

## DETACHED-CONTACT-TYPE SCHEMATIC DRAWINGS (SDs) DESCRIPTIVE INFORMATION

CONTENTS	PAGE	CONTENTS	PAGE
1. GENERAL . . . . .	2	6. NOTES AND GENERAL CIRCUIT INFORMATION . . . . .	13
2. ARRANGEMENT OF INFORMATION IN THE DRAWINGS . . . . .	3	A. Circuit Notes . . . . .	13
A. General . . . . .	3	B. Equipment Notes . . . . .	15
B. Sectionalized Drawings . . . . .	4	C. Information Notes . . . . .	15
C. Nonsectionalized Drawings . . . . .	4	D. Cross-connection Information . . . . .	15
3. INDEXES AND SUPPORTING INFORMATION . . . . .	5	E. Transmission Test Requirements Information . . . . .	15
A. Sheet Indexes . . . . .	5	F. Working Limits Information . . . . .	15
B. Supporting Information . . . . .	6	7. SEQUENCE CHARTS . . . . .	15
C. Apparatus Index . . . . .	6	8. CIRCUIT REQUIREMENTS TABLES . . . . .	16
D. Lead Index . . . . .	6	9. TIMING REQUIREMENTS TABLES . . . . .	16
E. Option Index . . . . .	7	10. CABLING DIAGRAMS . . . . .	17
4. FUNCTIONAL SCHEMATICS . . . . .	7	11. LOCATING INFORMATION IN THE DRAWING . . . . .	17
5. APPARATUS FIGURES . . . . .	8	12. CIRCUIT DESCRIPTIONS . . . . .	17
A. General . . . . .	8	REASONS FOR REISSUE . . . . .	18
B. Wire-spring General Purpose Relays . . . . .	8		
C. Wire-spring Multicontact Relays . . . . .	9	<b>FIGURES</b>	
D. Dry Reed Relays . . . . .	10	1 Sheet Index for Sectionalized Drawing . . . . .	20
E. Mercury Contact Relays . . . . .	11	2 Sheet Index for Nonsectionalized Drawing Arranged for Individual Sheet Reissue . . . . .	21
F. General Relay Tabular Form . . . . .	11	3 Sheet Index for Nonsectionalized Drawing Not Arranged for Individual Sheet Reissue . . . . .	21
G. Individual Relays . . . . .	11	4 Supporting Information . . . . .	21
H. Capacitors . . . . .	11	5 Apparatus Index . . . . .	22
I. Cords . . . . .	11	6 Lead Index . . . . .	22
J. Fuses . . . . .	12	7 Option Index . . . . .	22
K. Jacks . . . . .	12	8 Functional Schematics — Methods of Showing Information . . . . .	23-25
L. Keys and Keytops . . . . .	12	9 Apparatus Figures — Methods of Showing Information . . . . .	26-29
M. Lamps and Networks . . . . .	12	10 Fusing Note . . . . .	30
N. Outlets and Receptacles, Potentiometers, Rectifiers, and Regulators . . . . .	13	11 Feature or Option Note . . . . .	30
O. Resistors . . . . .	13	12 Network Values Note . . . . .	30
P. Selectors . . . . .	13	13 Job Record Note . . . . .	30
Q. Switches . . . . .	13		
R. Thermistors, Transformers, Transistors, Tubes, and Varistors . . . . .	13		

FIGURES	CONTENTS	PAGE
14	Transmission Test Requirements Table . . . . .	30
15	Working Limits Table . . . . .	30
16	Sequence Charts — Methods of Showing Information . . . . .	31
17	Sequence Chart Index of Operate and Release Locations . . . . .	32
18	Circuit Requirements Table . . . . .	33
19	Timing Requirements Table . . . . .	33
20	Cabling Diagrams — Methods of Showing Information . . . . .	34

## 1. GENERAL

**1.01** This section describes a type of circuit drawing being issued by the Bell Telephone Laboratories, Incorporated, in the SD drawing series. The drawings are called detached-contact schematics. The manner of presenting the circuit information, the symbols and conventions employed, and other facts concerning detached-contact schematics are covered in this section.

**1.02** This section is reissued in order to bring the information it contains into agreement with the latest practices. This involves changes and additions to the text and illustrations. Since this is a general revision, the arrows ordinarily used to indicate changes are omitted. Detailed information concerning the changes will be found under Reasons for Reissue at the end of this section.

**1.03** An SD drawing contains the *basic* circuit information for a specific part of a switching system. An entire switching system may be represented by a group of SDs. These drawings provide, in one compact whole, information needed for:

- (a) Manufacture and shop testing.
- (b) Installation and testing prior to cutover.
- (c) Training of personnel in the understanding of the circuit.
- (d) Engineering of switching systems.
- (e) Operation and maintenance of the circuit.

**1.04** Since about 1928, SD drawings have been prepared in what may be called "attached" form. That is, the individual relays, jacks, keys,

coils, tubes, etc, which, when properly wired together, constitute a circuit, were shown in the SD as complete physical units. Because many of these apparatus items consisted of separate parts (contacts) that were used to perform multiple functions in the circuit, it was necessary to show the circuit paths going back and forth between the separate parts of the apparatus items. This method of presenting the circuit was generally satisfactory for the types of circuits then in use. However, with the gradual replacement of manual switching systems by more and more complex dial switching systems, it became increasingly difficult to present the circuit information in SD drawings in a manner suitable for the many uses made of the information. Sometimes, it was difficult to understand the circuit, and the tracing of circuit paths was complicated by having to follow the action of the circuit through a large number of paralleling and crossing lines that frequently extended over a number of sheets of the drawing. In recent years, with the introduction of common control switching systems and automatic message accounting, it became imperative that a different method of presenting switching systems circuits be devised. Some of the complex circuits of these newer systems are comprised of thousands of individual relays, tubes, and other apparatus items. Under such conditions, the presentation, understanding, and use of the circuit information involved numerous difficulties. As a result of extensive investigation of various arrangements for presenting switching systems circuit information in a simplified and more generally satisfactory manner, the detached-contact-type SD described in this section has been devised. Indications are that these methods of presenting circuit information are well suited for large complicated circuits as well as for smaller, simpler circuits. It is intended, therefore, that the detached-contact-type of drawing will be used for all new systems and for major new circuits added to existing systems. In addition, it will be used for major changes in existing switching systems circuits.

**1.05** The information contained in a detached-contact-type schematic drawing is separated into class groups, each serving to portray information of a similar character. Cross referencing between the groups is employed to coordinate the information. Extensive indexes located on the first page or pages of the drawings help to locate individual items of information in any

group of the drawings. Each of these groups that has been established is described in individual detail in this section.

**1.06** In a detached-contact-type SD drawing, the circuit paths are presented in a manner that emphasizes the functions performed by the circuit. The circuit paths are shown in a series of Functional Schematics (FSs) constituting one of the groups of the drawing. Each FS represents a function or a related group of functions and shows the complete functioning paths of all relays and other apparatus involved. An attempt is made to show all circuit paths complete from battery to ground, even though this may require repeating information shown in other FSs or other circuits. External circuit information, however, is not necessarily shown in complete detail, but only sufficiently to give meaning to the function path.

**1.07** In order to achieve the objectives of an FS, relays, jacks, keys, switches, and other apparatus having parts that perform separate operations are shown in a "detached" manner whenever this is helpful. For example, relay contacts are shown directly associated with the functional path of which they are a part and not in their physical relation to the relay coil that operates them. In this sense, therefore, the relay contacts are "detached" from their operating coil. Thus, detached-contact schematics are fundamentally different from attached-contact-type schematics which emphasized physical apparatus grouping.

**1.08** In switching systems circuits, the individual parts of a given relay, jack, key, or other switching component in a circuit may perform different functions. As a result, the individual parts may be shown in numerous FSs of the circuit. This condition requires that a means be provided for readily associating the detached parts into their physical relation to each other. This is done by showing all of the parts of each piece of apparatus in "attached" form in another group of the drawing called Apparatus Figures (APP FIGs). In addition to showing each apparatus item in its physical arrangement, APP FIGs serve as an index of where all of the parts of each piece of apparatus are shown on the FSs of the circuit. Also, the APP FIG. gives the code number of each apparatus item as well as the quantity required. When the apparatus item is available in a variety of values, the particular

value required is given. An APP FIG., therefore, indicates complete information for ordering all of the individual apparatus items that are included in a coded apparatus unit (J code).

**1.09** As an aid to understanding the circuit, another group of information known as Sequence Charts (SCs) is usually included as part of the drawing. These SCs show the time order (sequence) of operation and release of the relays, switches, and other electromagnetic and electronic devices as they perform their various functions in the circuit.

**1.10** In addition to the three groups of circuit information (FSs, APP FIGs., and SCs) described briefly above, other information required to complete the circuit story is contained in other groups of the drawing. However, since they are all auxiliary to the above three fundamental groups of circuit information, these other groups will be discussed in detail later in this section.

**1.11** The figures referred to in the following text are to be found at the end of the section. The configurations, charts, tables, indexes, etc, illustrated in these figures are typical and do not represent a particular systems drawing.

## **2. ARRANGEMENT OF INFORMATION IN THE DRAWINGS**

### **A. General**

**2.01** Reference is made in this section to sectionalized and nonsectionalized drawings. Drawings that contain three or more sheets of FSs, or drawings covering circuits comprised of approximately 30 or more relays having different functional designations are usually sectionalized. Drawings that do not meet one or the other of the above conditions are usually classed as non-sectionalized.

**2.02** All sheets of both sectionalized and non-sectionalized SDs of the detached-contact type are drafted on tracing forms measuring 22 by 34 inches; when printed for field use, all sheets are reduced to 11 by 17 inches.

**2.03** The drawing number, sheet number, complete title, and rating are shown in the lower right-hand corner of the first sheet of each drawing. All subsequent sheets show the drawing, sheet number, and an abbreviated title. The

system of numbering the sheets and the arrangement of the circuit information differs for sectionalized and nonsectionalized drawings. These differences are explained below in B and C.

**2.04** As will be noted from the following text, the circuit information for both sectionalized and nonsectionalized drawings is given in clearly separated groups. For this reason, when drawings are reissued to add information it will be possible, in most instances, to place the added information with existing similar information without disturbing the sheet numbers of the drawing.

**2.05** Occasionally the statement SEE NOTE, followed by the numbers 1, 2, etc, is shown on a sheet of the drawing. These are references to sheet notes located somewhere on the sheet. These notes are numbered in sequence starting with note 1 on each sheet, and they are used to clarify the information on the sheet where the SEE NOTE statement is shown.

#### B. Sectionalized Drawings

**2.06** Sectionalized drawings are arranged in clearly separated groups for each type of circuit information. Each group is assigned a letter designation from A to G, as shown in Table A. The sheets in each group are numbered in sequence. The group letter and sheet number are shown on each sheet as part of the last suffix in the drawing number. For example, on SD-27000-01-A2, the A2 indicates Group A, Sheet 2.

**Table A — Arrangement of Information in Sectionalized Drawings**

GROUP	CONTENTS
A	Sheet Index Supporting Information Apparatus Index Lead Index Option Index
B	Functional Schematics (FS)
C	Apparatus Figures (APP FIG.)
D	Circuit Notes (100 Series) Equipment Notes (200 Series) Information Notes (300 Series) (Block Diagrams, Theory Schematics) Cross-connecting Information and Notes (400 Series) Transmission Test Requirements Table Working Limits

GROUP	CONTENTS
E	Sequence Charts (SC)
F	Circuit Requirements Tables (CRT) Timing Requirements Tables (TRT)
G	Cabling Diagrams (CAD)

**2.07** Each type of information listed above is described in this section. Some circuits may not contain information in one or another of the groups; in such cases, the group letter is not used. For example, if SCs are not furnished with issue 1 of a drawing, the E group is omitted.

**2.08** To facilitate locating the information in the SD, sheet coordinates are furnished on most sheets. Only sheets in the A group and the F group do not have sheet coordinates since they would serve no useful purpose on sheets of these groups. Two systems of coordinates are used, as follows:

(a) On sheets in the B, C, D, and G groups, the numbers 0 to 9, evenly spaced, are placed from left to right on the top and bottom edges of the sheet. The letters A to H, evenly spaced, are placed from top to bottom at the left- and right-hand edges of the sheet.

(b) On sheets in the E group (which contain the Sequence Charts) numbers starting with 1, evenly spaced, are placed from top to bottom on the left- and right-hand edges of the sheet. Letters starting with A, evenly spaced, are placed from left to right at the top and bottom edges of the sheet.

**2.09** Coordinate location information consists of three parts, the sheet number, a letter coordinate, and a number coordinate. Except where FS (B group) coordinate locations are referred to in APP FIGs (C group), coordinates are not usually cross-referenced from one group of sheets to another group. Therefore, the group identification is omitted from the coordinate. A coordinate such as 7H5 referred to in the FS sheets (B group) means sheet B7, letter coordinate H, and number coordinate 5. Coordinate 3AA10 referred to in the SC sheets (E group) means sheet E3, letter coordinate AA, and number coordinate 10.

