragraph 4.52, resistances were changed to resistors and an additional convention was added.
30. In paragraph 4.58, conventions were changed.
31. In paragraph 4.59, conventions were changed and additional figures were added.
32. In paragraph 4.61, conventions were added.
33. Paragraphs 4.62, 4.63, 4.64, 4.66, 4.67, 4.70, and 4.73 were added.
34. In paragraph 4.65, an additional convention was added.
35. In paragraph 4.72, varistors and rectifiers were combined under one heading and new conventions were added.
36. In paragraph 5.07, heading was changed to read "Directional Coupler."
37. Under attachments, Fig. 1 was removed.

Bell Telephone Laboratories, Inc.