#### C. Nonsectionalized Drawings

**2.10** In nonsectionalized drawings, the information is arranged as follows:

- (a) All sheets are numbered in sequence starting with sheet 1. The last sheet number is shown on each sheet as the last suffix in the drawing number. For example, on SD-26085-01-3, the digit 3 indicates sheet 3.
- (b) An Apparatus Index is not ordinarily furnished, but if it is, no equipment location is shown, since for small circuits the apparatus is usually concentrated in a small area on a single equipment unit or central office frame.
- (c) The circuit notes and other information (assigned to the D group in sectionalized drawings) are located on the first sheet and second sheet, if necessary.
- (d) If space permits, the APP FIG. is placed on the same sheet as the FS.
- (e) SCs are generally located on a separate sheet, but if there is sufficient space they may be located on the same sheet with the FS to which they apply. Circuits with only a few operating elements may not require an SC.
- (f) If space permits, CADs are placed on the same sheet with the Circuit Requirements Table.
- 2.11** The system of coordinates, as described in 2.08 for sectionalized drawings, is also used on nonsectionalized drawings.
- 2.12** On reissues of nonsectionalized drawings, if a new sheet is added it usually is placed at the end of the drawing, but it may be placed within the existing sheet structure by reassigning the page numbers of the drawing.
- 2.13** Based on the above, the arrangement of a typical nonsectionalized drawing is as shown in Table B.

**Table B — Arrangement of Information in Nonsectionalized Drawings**

SHEET	CONTENTS
Sheet 1 (and Sheet 2, if required)	Sheet Index Supporting Information Apparatus Index (if furnished) Lead Index (if furnished) Option Index Transmission Test Requirements Tables Working Limits

SHEET	CONTENTS
	Circuit Notes (100 series) Equipment Notes (200 series) Information Notes (300 series) (Block Diagrams, Theory Schematics) Cross-connection Information and Notes (400 series)
Subsequent Sheets	Functional Schematics (FS) Apparatus Figures (APP FIG.) Sequence Charts (SC) Circuit Requirements Tables (CRT) Timing Requirements Tables (TRT) Cabling Diagrams (CAD)

### 3. INDEXES AND SUPPORTING INFORMATION

#### A. Sheet Indexes

**3.01** The Sheet Index gives the contents of each sheet of the drawing. It is always placed in the upper left-hand part of sheet 1 of nonsectionalized drawings. On sectionalized drawings, it is placed on sheet A1 and may extend to sheets A2, A3, etc.

**3.02 Sectionalized Drawings:** Fig. 1 shows a Sheet Index for a sectionalized drawing. The column designated CONTENTS lists the subject or title of the circuit information shown on each sheet. The column designated SHEET NO. lists the sheet numbers in sequence; namely A1, A2, A3, B1, B2, B3, etc. The remaining columns with the over-all designation of ISSUE NO. show the latest issue of each sheet.

**3.03 Nonsectionalized Drawings:** Fig. 2 and 3 show a Sheet Index for a nonsectionalized drawing. Fig. 2 illustrates a Sheet Index for a nonsectionalized drawing that is arranged to be reissued on an individual sheet basis. This type of Sheet Index is the same as for sectionalized drawings except that the sheet numbers are listed as 1, 2, 3, 4, etc. Fig. 3 illustrates a Sheet Index for a nonsectionalized drawing that is not arranged to be reissued on an individual sheet basis. In this type of Sheet Index, the first column, designated SHEET NO., lists the sheet numbers in sequence; namely 1, 2, 3, etc. The second column, designated CONTENTS, lists the subject or title of the circuit information shown on each sheet.

**B. Supporting Information**

**3.04** The Supporting Information Table (see Fig. 4) shows the Equipment Drawings (J or ED) and Equipment Design Requirements Specifications (J Specs) for the circuit. If there are any other specifications covering Supporting Information, such as Trunk Tables, they also are shown. The Supporting Information is always located in the upper right-hand part of sheet A1 on sectionalized drawings and sheet 1 on non-sectionalized drawings.

**C. Apparatus Index**

**3.05** The Apparatus Index, when provided, contains information for locating all apparatus in the FSs and APP FIGs. (excepting networks as explained in 3.07). For some circuits, the Apparatus Index also shows the equipment location of the apparatus.

**3.06** As shown in Fig. 5, the Apparatus Index is divided into four columns, arranged as follows:

(a) The DESIG column lists the apparatus designations. Relays are listed first, followed by other types of apparatus in alphabetical order of their type. For example, relays, capacitors, cords, jacks, keys, lamps, etc. The apparatus type is shown horizontally above the associated information. For each type of apparatus, numbered functional designations are listed first in numerical order, and are followed by lettered functional designations in alphabetical order.

(b) Under the heading LOCATION, the FS column lists the FS sheet number and location coordinates of the apparatus. The location coordinates for relays refers to the location of the relay coils. Note that the sheet group designation (B) is omitted, since it is understood that on sectionalized circuits FSs are always located in the (B) group.

(c) Under the heading LOCATION, the APP FIG. column lists the APP FIG. number of which the apparatus is a part. Where an APP FIG. extends over several sheets of the drawing and the apparatus is not arranged alphabetically within the APP FIG., the APP FIG. sheet number where the apparatus is located is shown in addition to the APP FIG. number. The APP FIG. number is shown first, followed by the sheet number; that is, 18 (C7).

(d) The EQPT column is always provided, but is used only when it is desired to show where the apparatus is located on the frame, bay, plate, etc. This is usually necessary only when the apparatus is spread over eight or ten mounting plates or over more than one equipment bay. The bay number is shown first, followed by the plate number; that is, 1-10. It may also be necessary to show the apparatus location when the apparatus is mounted in a cabinet or on a panel. In these cases, the cabinet or panel name is shown.

**3.07** Contact protection networks are not usually included in the Apparatus Index since they are usually connected to and given the same designation as the apparatus whose energy is to be absorbed. However, they are included in the Apparatus Index where they are used for purposes other than contact protection or where they are not directly associated with a particular piece of apparatus. Contact protection networks are listed in the APP FIG. and the exact FS location is given there.

**D. Lead Index**

**3.08** The Lead Index gives the location on the FS and on the CAD sheet, where necessary, of all the leads that connect to other circuits.

**3.09** As shown in Fig. 6, the Lead Index is arranged as follows:

(a) The connecting circuit title is shown horizontally above the associated group of leads. The circuit titles are usually listed alphabetically.

(b) The DESIG column lists the designations of leads (or groups of leads) to the connecting circuit. Number designations are listed first in numerical order, and are followed by letter designations in alphabetical order.

(c) The FS LOC column lists the FS sheet number and location coordinates where the leads are shown. When a group of leads is spread over several consecutive coordinates, only the coordinates for the center of the group are given.

(d) The CAD LOC column lists the CAD sheet number and location coordinates where the leads are shown. When a group of leads is spread over several consecutive coordinates,

ordinates, only the coordinates for the center of the group are given. Where CAD information is shown on a sheet that does not have location coordinates, the number of the CAD that contains the leads is listed.

#### E. Option Index

**3.10** The Option Index gives the location on the drawing of all optional APP FIGs., optional apparatus, and optional wiring. The Option Index (see Fig. 7) is arranged as follows:

(a) The APP OR WIRING column lists the designations of optional APP FIGs., optional apparatus, and optional wiring. Number designated APP FIGs. are listed first in numerical order followed by letter designated APP FIGs., if any, in alphabetical order and then by single letter designations in reverse alphabetical order. Additional designations ZA, ZB, ZC, etc, are listed, if required.

(b) The LOCATION column shows:

(1) For optional APP FIGs., the APP FIG. designation and, in addition, where necessary, the FS sheet number and location coordinates of wiring not covered in the APP FIG. See Fig. 7 (first five entries).

(2) For optional apparatus and wiring, the APP FIG. number of which the apparatus is a part and, in addition, the FS sheet number and location coordinates of the option not covered in the APP FIG. See Fig. 7 (Y, X, and T entries).

(3) For optional wiring only, the FS sheet number and location coordinates. See Fig. 7 (Z, W, V, S, and Q entries). Where a wiring option appears only in a cabling diagram (CAD), the CAD number in which the option appears is entered in the location column. See Fig. 7 (R entry).

#### 4. FUNCTIONAL SCHEMATICS

**4.01** A general description of FSs is given in 1.06 and 1.07.

**4.02** The rules covering the methods of showing information in an FS, together with detailed explanations of the symbols used, are given in Fig. 8.

**4.03** The number of FSs in a circuit depends on the size and type of circuit. Circuits that perform several different functions will have several FSs, whereas a small circuit, such as a trunk, might have only one FS.

**4.04** Each FS is given a number and a title. The title may indicate a circuit function, such as Pulse Counting, or the name of the circuit, such as Trunk Circuit.

**4.05** As will be observed upon examination of Fig. 8, there are two basic symbols used for contacts, as follows:

- (a) A line with a superimposed X is used for a make contact (open when unoperated).
- (b) A line with a superimposed bar is used for a break contact (closed when unoperated).

The two symbols are used together to form the various combinations of associated springs. These contact symbols are designed to allow a circuit path to be shown by straight lines without continual offsets, as would be required if the armature spring and arrowed contacts were used to represent contacts.

**4.06** It will also be observed that the battery symbol employed consists of the spelled out battery voltage rather than a battery symbol.

**4.07** The symbols used on FSs are, in general, the same as have been standard in the past.

**4.08** Use is made in FSs of abbreviations and condensing patterns. However, an FS always contains sufficient detail to permit a person familiar with the rules, but not necessarily familiar with the scope of the circuit, to interpret and apply the information.

**4.09** In most cases, an FS is limited to one sheet of the drawing and portrays only one function or subfunction of the circuit.

**4.10** One of the features of FSs is the showing of the circuit paths complete from battery to ground, which involves in some cases extending the paths beyond the circuit boundary. As illustrated in Fig. 8, Sheet 2, all external circuit information is enclosed within a double-line box.

**5. APPARATUS FIGURES****A. General**

**5.01** A general description of APP FIGs. is given in 1.08.

**5.02** The amount of apparatus contained in an APP FIG. is the number of relays, resistors, etc, that can be conveniently manufactured or ordered as a unit. When only one or two pieces of apparatus is required, a separate APP FIG. may be shown, or the apparatus may be shown as a letter-designated option within another APP FIG.

**5.03** The contents of an APP FIG. are governed by equipment, manufacturing, and optional ordering considerations, and are not affected by the content of any particular FS. Therefore, one APP FIG. may combine apparatus appearing on more than one FS.

**5.04** Depending on circumstances, an APP FIG. may be nonoptional, meaning that it is always furnished; optional as a whole; or optional in part.

**5.05** Fig. 9 shows the method of listing the various types of apparatus in an APP FIG. Practically all apparatus is listed in the APP FIG.; notable exceptions are mounting plates, lamp sockets, and tube sockets. For each piece of apparatus listed, the following information is shown:

- (a) Type of apparatus (relay, capacitor, etc).
- (b) Functional designation.
- (c) Location on the FS of each component part.
- (d) Apparatus option designations.
- (e) Code (complete ordering information).
- (f) Type of contact components and their sequence characteristics. Either of two methods is used to show this information. One is a pictorial representation using familiar contact symbols of the attached-contact-type schematic. This method is used for apparatus having contact springs that are numbered individually, such as U-type relays. The other method is tabular in form and employs abbreviations to represent contact-type and sequence characteristics. For wire-spring relays, the following abbreviations are used.

- M — Make
- B — Break
- EM — Early Make
- EB — Early Break
- BM — Break-Make (Nonsequence transfer)
- EBM — Early Break-Make (Sequence transfer)
- EMB — Early Make-Break (Continuity)
- PM — Preliminary Make
- PB — Preliminary Break
- PMEB — Preliminary Make — Early Break (Preliminary transfer with respect to late contacts)
- PBEM — Preliminary Break — Early Make (Preliminary continuity with respect to late contacts)

**5.06** Whenever more than one functional designation is associated with a single code, the required quantity of the coded apparatus is shown in brackets (see capacitors and networks in Fig. 9, Sheet 3.)

**5.07** Whenever practicable, the information in an APP FIG. is shown in tabular form. The methods used to show information for specific types of apparatus are discussed in detail in the following paragraphs of this part.

**B. Wire-spring General Purpose Relays**

**5.08** Wire-spring general purpose relays are listed in one of two tabular forms, as shown in Fig. 9, Sheet 1, and described as follows:

(a) The table for relays with twelve contact positions is shown under APP FIG. 1 and accommodates as many as 12 relays. Reading across, it will be noted that the table is divided into major columns formed by heavy vertical lines. Each column contains the information for a particular relay. An additional column at each end of the table shows the type of information listed for each relay. For example, starting at the upper left-hand corner of the table and reading across:

- (1) The DESIG line shows the functional designation of each relay.
- (2) The CODE line shows the code of each relay.
- (3) The OPTION line shows the option (if any) for the relay.

(4) The numbers 12 down to 1 refer to the contact position numbers. The contact arrangement of a particular position on a particular relay is determined by reading across from the spring position number to the CONT ARR (contact arrangement) column. If no contact arrangement is given in the table (see MAN relay, contacts 3, 5, 9, and 11), the interpretation is that the relay is not equipped with contacts in that position. The location on the FS of the contacts provided in a particular position is determined by reading across to the LOC (location) column. If no location information is given for a contact (see F relay, contacts 5 and 7), the interpretation is that the contact is not used in the circuit.

(5) The COIL line shows the FS location of the relay coil.

(b) The table for relays with 24 contact positions is as shown in Fig. 9, Sheet 2, for the AJ702 relays, and may accommodate as many as 20 relays. This table is similar, in some respects, to the table described for the 12 contact arrangement. This is because all contacts columns formed by heavy vertical lines. Each column contains the information for a particular relay. An additional column at each end of the table shows the type of information listed for each relay. Note that no column is included on this table for indicating the composition relays. The table is divided into major of the 24 contact position relays are "makes." Starting at the upper left-hand corner and reading across:

- (1) The DESIG line shows the functional designation of each relay.
- (2) The CODE line shows the code of each relay.
- (3) The OPTION line shows the option (if any) for the relay.
- (4) The numbers 24 down to 1 refer to the contact position numbers. The location on the FS of a particular contact of a particular relay is determined by reading across from the contact number to the vertical column for the relay.
- (5) The COIL line shows the location on the FS of the coil for each relay.

**5.09 Dual Armature Relays:** Dual armature relays such as the AK type are listed in the same table as other general purpose wire-spring relays as illustrated by the MB-SK relay in Fig. 9, Sheet 1 under APP FIG. 1. The information for this type of relay covers two adjacent major columns of the table, each half of the relay being entered in its own column. Each half of this type of relay has a maximum of five contact positions. Contact springs 1 to 5 and the associated coil (terminals 1L and 2L) form the lower half of the relay. Contact springs 8 to 12 and the associated coil (terminals 1U and 2U) form the upper half of the relay. Because of this division of contact numbering only five contacts are tabulated in each of the adjacent columns of the APP FIG.

**5.10 Split Contacts:** When separate functions in different FSs are controlled by the make and break contacts of a transfer contact having direct battery or ground on its common spring, the transfer may be split into its make and break components in the FS. This is done to avoid leads between FSs. The double location is given by a footnote to which reference is made by letters a, b, etc, in the LOC column for each split transfer. This is illustrated in APP FIG. 1, relay ON, contact 4.

**5.11 Options:** If, because of options, a contact is shown in more than one location on the FS, the same method of showing the location is used as described above for split contacts. This is illustrated in APP FIG. 1, relay SR, contact 6; and relay ST, contacts 12 and 5, and the coil.

### C. Wire-spring Multicontact Relays

**5.12** Wire-spring multicontact relays are listed in the tabular form, as shown in Fig. 9, Sheet 1, for the 286A, 287A, and 288A relays. These tables are similar to the table described previously for 24 contact position general purpose wire-spring relays. Note that no column is included on these tables for indicating the contact arrangement. This is because all contacts of the wire-spring multicontact relays are "makes."

**5.13** The 286A relay consists of a single unit having a coil and 30 springs. The table for this relay is divided into major columns formed by the heavy vertical lines. Each column contains the information for a particular relay. A column

at the left-hand side of the table shows the type of information listed for each relay. For example, starting at the upper left-hand corner and reading across

- (a) The DESIG line shows the functional designation of each relay.
- (b) The CODE line shows the code of each relay.
- (c) The OPTION line shows the options (if any) for the relay.
- (d) The numbers 54 down to 0 refer to the contact numbers. The location on the FS of a particular contact of a particular relay is determined by reading across from the contact number to the vertical column for the relay.
- (e) The COIL line shows the location on the FS of the coil for each relay.

**5.14** The 287A and 288A relays consist of two units (upper and lower), each having a coil and 30 springs. The methods used for covering these double-unit relays in the APP FIG. are in general the same as described above for the 286A relay.

#### D. Dry Reed Relays

**5.15** Dry reed relays may be tabulated in several different ways as shown on Fig. 9, Sheet 2. The arrangement of the coils and contacts is shown in the diagram to the left of the designation and location information.

(a) Where all of the parts of a 293-type relay are grouped together at one location in the FS, the APP FIG. information is tabulated as illustrated by the A0, 1, 2, 4, 7, the B0, 1, 2, 3, 4, 7, etc. entries. The columns giving the location information are arranged as follows:

- (1) The DESIG column lists the functional designation of each relay unit used in the circuit. For example, A0, 1, 2, 4, 7 indicates that coils 1, 2, 3, 4 and 5 are used; CT0, 1, 2 indicates that coils 1, 2 and 3 are used; CVA, VG10, CN, CR, TN indicates that coils 1, 2, 3, 4, and 5 are used. With each coil, a coil contact and load contact having the same designation are shown on the FS.
- (2) The LOCATION column shows the location on the FS of the items listed in the subcolumns. For example, the COIL column

lists the location of the coils and the associated A (coil) contacts. The B CONT column lists the location of the B (load) contacts.

- (3) Option indications, where required, are shown to the left of the functional designations.
- (4) The quantity indication, in brackets placed at the left of the designation, indicates that only one 293A relay is required to obtain the relays covered in each listing.

(b) Where the parts of a 293-type relay are scattered throughout the FSs, the APP FIG. information is tabulated as illustrated by the BA, BB, BC, BD, BE, and the DR1D, DR2D, DR3D, DR4D, DR5D entries. This table accommodates a convenient number of relays. Reading across, the table is divided into major columns formed by heavy vertical lines. Each major column is further divided into five parts and contains the information for each relay unit of a particular relay. A column at the left end of the table shows the type of information listed for each relay. Another column of this nature is shown at the right end of the table when more than three relays are listed. Starting at the upper left-hand corner of the table and reading across

- (1) The DESIG line shows the functional designation of each relay unit.
  - (2) The CODE line shows the code of each relay.
  - (3) The OPTION line shows the option (if any) for the relay.
  - (4) The COIL line is divided into two lines. The POS line shows the coil position number. The LOC line shows the FS location of the coils of the relay.
  - (5) The CONT POS line is divided into two lines. The A LOC line shows the FS location for the A contact of the relay units. The B LOC line shows the FS location for the B contact of the relay units.
- (c) The table for the 295-type relays accommodates a convenient number of relays. Reading across, the table is divided into major columns formed by heavy vertical lines. Each column contains the information for a particular relay. A column at the left end of the table shows the type of information listed for

each relay. Another column of this nature is shown at the right end of the table when more than eight relays are listed. Starting at the upper left-hand corner of the table and reading across

- (1) The DESIG line shows the functional designation of each relay.
- (2) The CODE line shows the code of each relay.
- (3) The OPTION line shows the option (if any) for the relay.
- (4) The CONT line is divided into six lines, namely, F, E, D, C, B, A. These six lines show the FS locations for the A, B, C, D, E, and F contacts of the relay.
- (5) The COIL line shows the FS location of the relay coil.

#### E. Mercury Contact Relays

**5.16** Mercury contact relays (see tables for 275- and 276-type relays in Fig. 9, Sheet 1) are shown individually or in tabular form. If there is more than one relay of a type, the tabular form is generally used. As will be noted, the table is similar to those described previously except that the numbers in the left-hand column refer to the terminal numbers of the relays. Because of the different internal contact arrangements of these relays, the arrangement is illustrated to the left of the table. For each different arrangement, a separate illustration and table is shown. Split contact appearances on the FS are shown as described for wire-spring general purpose relays in 5.10 (see JM relay).

#### F. General Relay Tabular Form

**5.17** Except as noted above for relays of the wire-spring, dry reed, and mercury contact types, if an APP FIG. contains relays having the same code, they are listed in the manner shown for the UB6002 relay or the S63 relay, Fig. 9, Sheet 1. The table is arranged as follows:

- (a) The designations to the right of the relay code are the relay functional designations. All information shown under each designation applies to the same relay.
- (b) Any option designation applying to the relay is shown directly under the relay designation (see KA2 relay).

- (c) The location on the FS of the coil or a particular contact of a particular relay is determined by reading across from the symbol in the illustration to the relay designation column.

#### G. Individual Relays

**5.18** Individual relays are listed as shown for the GT, CLR, RL and TR, and IC relays in Fig. 9, Sheet 1. Such relays are shown as follows:

- (a) They are grouped together, and the group is headed by the word RELAY.
- (b) The convention for each relay is shown.
- (c) The code is shown above each convention.
- (d) The relay functional designation is shown above the code.
- (e) Option designations, if any, are shown to the left of the functional designation (see GT relay).
- (f) The location on the FS is shown adjacent to each detached part of the relay.

The 266-type relays consist of two R-type relays permanently joined. The left- and right-hand units are referred to as ICL and ICR, and are so indicated in the FS. The IC relay illustrated is a 266A. This relay has a set of make contacts which are actuated by the cover cap. At these contacts in the FS the notation is made that they are operated by the cap.

#### H. Capacitors

**5.19** Capacitors are listed in the APP FIG. in tabular form, as shown in Fig. 9, Sheet 3. The LOC column lists the location on the FS of each capacitor. Option and quantity indications, if required, are shown to the left of the functional designation. The table includes all coded capacitance units that are not part of coded networks. Complete ordering information is given in the CODE column.

#### I. Cords

**5.20** Cords are illustrated in the APP FIG. as shown in Fig. 9, Sheet 3. No location information is given unless the cord is shown on an FS.

**J. Fuses**

**5.21** Fuses are listed as shown in Fig. 9, Sheet 3.

**K. Jacks**

**5.22** Jacks are listed as shown in Fig. 9, Sheet 3.

**5.23** When a jack is not shown in a detached manner, one set of location coordinates is, of course, sufficient to locate the jack on the FS. In such cases, the jack is listed in a table as shown for jacks A, B, L14, etc.

**5.24** When a jack is shown in a detached manner, the standard jack convention is illustrated, together with a table giving the functional designations, location coordinates, and code information (see L and M jacks). This arrangement is similar to that for individual relays. The contacts of each jack are numbered, with the jack viewed from the wiring side to permit identification of the detached contacts of the jack in the FSs.

**L. Keys and Keytops**

**5.25** As will be noted from Fig. 9, Sheet 3, an individual diagram is given for each different functionally designated key. The functional designations appear above the diagrams for push-button- and turn-button-type keys. This is illustrated by the LINE PERF and EMER RESET keys, which are push-button-type keys, and by the 2/5 CHECK key, which is a turn-button-type key. For lever-type keys, the functional designations are located as illustrated by the NORTH-SOUTH and EAST-WEST keys. The code number of the key appears at the top of the diagram, as illustrated. If options are involved, the option designation appears to the left of the functional designation or code number.

**5.26** The springs of each key are numbered to permit identification of the detached contacts of the key in the FS.

(a) Lever-type keys are divided into quadrants which are identified by the letters A, B, C, and D. The lettering of the quadrants is fixed in relation to the front of the key. The front of the key is defined as the end where the key code is stamped. The operation of the key lever towards the front of the key always operates the springs in the A and D quadrants. The quadrants are arranged in the diagrams

so that the springs of the key are pictured in the same position as they appear to a person working on the wiring side of the equipment. If the key is mounted so that it is rotated either 90 or 180 degrees, the quadrants rotate accordingly. In each quadrant, the springs are numbered from the plunger out. The plunger is represented by a single- or double-ended arrow. In the example shown in Fig. 9, Sheet 3, the NORTH-SOUTH key diagram shows the front of the 479DW key towards the bottom of the frame as seen from the wiring side. In the EAST-WEST key diagram, the view shown is for a 479DW key mounted in a keyshelf as seen when the keyshelf is raised to permit access to the wiring side of the key. In this case, the front of the key is toward the front of the keyshelf.

(b) The springs of push-button and turn-button-type keys that are mounted with their contact terminals in a vertical or horizontal row, as viewed from the wiring side, are numbered from bottom to top or left to right, respectively. Where this type of key is mounted with its row of terminals in other than a vertical or horizontal position, the row of terminals is projected into an imaginary horizontal position by rotating it in a clockwise direction. The springs are then numbered from left to right.

**5.27** A keytop diagram is given for each different functionally designated key and indicates the position in which a key is mounted in the equipment. For lever-type keys, the placement of the code at the keytop diagram indicates the front or code stamped side of the key. At the NORTH-SOUTH keytop diagram in Fig. 9, Sheet 3, the code 479DW is shown at the bottom. This illustration indicates that this particular key is mounted in such a way that the front is toward the bottom. The TALK-RING keytop diagram shows the code at the top of the key diagram. This indicates that this key is mounted with the front toward the top.

**M. Lamps and Networks**

**5.28** The APP FIG. information for lamps and networks is presented in tabular form, as shown in Fig. 9, Sheet 3. Built-up-type contact protection, which consists of a coded capacitor and a coded resistor, is not listed under networks; the individual parts are listed under capacitors and resistors.

#### N. Outlets and Receptacles, Potentiometers, Rectifiers, and Regulators

5.29 The APP FIG. information for this type of apparatus is presented in tabular form, as shown in Fig. 9, Sheet 4.

#### O. Resistors

5.30 Resistors are listed in tabular form as shown in Fig. 9, Sheet 4. Option and quantity indications, when required, are shown to the left of the functional designation. Note that the ordering information under the heading CODE is complete but varies, depending upon the type of resistor, for example

(a) For resistors A and B, the codes 18AG and 19GH are sufficient since these particular codes define the resistance value and the tolerance.

(b) For resistor C, the code 145B defines the type and the tolerance but not the resistance value. Therefore, the resistance value is shown.

(c) For resistor D, the required tolerance is specified by L1, L2, or L3 (corresponding to  $\pm 5$  per cent,  $\pm 10$  per cent, or  $\pm 20$  per cent. Also, the required resistance value is shown.

#### P. Selectors

5.31 Selectors are shown in tabular form as illustrated in Fig. 9, Sheet 4. Starting at the left, the columns give the following information. Functional designation, option (if any), selector code and bank code. The ARC column is divided into a number of columns, one for each arc of the bank. Where the terminals of each arc are at one location in the FS, one locating coordinate is shown in the column. Where the terminals of any arc are at more than one location in the FS, the arc columns are subdivided into two columns, one designated TERM, which lists the terminals of the arc and the other designated LOC which lists the FS location of the terminals. The next major column is designated STEP MAG LOC and shows the location of the core of the stepping magnet. The last column, designated INT CONT LOC, lists the location of the interrupter contacts. In some cases, where the interrupter contacts are composed of several springs, a spring combination symbol is shown in this column and the locations of the individual springs are given.

#### Q. Switches

5.32 Fig. 9, Sheet 4 shows the APP FIG. arrangements for various types of switches.

5.33 Single-pole toggle switches (CLP, PLP, etc) are covered by a table showing the functional designation, the location, and the code number.

5.34 A double-pole, double-throw toggle switch is covered as illustrated by the MB switch.

5.35 Section-type switches are listed in several ways depending upon the switch and its use in the FS.

(a) Switches with only one circuit per section and having the contacts at one location in the FS are covered as illustrated by the AUD TEST switch. Where the contacts are at more than one location in the FS, the switch is covered by a table as illustrated by the FREQ switch. This table shows the functional designation, code, option (if any), and location of the terminals of the various parts of the sections.

(b) Switches with more than one circuit per section are covered by a table as illustrated by the S switch. This table shows the functional designation, option (if any), code, and location of the terminals of the circuits of the various sections.

5.36 Crossbar switches are covered in tables arranged in various ways, depending on how the switch is employed in the circuit. The illustrations in Fig. 9, Sheet 4 cover a number of different usages; these, with some minor variations, are adequate to cover most conditions that will occur.

#### R. Thermistors, Transformers, Transistors, Tubes, and Varistors

5.37 The tables at the bottom of Fig. 9, Sheet 4 show the methods for covering the above types of apparatus.

### 6. NOTES AND GENERAL CIRCUIT INFORMATION

#### A. Circuit Notes

6.01 Notes pertaining to the operation of the circuit are called Circuit Notes and are assigned to the 100 series.

**Fusing Information**

**6.02** Circuit Note 101 is always the fusing note. This note is in tabular form, and gives information for the battery, ground, and tone supply leads.

**6.03** Fig. 10 shows a fusing note. It is divided into either four or five columns, arranged as follows:

- (a) The DESIG column lists the designation of the battery, ground, and tone supply leads. This is also the designation of the fuse when the lead is fused.
- (b) The FUSE AMP column lists the rated capacitance of the fuses.
- (c) The POTENTIAL column lists the nominal potential of the power supply leads and the designation of tone leads.
- (d) The ONE PER column indicates that one fuse is needed for each part of the circuit listed in the column.
- (e) On circuits for which connecting block terminals are shown on the FS and in which the power is supplied through connecting block terminals, an added column designated TERM. DESIG shows the block and terminal to which the supply leads are connected. If the terminal differs for different options, the option designation is shown (in a circle) to the left of the block designation.

Explanatory notes and the voltage limits of the circuit are shown at the bottom of the table.

**Feature or Option Information**

**6.04** Circuit Note 102 is always the feature or option note. This note is in tabular form, and shows the apparatus and wiring required to obtain desired features and options.

**6.05** Fig. 11 shows a feature or option note. It is arranged as follows:

- (a) The FEATURE OR OPTION column lists the features or options for which the circuit can be arranged.
- (b) The APP FIG. column shows the APP FIG. number (or numbers) that must be provided to obtain the feature or option.

- (c) The APP OR WIR column shows the optional apparatus or wiring, or both (designated by letters), that must be provided to obtain the option.

- (d) The QUANTITY column shows the quantity of each APP FIG. that must be provided to obtain the feature or option.

**Network Information**

**6.06** Circuit Note 103 is always the network values note. This note is in tabular form and shows the resistance and capacitance of the networks used in the circuit. If no networks are used in a circuit, the note is reserved for network information that may be required on later issues of the drawing.

**6.07** The term network refers to a coded apparatus unit containing a resistor and capacitor. The term applies whether the unit is used for contact protection, termination for a transmission line, or for any other purpose.

**6.08** Fig. 12 shows a network value note. It is divided into three columns, arranged as follows.

- (a) The NETWORK NO. column lists the arbitrarily assigned numbers that are shown as part of network symbols throughout the FSs. These numbers are for reference as to value only and do not indicate the functional designation of the networks.
- (b) The RESISTANCE IN OHMS column lists the nominal value, in ohms, of the resistance part of the network.
- (c) The CAPACITANCE IN  $\mu$ f column lists the nominal value, in microfarads, of the capacitance part of the network.

**Job Record Information**

**6.09** Circuit Note 104 is always the job record note. Usually no job record note is provided on Issue 1, but the note is reserved for later issues. This note is used to record the changes that have been made on various issues of the drawing.

**6.10** Additional circuit notes may be shown covering other information relating to the operation of the circuit. These are numbered from note 105 up.

**B. Equipment Notes**

6.11 The 200 series notes are reserved for equipment information, and are referred to as Equipment Notes. These notes are primarily intended for use in the preparation of manufacturing information. They may also be used by the installer. They cover mounting restrictions of apparatus, size of wires, length of leads, balancing of capacitors, resistance of leads, running of leads, etc. The following is an example of an equipment note. "Where more than 70 SC relays are provided, the sleeve leads shall be cabled directly to the SC relays."

**C. Information Notes**

6.12 The 300 series notes, referred to as Information Notes, are reserved for information of a general nature which cannot be correctly listed with the other categories of notes. They cover interrupted intervals or timing, normal post springs, position of switches, direction of transmission, block diagrams, theory schematics, etc.

**D. Cross-connection Information**

6.13 Information required for assigning and making cross connections that are subject to periodic changes is sometimes given in the SD, usually in a cross-connection information table. Any explanatory notes are assigned to the 400 series. This information is required by the field in order to determine

- (a) The conditions that require specific terminals to be cross connected.
- (b) How to locate the punchings on the equipment. (The designations of the terminal strips and punchings.)
- (c) The type and color of wire used to cross connect specific punchings.

6.14 Two methods of presenting cross-connection information in the circuit drawing are described below.

- (a) All the information is placed in tables (D group sheets on sectionalized drawings), with references, if required, to notes in the 400 series. These notes are a combination of explanations and schematics.

- (b) The information is placed in a series of FSs numbered in the next available 100 group to the regular FSs. Each FS shows the cross connection between specific punchings (or groups of punchings) and in some cases shows the complete circuit to the punchings. References are made in the FSs to the 400 series notes which explain the conditions under which the cross-connections are made.

**E. Transmission Test Requirements Information**

6.15 Where required, the allowable transmission losses for an entire transmission circuit and for individual pieces of apparatus affecting transmission in the circuit are listed in tabular form. Fig. 14 shows a Transmission Test Requirements Table. These tables are described in detail in Section A804.003.

**F. Working Limits Information**

6.16 The working limits information shown on SDs may include the following:

- (a) Maximum external circuit loop.
- (b) Minimum external circuit loop.
- (c) Maximum conductor loop.
- (d) Minimum insulation resistance.
- (e) Earth potentials.
- (f) Sleeve resistance.
- (g) Voltage limits for different maximum external circuit loops.

Fig. 15 shows the layout of a typical Working Limits Table.

**7. SEQUENCE CHARTS**

7.01 A general description of SCs is given in 1.09.

7.02 As many SCs are furnished as are considered necessary to explain the operation of the circuit. Each "usage" may be covered by a separate SC. A usage of the circuit may be the operation on normal calls, the operation on abandoned calls, the operation of the timing part of the circuit, etc.

7.03 Although SCs are presented on a "circuit" basis, related operations of connecting circuits are included when necessary in order to

preserve continuity of operation of a call. Thus, a connected story is given even though the functions involve a number of other circuits. The responsibility for continuity of description lies with the major circuit of a system.

**7.04** Each SC is given a number and a title. The title shows the usage or function that the SC covers, such as Establishing Connection, Operator Answers At Distant End, Timing, etc.

**7.05** To interpret an SC, an understanding of the rules governing their arrangement and the symbols used is required. Fig. 16 shows this information.

**7.06** On very large sectionalized circuits, an index may be provided as the first item in the E group of sheets covering the sequence charts. This index shows the location on the SCs of the operate and release symbols of each relay, electron tube, etc. Fig. 17 illustrates such an index. It is arranged by circuits rather than by SCs. The index in a particular SD drawing lists the information for that SD first, and then follows with the information for connecting circuits. The title of each circuit is shown horizontally at the head of the associated group of information.

**7.07** The index is divided into three columns, arranged as follows:

(a) The DESIG column lists the functional designations of the apparatus. Number designations are listed first in numerical order and are followed by letter designations in alphabetical order. Electron tubes are listed with the relays and the word TUBE is placed under the designation. If an option designation, in addition to a functional designation, is required to identify a particular relay, the option designation is shown (circled) to the right of the functional designation.

(b) The OPR column lists the SC sheet and location coordinates of the operate symbols of the apparatus. If the designation appears on more than one SC location, information is given for each appearance. If the designation occurs repeatedly in an SC, the number of the SC may be listed instead. To avoid repetition and to conserve space, the drawing group designation for Sequence Charts (E) is omitted from the SC sheet number.

(c) In a similar manner, the RLS column lists the location information for the release symbols of the apparatus.

## 8. CIRCUIT REQUIREMENTS TABLES

**8.01** The Circuit Requirements Table (CRT) gives the electrical and/or mechanical requirements for relays and other apparatus, as required. It also covers the requirements for certain electron tubes. It gives the procedures (in the form of block and insulate directions and notes) to be followed when testing or readjusting the apparatus. This procedure lists all information necessary for taking equipment out of service, but it assumes that the equipment has been made busy.

**8.02** The block and insulate procedures are required in order to

(a) Prevent interference with the reading on the test set, locally or over paths from or through connecting circuits.

(b) Prevent interference with connecting circuits.

(c) Prevent the operation of alarms, traffic and plant registers, and lamps and signals on other frames or before operators. If registers cannot be protected by blocking or insulating, a CRT note specifies that local instructions should be followed with regard to recording the registrations.

(d) Prevent the blowing of fuses and the removal of make-busy conditions.

(e) Prevent contact with hazardous voltages.

**8.03** The sheets containing the CRT are arranged so that, if desired, they may be removed from the SD, cut into individual CRTs, and filed in 8-1/2-inch by 11-inch binders. Fig. 18 shows the arrangement of a CRT.

**8.04** CRTs are described in detail in Section A804.001.

## 9. TIMING REQUIREMENTS TABLES

**9.01** The Timing Requirements Table (TRT) gives the timing requirements applied to certain relays, tubes, and relay interrupter circuits. Fig. 19 illustrates the arrangement of a

Timing Requirements Table on a sheet of detached-contact-type SD. The Section A804.001 contains a detailed description of TRTs.

## 10. CABLING DIAGRAMS

**10.01** The cable connections between a circuit and other parts of the plant are shown in Cabling Diagrams (CADs). These are consecutively numbered and give all the information required for cabling. As shown in Fig. 20, CADs are arranged as follows:

- (a) The associated APP FIG. number (or numbers) is shown directly below the CAD number.
- (b) The type of cabling and wiring is indicated. The conventions and symbols used for this purpose are explained in Section A804.009, AA610.004 and 005-108-111.
- (c) The title of the connecting circuit or apparatus is shown at the ends of connecting leads.
- (d) The destination of each lead to the local circuit is given in sufficient detail so that it can be traced on the FS.
- (e) Terminal strips are designated and the terminals numbered.
- (f) Optional wiring and optional APP FIGs. are indicated.
- (g) The method of interconnecting CADs is indicated.

## 11. LOCATING INFORMATION IN THE DRAWING

**11.01** The various items of information contained in the detached-contact-type SD drawing are readily found by means of the indexes, the sheet coordinates, and the cross-referencing arrangements furnished as part of each drawing. The following paragraphs illustrate means whereby typical items of information are located.

### FS Information

- 11.02** To locate any piece of apparatus, refer to the Apparatus Index.
- 11.03** To locate contacts of relays, jacks, etc, refer to the Apparatus Index and find the APP FIG. for the relay, jack, etc, having the re-

quired functional designation. Next, find the APP FIG. by referring to the Sheet Index or by scanning the sheets of the drawing. When the APP FIG. is found, look under relays, jacks, etc, for the required functional designation. When found, the FS sheet coordinates for the particular contact of the relay, jack, etc, will be seen associated with the contact.

**11.04** To determine the resistance and capacitance of networks, note the number shown in the network symbol on the FS. Next, refer to Circuit Note 103, the Network Values Note, where the resistance and capacitance for the corresponding number will be found. The code of the network is given in the APP FIG.

**11.05** Leads to connecting circuits are traced as follows (assuming that a lead is being traced from circuit G to circuit H). In circuit G, note the designation of the lead and the title of the connecting circuit (circuit H in this case). In the SD for circuit H, in the Lead Index, find the title for circuit G. Under this title find the designation of the lead; from the designation, determine the FS sheet number and location of the lead in circuit H.

### APP FIG. Information

**11.06** To determine the complete ordering information for any piece of apparatus, refer to the Apparatus Index and determine the APP FIG. for the apparatus. Next, locate the APP FIG. by referring to the Sheet Index or by scanning the sheets of the drawing. When the APP FIG. is located, find the particular piece of apparatus where the complete ordering information will be found.

### SC Information

**11.07** To determine the SC (or SCs) in which a relay, electron tube, switch, etc, is shown, refer to the SC Index.

## 12. CIRCUIT DESCRIPTIONS

**12.01** A Circuit Description (CD) is issued for each detached-contact-type SD drawing. In general, they contain the same type of information as given in the CDs for attached-contact SDs. The arrangement of the information in the CD for a detached-contact schematic is as follows:

**SECTION I — GENERAL DESCRIPTION**

This covers the general use and/or purpose of the circuit and its general method of operation.

**SECTION II — DETAILED DESCRIPTION**

This covers the detailed description of the circuit. In this section references are made to the SCs of the drawing.

**SECTION III — REFERENCE DATA**

This covers the following information.

- (a) Working limits of the circuit.
- (b) Explanation of the functional designations of the operating elements used in the circuit.
- (c) A list of the circuit functions.
- (d) A list of the connecting circuits.
- (e) Alarm information.
- (f) Manufacturing test requirements.
- (g) TEOS (taking equipment out of service) information.

**SECTION IV — REASONS FOR REISSUE**

This describes and gives the reasons for changes made on reissue of the drawing.

**REASONS FOR REISSUE**

- 1. 1.02 was added
- 2. 2.09 was revised to clearly describe the use of coordinates.
- 3. 3.01 was revised to indicate the latest practices of locating Sheet Indexes.
- 4. 3.02 and 3.03 were revised to incorporate information pertaining to the individual sheet reissue plan.
- 5. 3.06(c) was revised to add a means of locating apparatus in an APP FIG. that extends over several sheets.
- 6. 3.06(d) was revised to add reference to equipment mounted in cabinets or on panels.
- 7. 3.07 was revised to indicate when networks are listed in the Apparatus Index.

- 8. 3.08 was revised to add reference to CAD sheet locations.
- 9. 3.09(a) formerly indicated that the connecting circuit with the most leads was listed first.
- 10. 3.09(d) has been added to cover the CAD LOC column that has been added to the Lead Index table.
- 11. 3.10(a) was revised to add reference to letter designated APP FIGs.
- 12. 3.10(b) (1) and (2) were changed to indicate that the APP FIG. designation should be shown for locating optional APP FIGs. and apparatus.
- 13. 3.10(b) (3) was revised to add reference to wiring options that appear only in CADs.
- 14. 5.06 was revised to state when quantity indications are required.
- 15. 5.08(b) was added to cover APP FIG. information for the 24 contact position-type relays.
- 16. 5.09 was added to cover information concerning dual armature type relays.
- 17. 5.15(b) was added to describe an alternate method of showing 293-type relays in an APP FIG. 5.15(c) was added to provide information for the 295-type relays.
- 18. 5.18 was revised to add information concerning the contacts of a 266A relay that are operated by the cover cap.
- 19. 5.21 was added to give information concerning fuses.
- 20. 5.27 was added to describe keytop diagrams.
- 21. 5.31 was added to cover selectors.
- 22. 5.35 was revised to add reference to the FREQ and S switches.
- 23. Fig. 1 was revised to show the Sheet Index arrangement when a drawing is on an individual sheet reissue basis.
- 24. Fig. 2 was added in order to illustrate the Sheet Index arrangement for a nonsectionalized drawing that is arranged on an individual sheet reissue basis.
- 25. Fig. 6 was revised to add the CAD LOC column to the Lead Index.

26. Fig. 7 was revised to apply the latest method of locating optional APP FIGs. and apparatus.
27. Fig. 8 was revised as follows:
- (a) Note 14 was added to indicate the method of showing normally operated relays.
  - (b) The method of splitting a multiwound relay was added to item 4.
  - (c) Item 10 was added to illustrate double transfer contacts.
  - (d) Item 11 was added to illustrate interrupter and off-normal contacts.
  - (e) Item 14 was revised to illustrate the method used in detaching jack springs.
  - (f) Item 17 was added to illustrate the method of showing trouble record information.
  - (g) Item 19 was added to cover connector terminals.
  - (h) Item 22 was revised to add reference to rotary switches and to show the latest illustration for this type of switch or selector.
  - (i) Item 24 was added to illustrate alarm type fuses.
  - (j) Item 25 was revised to reverse the order of assignment of the S leads.
  - (k) Item 30 was revised to add an illustration of the unenclosed appearance of the contact.
  - (l) Item 52 was revised to add reference to lettered circuit figures when converting attached-contact-type schematics to detached-contact-type schematics.
  - (m) Item A was revised to illustrate optional wiring between a number of points.
  - (n) Item C was revised to add the method of showing looping around a relay cove.
  - (o) Item E was revised to clearly define the use of arrowed circles.
- (p) Item H was revised to indicate the circumstances under which option designations may be omitted.
  - (q) Item I was added to provide a method of indicating letter designated APP FIGs.
  - (r) Item J was added to illustrate the use of negative options which occur when converting attached-contact-type schematics to detached-contact-type schematics.
28. Fig. 9 was revised to
- (a) Add illustrations of the dual armature-type relay, the 295-type dry reed relay, and the 24 contact position wire-spring relay.
  - (b) Illustrate alternate tabular information for the 293-type dry reed relay.
  - (c) Show the latest symbol for the 235-type relays.
  - (d) Add fuse information.
  - (e) Show the latest method of numbering jack terminals.
  - (f) Illustrate the latest method of showing keys.
  - (g) Add a number of network illustrations.
  - (h) Add an illustration of a rotary-type switch and a selector.
  - (i) Add a switch top illustration.
29. Fig. 16, item 15 was added to illustrate an alternative action pattern.
30. Fig. 16, item 16 was revised to indicate the use of functional designations and coordinates at interconnections of SCs.
31. Fig. 16, item 18 was revised to include reference to the trouble ticketer.
32. Fig. 18 was revised to illustrate dual armature relay and electron tube circuit requirements information.
33. Reference to tubes was removed from Fig. 19.







**APPARATUS INDEX**

DESIG	LOCATION		
	FS	APP FIG.	EQPT
<b>RELAYS</b>			
11A	6H5	18	1-10
11B	6H6	18	1-10
11C	6H7	18	1-10
AO, 1, 2, 4, 7	11F3	13	1-5
ABL	9A4	12	1-7
ARBO	12B2	10	1-6
ATO-1	12A6	10	1-6
AVO, 1, 2, 4, 7	8A3	7	2-14
AV10	8A4	7	2-14
B	12A3	9	1-3
BK	12C5	11	1-6
-----			
T	11F6	13	1-5
T	11F6	14	1-5
<b>CAPACITORS</b>			
C	4H5	10	1-7
CR	10F5	11	1-5
-----			
T	11F8	13	1-6
<b>RESISTORS</b>			
CM	808	17	1-7
CR	1A7	8	1-5
-----			
TP	1C2	12	1-6

Fig. 5 - Apparatus Index

**LEAD INDEX**

DESIG	FS	CAD
	LOC	LOC
<b>AUTOMATIC MONITOR REG &amp; SDR TEST CKT</b>		
BS	11E5	14E3
CN	11E5	14E3
FR	11E5	14E3
H	11B1	14E5
-----		
M	11E5	14C1
MB	11B1	14C1
MON	11E5	14D3
MST	11E1	14C2
-----		
N	11E1	14C1
-----		
<b>INC REG MKR CONN CKT</b>		
11	15G0	17B1
AO, 1, 2, 4, 7	14E6	18B1
BO, 1, 2, 4, 7	14G6	18E7
BT	11A5	17D3
-----		
CO, 1, 2, 4, 7	14G6	17D3
-----		
LT	15F0	16F2
M7	14H8	16F2

Fig. 6 - Lead Index

**OPTION INDEX**

APP OR WIRING	LOCATION
8	APP FIG. 8
9	APP FIG. 9
19	APP FIG. 19, 64F7, 65B2-55D2, 67C3, 67D1, 86A4, 86A5
20	APP FIG. 20
21	APP FIG. 21
FIG. A	APP FIG. A
FIG. B	APP FIG. B
Z	64H1, 64H2, 64H7, 67C2
Y	APP FIG. 2, 30C3
X	APP FIG. 4
W	30C3, 30D3
V	30C3, 30D3
T	APP FIG. 3,
S	85A3
R	CAD 5
Q	89F6

Fig. 7 - Option Index



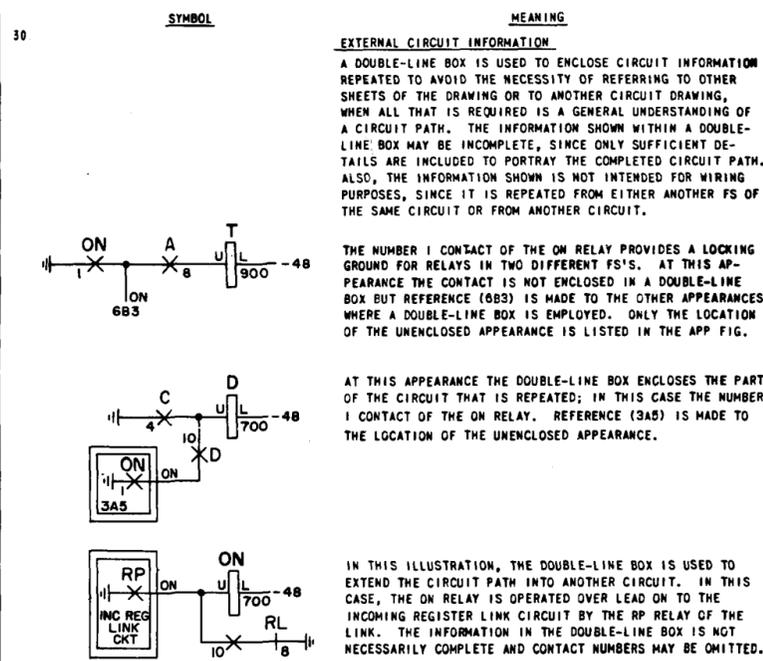
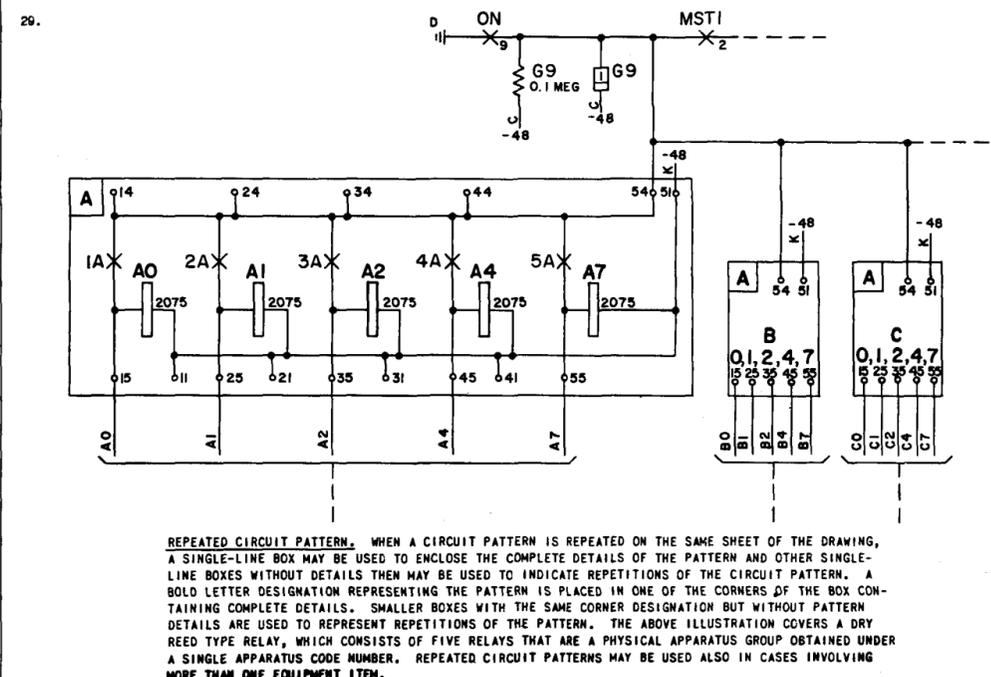
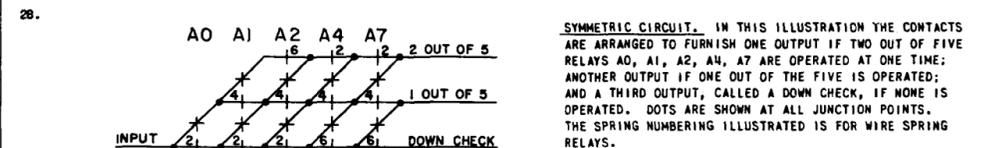
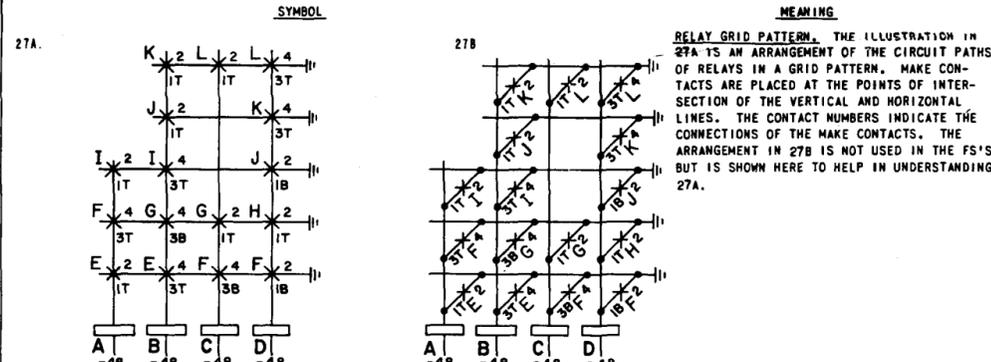
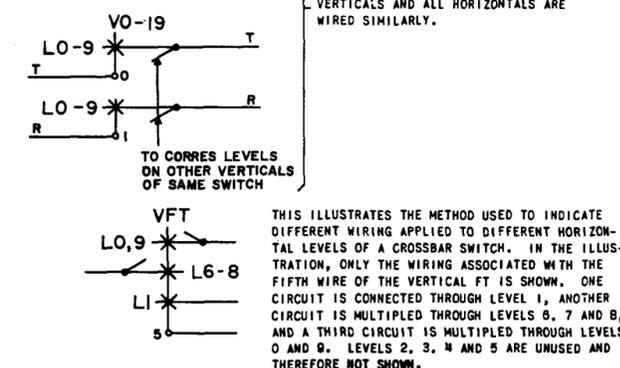
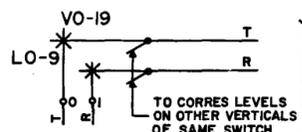
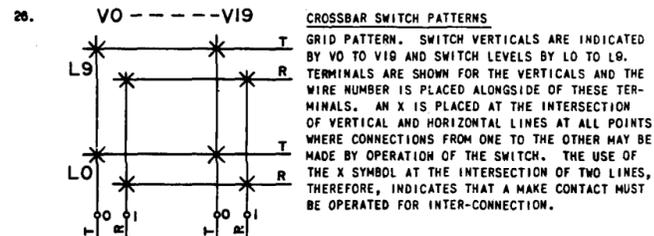
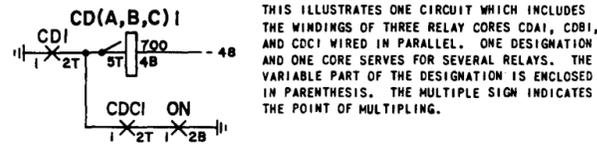
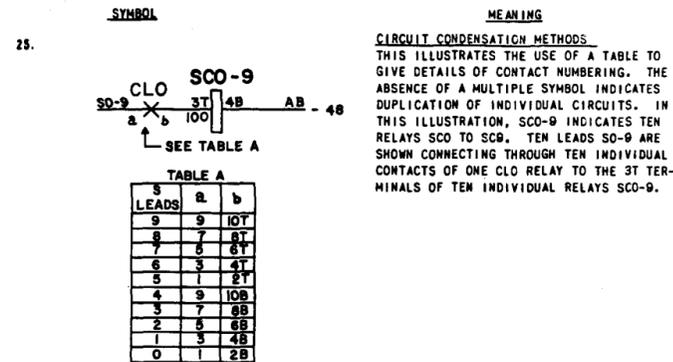


Fig. 8 - Functional Schematics - Methods of Showing Information (Contd)



APP FIG. 1

RELAY		F		MAN		MB		CK		DN		CM1		RL		(S)S1-5		SF		ST		DESIG	
CCDE		AFB7		AFT6		AKB		AFB2		AFB2		AFB2		AFB2		AG5		AGE		AFB4		CCDE	
CFTICM		W		W		W		W		W		W		W		W		W		W		CFTICM	
DESIG	CCDE	CCNT	LCC	CCNT	LCC	CCNT	LCC	CCNT	LCC	CCNT	LCC												
12	M	6C7	M	2H3	EM	1B4																	12
11	M	6C7	M	2H3	EM	1E7																	11
10	M	6D7	M	4D3	EBM	1C6																	10
9	M	6E4	M		EBM	3B7																	9
8	M	10A8	EBM	3E1	M	1F6																	8
7	M		B	5CB																			7
6	M	7G2	EBM	1E6																			6
5	M																						5
4	M	6D3	EBM																				4
3	M	8F3																					3
2	M	2H2	M	6C2																			2
1	M	8A1	M	6C2																			1
CC1L		6C7		2H3		1C1		2A2		1H2		6B7		10H6		106		106		106		106	CC1L

RELAY		RA		RB		DESIG	
CCDE		CBA		CBA		CCDE	
CFTICM		CFTICM		CFTICM		CFTICM	
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53	L65	3B4					
52	L65	3B5					
51	L65	3B5					
50	L65	3B6					
49	L65	3A5					
48	L65	3A5					
47	L65	3A5					
46	L65	3A5					
45	L65	3A5					
44	L65	3A5					
43	L65	3A5					
42	L65	3A5					
41	L65	3A5					
40	L65	3A5					
39	3B1	3F1					
38	3B1	3F1					
37	3B1	3F1					
36	3B1	3F1					
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05	3B1	3F1					
04	3B1	3F1					
03	3B1	3F1					
02	3B1	3F1					
01	3B1	3F1					
00	3B1	3F1					
CC1L	L65	3C3					

RELAY		C		H		DESIG	
CCDE		CBA		CBA		CCDE	
CFTICM		CFTICM		CFTICM		CFTICM	
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53	L6L	6D2					
52	L6L	6D2					
51	L6L	6D2					
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01	L6L	6D2					
00	L6L	6D2					
CC1L	L6L	6D2					

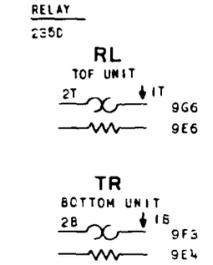
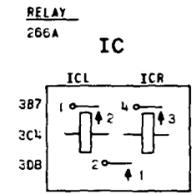
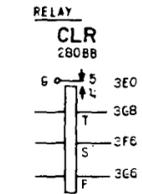
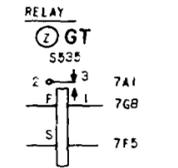
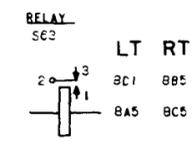
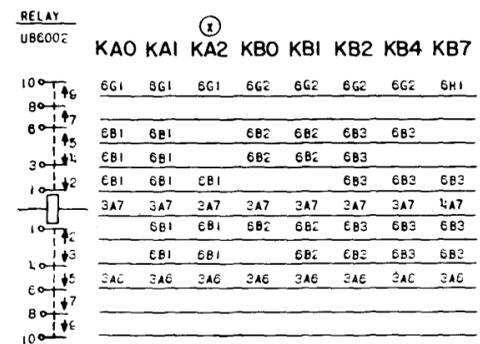
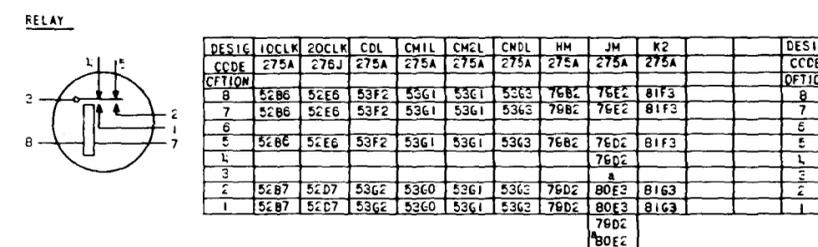
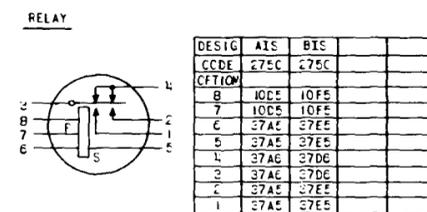
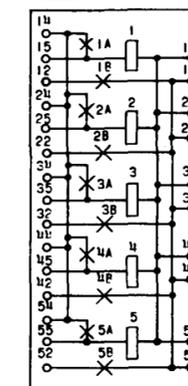


Fig. 9 - Apparatus Figures - Methods of Showing Information

RELAY

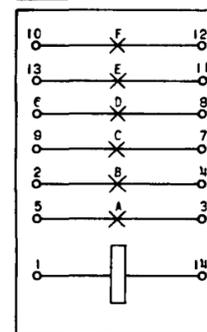
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OPTION																			OPTION
24	2CF8			17D4	24														
23	19F7	2CB1		19G8	23														
22	19FE	2CB1		19H7	22														
21	19FE	2CBC		22A4	21														
20	19F8	2CB2	22B6																20
19	19F8	2CB2	22B6																19
18	19F8	2CB2	22B6																18
17	19F8	2CB2	22B6																17
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12	19F8	2CB2	22B6																12
11	19F8	2CB2	22B6																11
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9	19F8	2CB2	22B2	22E7	22F7	22E7	22F7	22E8	22F8	22E8	22F8	22E9	22F9	22E3	22F3	22E3	22F3	22E4	22F4
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3	19F8	2CB2	22B2	22E7	22F7	22E7	22F7	22E8	22F8	22E8	22F8	22E9	22F9	22E3	22F3	22E3	22F3	22E4	22F4
2	19F8	2CB2	22B2	22E7	22F7	22E7	22F7	22E8	22F8	22E8	22F8	22E9	22F9	22E3	22F3	22E3	22F3	22E4	22F4
1	19F8	2CB2	22B2	22E7	22F7	22E7	22F7	22E8	22F8	22E8	22F8	22E9	22F9	22E3	22F3	22E3	22F3	22E4	22F4
CC1L	17F8	17H2	20DC	19G8	CC1L														

RELAY



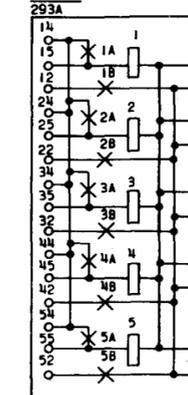
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CONT	LCC	3C1	3C1	3C2	3C2	3C4	19G5	20A1	19G5	19G5	23B5
POS	B	LOC	6B3	6B4	6B4	6B5	6B6	25E3	25E3	22AB	25E3

RELAY



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OPTION													OPTION
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E	31E7	31E7	31E8	31E8	31E3	31E4	31E4	31E4	31F1	31F2	31F3	31F3	E
D	31E6	31E6	31E7	31E7	31E2	31E3	31E3	31E3	31F1	31F2	31F3	31F3	D
C	31E5	31E5	31E6	31E6	31E1	31E1	31E2	31E2	31F1	31F2	31F3	31F3	C
B	31E2	31E3	31E4	31E5	31E6	31E6	31E7	31E7	31FC	31F2	31F3	31F3	B
A	31E2	31E3	31E4	31E5	31E6	31E6	31E7	31E7	31FC	31F2	31F3	31F3	A
CC1L	31B2	31B1	31B3	31B3	31P5	31B4	31P5	31B6	31A9	31B9	31C9	31C9	CC1L

RELAY

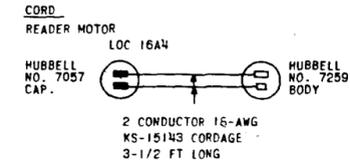


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(1) B0, 1, 2, 4, 7	3D3	6C3
(1) C0, 1, 2, 4, 7	3D4	6B6
(1) CTD, 1, 2	3C3	3D3
(1) CVA, VG10, CN, CR, TN	3B4	3D4
(1) DO, 1, 2, 4, 7	3B5	3D5

Fig. 9 - Apparatus Figures - Methods of Showing Information (Contd)

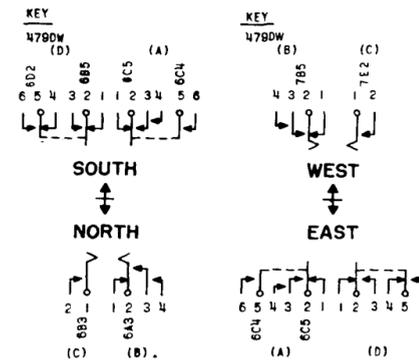
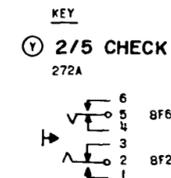
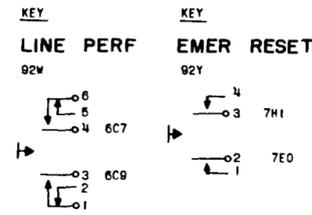
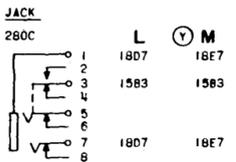
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DESIG	LOC	CODE
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B	3M3	KS-14330
(1) R	4B5	437A
T	4C3	
S	6E9	KS-13368, L3, 0.001 UF
(2) W1,2	5C2	KS-13368, L3, 0.001 UF

CORD PATCHING		
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---	7B6	2P4B

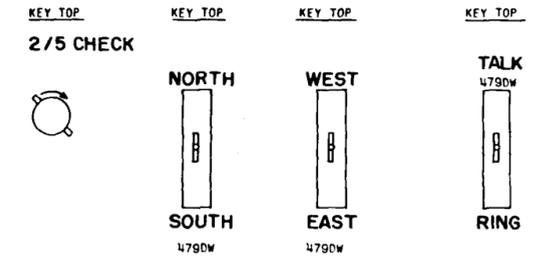
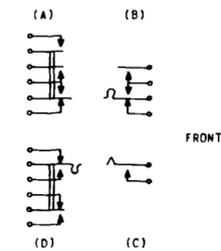


FUSE		
DESIG	LOC	CODE
20A	3B5	RUSSMAN AGS, 20 AMP
PF	5D4	70A

JACK		
DESIG	LOC	CODE
A	7F7	364
B	7B2	364
L14	8C1	141
L15	3B5	141
L17	5C8	141
T	2F5	239



BELOW IS AN ILLUSTRATION OF HOW THE 4790W KEY APPEARS ON THE WECD CARD CATALOG WITH THE EXCEPTION THAT THE QUADRANT LETTERS A, B, C, AND D AND THE WORD "FRONT" ARE NOT SHOWN ON THE CARD CATALOG FIGURES. THIS ILLUSTRATION IS INCLUDED HERE ONLY AS AN AID IN INTERPRETING THE METHOD USED IN CONVERTING THE CARD CATALOG PICTURE TO THE APP FIG. SYMBOL AND IS NOT SHOWN IN THE APP FIGS. OF THE SD DRAWINGS.



LAMP		
DESIG	LOC	CODE
ALARM	13A4	MAZDA 72
CR	1A9	13L (RES)
FA1	9C7	2Y
FA2	9C8	2Y
L1	7D3	2Y (RED)

NETWORK		
DESIG	LOC	CODE
(3) A0, 1, 2	3A7	185A
BLC	6B9	180A
G1A	5C6	185A
G2A	5D6	185A
PB	2A6	180A
(3) RA0, 1, 2	3B5	185A
(5) RBO, 1, 2, 4, 7	3D4	185A
RH	4B2	185A
(2) S	3G2	185A
(10) TO-9	6C5	177C
(1) TA-	6F3	185A
(1) TA-	6F3	185A
(5) TA0-9	7E2	177C
(20) VO-9	4D4	185A
(1) W	7D5	185A
(1) W	3B1	

Fig. 9 - Apparatus Figures - Methods of Showing Information (Contd)

OUTLET & RECEPTACLE

DESIG	LOC	CODE
CAB	9C2	HUBBELL 52151-1/2 OUTLET BOX
		EW 2-9575 OUTLETS
RECT	9B4	HUBBELL 7240 RECEPTACLE

POTENTIOMETER

DESIG	LOC	CODE
PPS ADJ	9H5	KS-5563, L3
PPS CAL	9H6	G.R.CO. TYPE 301A
VOLTS ADJ	9A5	KS-13790, L2, 1.5 MEG

RECTIFIER

DESIG	LOC	CODE
RECTIFIER	14C5	J862568

REGULATOR

DESIG	LOC	CODE
REGULATOR	14B5	KS-15631, L3

RESISTOR

DESIG	LOC	CODE
A	2B3	18AG
B	2B4	19GH
C	2B6	145B, 1000
D	2B7	KS-13490, L1, 1500
(Y)	3B9	18R
(5)	7C4	18AG
(X)		

SELECTOR

DESIG	OPTION	CODE	BANK CODE	ARC												STEP MAG LOC	INT CONT LOC
				1		2		3		4		5		6			
				TERM.	LOC	TERM.	LOC	TERM.	LOC	TERM.	LOC	TERM.	LOC	TERM.	LOC	TERM.	LOC
A	Y	206A	26A	1-4 5,6 7-18 19 20-22	7D3 7D4 7C3 7C1 7D4	1-22	8A4	1-22	8D4	1-10 11 12-21 22	8B3 9C3	1-20 21 22	9F7	1-22	10A2	7B3	7B5

SWITCH

DESIG	J	T
CODE	325B	325B
OPTION		
LEVEL	WIRE	LOC
0-9	0	2A5
0-9	1,2	3A2
MAGNETS	HOLD	2B5
	SEL	2E9

SWITCH

DESIG	COMB. LINE & JUNCTION SW	LINE SWITCH
CODE	325D	325U
OPTION		
LEVEL	WIRE	LOC
0-9	0	1D3
0-9	1	1B3
0-9	2	1A3
MAGNETS	L HOLD	1D0
	J HOLD	1D3
	LJ SEL	1E1
HOLD O.N. CONT	1T, 2T	1C1

SWITCH

DESIG	L OR SL
CODE	328B
OPTION	
LEVEL	WIRE
0-9	0-5
MAGNETS	HOLD
	SEL
SEL O.N. CONT	SSO-9

SWITCH

SEL MAG	LOCATION	HOLD MAG	HOLD O.N. CONT
9	3B0	3B1	
8	3B0	3B1	
7	3C0	3C1	
6	3D0	3D1	
5	3E0	3E1	
4	3E0	3E1	
3	3F0	3F1	
2	3G0	3G1	
1	3H0	3H1	
0	3H0	3H1	

SWITCH

DESIG	FREQ
CODE	KS-13546, L33
OPTION	
SECT	
	1
	2
	3

SWITCH

DESIG	S
CODE	KS-13546, L40
OPTION	
CIRCUIT	A
SECT 1	12-3
SECT 2	12-3
SECT 3	12-3

SWITCH

DESIG	LOC	CODE
CLP	7D5	ESA-676800-42
PLP	7E5	ESA-676800-42
PLP'	7E1	ESA-676800-42
PWR	9A1	HUBBELL 79C5
RLP	7B5	TOGGLE SWITCH

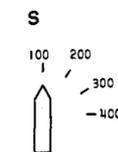
SWITCH

DESIG	LOC	CODE
MB		KS-13535-01, L1

SWITCH

DESIG	LOC	CODE
AUD TEST		KS-13546, L33

SWITCH TOP



THERMISTOR

DESIG	LOC	CODE
A	9B4	8C
B	9B5	8B

TRANSFORMER

DESIG	LOC	CODE
A	1MGI	373F
B	2C5	94E REP COIL

TRANSISTOR

DESIG	LOC	CODE
A	6B4	2A
B	5B4	3A
C	5B4	3A
D	7D8	2A

TUBE, ELECTRON

DESIG	LOC	CODE
CRI	7F4	313CC
CR2	7G4	313CC
TR	2C2	353A
TR1	2D5	353A

VARIATOR

DESIG	LOC	CODE
PK	3B6	400A
V	2D4	330

Fig. 9 - Apparatus Figures - Methods of Showing Information (Contd)

DESIG	FUSE AMP	POTENTIAL	ONE PER	TERM. DESIG
A	1/2HV	+130V SIG	REGISTER	A14, A24 H11, J22
B	1/2HV	-130V SIG	REGISTER ARRANGED FOR COIN LINES	H13
C	1/2HV	+130V SIG	REGISTER FRAME	A34
LT2	1/2	DIAL TONE	REGISTER FRAME	
A	1-1/3	-48V SIG	APP FIG. 1	A11
B	1-1/3	-48V SIG	APP FIG. 1	A21
C	1-1/3	-48V SIG	APP FIGS. 1, 21	A31
D	1-1/3	-48V SIG	APP FIG. 4	A41
E	1-1/3	-48V SIG	APP FIGS. 5, 6	A12
F	1-1/3	-48V SIG	APP FIG. 8	A22
G	1-1/3	-48V SIG	APP FIG. 2	D11
H	1-1/3	-48V SIG	APP FIG. 2	D21
J	1-1/3	-48V SIG	APP FIG. 2	D12
K	1-1/3	-48V SIG	APP FIG. 3	E11
L	1-1/3	-48V SIG	APP FIGS. 18, 19	G11
M	1-1/3	-48V SIG	APP FIGS. 12, 13	J11
N	1-1/3	-48V SIG	APP FIGS. 14, 15, 17, 22, 23, 24	P11, L13 N68, R16
P*	1-1/3	-48V SIG	APP FIG. 16	A32
Q	1-1/3	-48V SIG	APP FIGS. 7, 8, 9, 10, 11	H24 H31 S11
A		GRD	APP FIG. 1	A16
B		GRD	APP FIG. 1	A26
C		GRD	APP FIG. 1	A36
D		GRD	APP FIG. 1	A46
E		GRD	APP FIG. 1	A17
F		GRD	APP FIG. 1	A27
G		GRD	APP FIGS. 1, 2, 3, 21	A37, D14 E22
H		GRD	APP FIG. 3	E32
J		GRD	APP FIG. 3	E42
K		GRD	APP FIG. 3	E52
L		GRD	APP FIGS. 6, 18, 19	A47, G15
M		GRD	APP FIGS. 4, 12, 13	A18, J28
N		GRD	APP FIGS. 14, 15, 17, 22, 23, 24	P22, L11 N68, R38
P*		GRD	APP FIG. 16	A28
Q*		GRD	APP FIG. 16	A38
R		GRD	APP FIGS. 7, 8, 9, 10, 11	H15 H38 S18

\* (P) FUSE AND (P) AND (Q) GROUNDS SERVE APP FIG. 16 LOCATED ON THE MEMORY RELAY FRAME

BATTERY SYMBOL	VOLTAGE RANGE
-48	48-80V
+130	125-135V
-130	125-135V

Fig. 10 - Fusing Note

FEATURE OR OPTION	PROVIDE		
	APP FIG.	QUANTITY	
REGISTER CONTROL RELAYS	1	1 PER REG	
DIAL PULSE COUNTING	2	1 PER REG	
DIAL PULSE REGISTER	FOR 4 DIGITS	ZM	
	FOR 5 DIGITS	ZE, ZN	
	FOR 6 DIGITS	ZE, ZF, ZO	
	FOR 7 DIGITS	ZE, ZF, ZG, ZP	
	FOR 8 DIGITS	ZE, ZF, ZG, ZH, ZO	
	FOR 9 DIGITS	ZE, ZF, ZG, ZH, ZJ, ZR	
FOR 10 DIGITS	ZE, ZF, ZG, ZH, ZJ, ZK, ZS		
FOR 11 DIGITS	ZE, ZF, ZG, ZH, ZJ, ZK, ZL		
REGISTER TIMING	4	1 PER REG	
REGISTER AWAITS AN ADDITIONAL DIGIT (FOR EXAMPLE: A STATION DIGIT)	REQ	5	
	NOT REQUIRED	0	
MARKER SELECTION	6	1 PER REG	
LINE LOCATION & CLASS RELAYS	16	1 PER REG	
WHEN MORE THAN 10 CLASSES OF SERVICE ARE REQUIRED		Z	
WHEN 10 OR LESS CLASSES OF SERVICE ARE REQUIRED		Y	
AMA OPERATION REQUIRED		W	
COIN FEATURE REQUIRED REGISTER SERVES	DIAL TONE FIRST LOOP START COIN LINES	7, 10, 11	M
	DIAL TONE FIRST LOOP START COIN LINES AND COIN FIRST GROUND START COIN LINES	7, 10, 11	V, M
	LOOP START COIN LINES	9, 11	J
COIN FIRST	REG RETURNS DEPOSIT ON PERM SIGS. ABANDONED CALLS, CALLS TO OPERATOR TRMS AND OTHER FREE TRMS ON TRK LK FRAME	11	M, J, V, ZD
	REG RETURNS DEPOSIT ON PERM SIGS. AND ABANDONED CALLS	8	M, J
WHERE COIN RETURN POT. IS	NEGATIVE		G
	POSITIVE		F
COIN FEATURE NOT REQUIRED			J, K
2 PARTY TEST	REQ WHEN NO TIP PARTY STATION GROUND IS GREATER THAN 1000 Ω ± 10%	12	
	REQ WHEN ANY TIP PARTY STATION IS GREATER THAN 1100Ω	13	
	NOT REQUIRED		X
PREFIX COUNTER	REQ FOR 11X SERVICE CODES		ZA
	REQ FOR 11 FOREIGN AREA DIRECTING CODES & PRETRANSLATOR DOES NOT TRANSLATE 11 CODES	18	
	REQ FOR 11 FOREIGN AREA DIRECTING CODES & PRETRANSLATOR TRANSLATES 11 CODES		ZB
	NOT REQUIRED		ZC
WHERE PRETRANSLATION IS IN THE REG CKT	FOR "A" DIGIT	14	
	FOR "B" DIGIT	15	
	WHERE "A" DIGIT OF 11 PREFIX AREA CODES IS TRANSLATED DIFFERENTLY THAN THE "A" DIGIT OF HOME AREA CODES		D

Fig. 11 - Feature or Option Note

NETWORK VALUES		
NETWORK NO.	RESISTANCE IN OHMS	CAPACITANCE IN UF
1	470	0.11
2	120	0.3
3	150	0.4
4	160	1.0

Fig. 12 - Network Values Note

RECORD OF APP FIGURES, WIRING AND APPARATUS CHANGES						
CHANGED ON ISS	IF JOB RECORDS DO NOT SPECIFY	THIS OPTION WAS FURN	SEE NOTE	USE IN CIRCUIT		
				STD	A & M	M D
2D	S OR T	T	102	S		T
2D	A OR B	B		A		B
2D	E	NONE	102	E		

Fig. 13 - Job Record Note

TRANSMISSION TEST REQUIREMENTS (1000 CYCLE LOSS BETWEEN 6000 LINES)					
			MAX ALLOWABLE CIRCUIT LOSS (db)		
-			0.4		
ALLOWABLE INDIVIDUAL APPARATUS LOSSES (db)					
APPARATUS	DESIG	CODE	MAX LOSS	MIN LOSS	REMARKS
CAPACITORS	T, R	2μF	14.5	11.5	SEE NOTE 1
RELAY	A	AJ8	0.2		
RELAY	S	AJ1	0.2		

NOTES:  
1. THE IND LOSS FOR THE (T) & (R) CAPACITORS SHALL BE WITHIN 0.5db OF EACH OTHER

Fig. 14 - Transmission Test Requirements Table

WORKING LIMITS	
MAX EXT CKT LOOP RES	1650
MIN INS RES	10,000
MAX EARTH POT.	±10V

Fig. 15 - Working Limits Table

**NOTES**

- THE PURPOSE OF A SEQUENCE CHART IS PRINCIPALLY TO SERVE AS A GUIDE TO THE UNDERSTANDING OF THE CIRCUIT AS A WHOLE AND AS A KEY TO THE ORDER OF EVENTS IN THE OPERATION OF THE CIRCUIT. FOR THIS PURPOSE, A SEQUENCE CHART MAY NOT NECESSARILY DEPICT ALL OF THE INTERACTIONS TAKING PLACE IN THE CIRCUIT. THE SEQUENCE CHART SUPPLEMENTS, BUT DOES NOT REPLACE, THE WRITTEN CIRCUIT DESCRIPTION (CD) WHICH ALWAYS ACCOMPANIES A SWITCHING SYSTEMS SD DRAWING.
- SEQUENCE CHARTS EMPLOY SYMBOLS TO SHOW THE OPERATION AND RELEASE OF THE RELAYS, SWITCHES, AND OTHER DEVICES AS THEY PERFORM THEIR VARIOUS FUNCTIONS IN THE CIRCUIT.
- TIME PROGRESSES FROM TOP DOWN, AND NEVER IN AN UPWARD DIRECTION, NOR AROUND AN ACUTE ANGLE.
- THE OPERATION AND RELEASE OF THE CIRCUIT COMPONENTS IS INDICATED BY SYMBOLS PLACED IN A VERTICAL LINE(S) WHICH SERVES TO TRACE THE COURSE OF THE CIRCUIT ACTION. A SINGLE LINE OF ACTION MAY BRANCH INTO TWO OR MORE DEPENDENT LINES OF ACTION, AND CONVERSELY, SEVERAL LINES OF ACTION MAY CONVERGE. THUS, CAUSES ARE LINKED WITH THEIR EFFECTS BY SYMBOLS PLACED TO PORTRAY IN A CONCISE MANNER THE PROGRESSION OF THE CIRCUIT ACTION.
- EACH OPERATE AND RELEASE SYMBOL IS IDENTIFIED BY THE FUNCTIONAL DESIGNATION OF THE APPARATUS IT REPRESENTS. IF THE APPARATUS IS IN ANOTHER CIRCUIT, BUT IS INCLUDED IN THE SEQUENCE CHART TO AID UNDERSTANDING, AN ABBREVIATED TITLE OF THE OTHER CIRCUIT IS GIVEN IN PARENTHESES FOLLOWING THE FUNCTIONAL DESIGNATION, I.E., A (MCR), B (T), ETC.
- COORDINATES ARE USED TO LOCATE THE POSITION OF THE SYMBOLS. NUMBERS STARTING WITH 1, EVENLY SPACED, ARE PLACED FROM TOP TO BOTTOM ON THE LEFT AND RIGHT-HAND EDGES OF THE SHEET. LETTERS ARE PLACED LEFT TO RIGHT AT THE TOP AND BOTTOM EDGES OF THE SHEET. THUS, COORDINATE G24 MEANS VERTICAL COLUMN G, HORIZONTAL LINE 24.
- HORIZONTAL AND VERTICAL LINE COMBINATIONS ARE USED AS FOLLOWS:
  - CONNECTION BETWEEN LINES
  - NO CONNECTION BETWEEN LINES
- CONTROLLED DIRECTION IS INDICATED BY LINE COMBINATIONS, USED AS FOLLOWS:
  - ACTION ON VERTICAL LINE AFFECTS ACTION TO LEFT BUT NOT TO RIGHT.
  - NO CONNECTION BETWEEN ACTION ON LEFT AND RIGHT HORIZONTAL LINES. THE ACTION ON THE TOP VERTICAL LINE HAS NO CONNECTION WITH THE ACTION ON THE LEFT HORIZONTAL LINE.
- MAJOR ASSUMPTIONS OR OPTIONS ON WHICH A SEQUENCE CHART IS BASED ARE STATED IN THE SC TITLE, OR AS A SHEET NOTE ON THE SAME SHEET.
- NOTATIONS ARE USED IN CONJUNCTION WITH FUNCTIONAL DESIGNATIONS TO GIVE ESSENTIAL INFORMATION; THESE ARE EXPLAINED IN THE NEXT COLUMN UNDER THE HEADING "DESIGNATIONS".

**DESIGNATIONS**

FOR RELAYS	EXPLANATION
1. C-	ONE OR MORE OF CO TO Cn OR CA TO Cn
2. CO-9	ALL OF CO TO C9 INCLUSIVE
3. CO-Cn	ALL OF CO TO Cn INCLUSIVE
4. CO(0-9)	ALL OF CO0 TO CO9 INCLUSIVE
5. C(0-9)A	ALL OF COA TO C9A INCLUSIVE
6. FA-D	ALL OF FA TO FD INCLUSIVE
7. A,C	BOTH A AND C
8. HG $\frac{2}{5}$	A COMBINATION OF "2 OUT OF 5" OF HG
9. RF $\frac{1}{2-5}$	ANY ONE OF A SERIES RF2 TO RF5
10. L/R	EITHER L OR R
11. (TOP) MC	TOP HALF OF MC MULTICONTACT RELAY
12. (BOT) MC	BOTTOM HALF OF MC MULTICONTACT RELAY
13. MC	BOTH HALVES OF MC MULTICONTACT RELAY
FOR OTHER APPARATUS	EXPLANATION
14. A JACK	A JACK CONTACT
15. AR KEY	AR KEY CONTACT
16. AL LAMP	AL LAMP
17. T HOLD	T HOLD MAGNET
18. J SEL	J SELECT MAGNET
19. PAC MAG	PAC MAGNET
20. A2 PERF	A2 PERFORATOR MAGNET
21. RDR PIN	READER PIN
22. (PU) TC INT	TC INTERRUPTER, PU CONTACT
23. RC SEL 10-11	RC SELECTOR STEPS FROM POSITION 10 TO POSITION 11
24. AD XSTR	AD TRANSISTOR
25. CL PH XSTR	CL PHOTO TRANSISTOR
26. TWA TUBE	TWA TUBE
27. VAR VARISTOR	VAR VARISTOR

**SYMBOL**      **EXPLANATION**

1. *A	A RELAY OPERATES
2. *AL LAMP	AL LAMP LIGHTS
3. *TW TUBE	TW TUBE OUTPUT CURRENT INCREASES
4. +A	A RELAY RELEASES
5. +AL LAMP	AL LAMP EXTINGUISHES
6. +TW TUBE	TW TUBE OUTPUT CURRENT DECREASES
7. *A *B *C +D	SIMPLE SEQUENTIAL CAUSE AND EFFECT RELATION. RELAY A OPERATES AND CAUSES THE OPERATION OF RELAY B WHICH, IN TURN, CAUSES THE OPERATION OF RELAY C. RELAY C THEN RELEASES RELAY D.
8. *A *B *C +D	MULTIPLE EFFECTS FROM A SINGLE CAUSE. RELAY A OPERATES AND CAUSES THE OPERATION OF BOTH RELAYS B AND C AND THE RELEASE OF RELAY D.
9. *A *B *C	MULTIPLE CAUSES FOR A SINGLE EFFECT. BOTH RELAYS A AND B MUST OPERATE BEFORE RELAY C OPERATES.
10. *B *A *E *C *D	MULTIPLE CAUSES WITH MULTIPLE EFFECTS. BOTH RELAYS A AND B MUST OPERATE BEFORE EITHER OF RELAYS C AND D CAN OPERATE. THE ARROW IS USED TO INDICATE ONE WAY ACTION. IN THIS ILLUSTRATION E OPERATES FROM B ONLY.
11. *B *A *C	ALTERNATIVE CAUSES. EITHER OF RELAYS A AND B WILL CAUSE OPERATION OF RELAY C.
12. *Z	Z RELAY OR OTHER APPARATUS HAS EITHER OPERATED OR RELEASED.
13. *A SR +SR	<b>TIME DELAY</b> THE SR RELAY IS SLOW TO RELEASE FOLLOWING THE OPERATION OF RELAY A.
*CW 2 SEC *TMA TUBE	THE TMA TUBE OPERATES 2 SECONDS AFTER CW RELAY OPERATES.
14. *A --- *B	DOTTED VERTICAL LINE MAY INDICATE ONE OF FOLLOWING: A) INDEFINITE TIME INTERVAL. B) INTERMEDIATE ACTION WHICH IS EITHER ASSUMED OR SHOWN ELSEWHERE. IN THE LATTER CASE, REFERENCE IS USUALLY MADE TO THE PLACE WHERE THE ACTION IS SHOWN.

**SYMBOLS**

**SYMBOL**      **EXPLANATION**

15. *BTI TRK IDLE TRK BUSY +BT +PB	ALTERNATIVE ACTION. THE OPERATION OF THE BTI RELAY CAUSES THE RELEASE OF EITHER THE BT OR PB RELAY DEPENDING UPON WHETHER THE TRUNK IDLE OR TRUNK BUSY CONDITION IS MET.
16. A B C D E 1 *HG 2 LCK 3 *LCK HG 4 *TK	TK RELAY HAS OPERATED ON LINE 4 AS THE RESULT OF THE OPERATION OF BOTH HG ON LINE 1 AND LCK ON LINE 3. NEITHER HG NOR LCK OPERATION ALONE IS SUFFICIENT TO OPERATE TK. THE DIAGONAL LINE MAY BE CONTINUOUS OR AS SHOWN. HG AND LCK AT THE ENDS OF THE DIAGONAL LINE REFER TO THE FUNCTIONAL DESIGNATION OF THE APPARATUS TO BE ASSOCIATED. WHERE THIS APPARATUS IS SHOWN IN DIFFERENT SCs, ON DIFFERENT SHEETS OF THE DRAWING, OR IN WIDELY SEPARATED AREAS ON THE SAME SHEET, THE COORDINATE LOCATION OF THE ENDS OF THE DIAGONAL LINE MAY BE ADDED TO THE FUNCTIONAL DESIGNATION.
17. *RV (IR) *TG OF *SP	TG RELAY RELEASES AND THEN REOPERATES ON CURRENT REVERSAL.
18.	<b>TROUBLE RECORD</b> THE SPAN OF CIRCUIT OPERATION DURING WHICH A PARTICULAR TROUBLE MAY BE EXPECTED IF A TROUBLE RECORD IS TAKEN IS INDICATED BY TRIANGULAR MARKS AT THE BEGINNING AND END OF THE SPAN.  A SOLID INVERTED TRIANGLE (▼) INDICATES THAT A PERFORATION IS MADE, A LAMP IS LIGHTED, OR A NOTATION IS MADE ON A TICKET IF A TROUBLE RECORD IS TAKEN AT OR AFTER THIS TIME.  A SOLID UPRIGHT TRIANGLE (▲) INDICATES THAT A PERFORATION IS NOT MADE, A LAMP IS NOT LIGHTED, OR A NOTATION IS NOT MADE ON A TICKET IF A TROUBLE RECORD IS TAKEN AT OR AFTER THIS TIME.  THIS INDICATES THAT RK PERFORATION IS MADE OR RK LAMP IS LIGHTED IF A TROUBLE RECORD IS TAKEN WHILE THE RK RELAY IS OPERATED.  THIS INDICATES THAT CHARACTER 1 IS PRINTED IN POSITION 6 ON A TROUBLE TICKET.  IN THIS CASE, ONLY THE TICKET POSITION NUMBERS, 3 TO 6, ARE GIVEN. THE CHARACTERS THAT ARE PRINTED IN THESE POSITIONS ARE NOT SHOWN SINCE ANY CHARACTER FROM 0 TO 9, A DASH, OR AN ASTERISK MAY BE PRINTED.  THIS INDICATES THAT T1 PERFORATION IS MADE OR T1 LAMP IS LIGHTED IF A TROUBLE RECORD IS TAKEN WHILE THE PR2 RELAY IS OPERATED.

**SYMBOL**      **EXPLANATION**

18. (CONT) *AC *RD +CO ▲AC	THIS INDICATES THAT AC PERFORATION IS MADE OR AC LAMP IS LIGHTED IF A TROUBLE RECORD IS TAKEN AFTER THE AC RELAY HAS OPERATED AND BEFORE THE RD RELAY HAS OPERATED.
*CKG ▼ (11-0) *BC *RK ▼ (11-1) *DP (TG) --- *TCK ▼ (11-2)	THIS INDICATES THAT ONE OF A NUMBER OF TROUBLE INDICATIONS ARE MADE TO INDICATE CIRCUIT OPERATION PROGRESS. IF THE CIRCUIT OPERATION HAS ADVANCED TO THE OPERATION OF THE CKG RELAY, CHARACTER 0 IS PRINTED IN TROUBLE TICKET POSITION 11. IF THE CIRCUIT OPERATION HAS ADVANCED TO THE OPERATION OF THE RK RELAY, CHARACTER 1 IS PRINTED IN POSITION 11. CHARACTER 2 IS PRINTED IN POSITION 11 IF THE TCK RELAY IS OPERATED. IT IS NOT NECESSARY TO SHOW UPRIGHT TRIANGLES (▲) INDICATING THE END OF THE PRINTING OF A CHARACTER SINCE ONLY ONE CHARACTER AT A TIME CAN BE PRINTED IN A POSITION ON A TICKET.

Fig. 16 - Sequence Charts - Methods of Showing Information

SEQUENCE CHART INDEX

DESIG	OPR	RLS	DESIG	OPR	RLS	DESIG	OPR	RLS	DESIG	OPR	RLS	DESIG	OPR	RLS
DP ORG REG CKT			CR			MARKER CKT			MARKER CONN CKT			PRETRANSLATOR CKT		
11A	4W9	3Z12	CR	8Q6 8V9	8H14 8V20	2P	8G12 7F11	3Y1 6S23 7N25 8D26	MA	3N35	3Z8	GS	14W19	
11B	4X11	3Z12	CR1	8Q10 8V16	8M15 8T21	CHE			MB	3N36	3Z9	HDK	14U21	
11C	4W19	3Z12	CR1	8Q6 8V15	8R11 8U17	CN	8B9		MC	3N35	3AA8	PRA	14U16	
2P	6H12	6N33	TPT	6K20 6S14	6H22 6Q16	CS	4H20 8G10 7F9 8A10 9B8		MD	3N36	3AA9	PRS	14U18	
A2/5	3F36 14D8	3Z12 6U33 7P35 10P15	TPT	6K19 6S13	6H22 6Q15	DCT1	3E11 4E29 6J15 7A14 8D14 9E14		ME	3L35	3AB8	TM	14S16	
AS	3G7 6H12 8F11 9F10		VF2/5	3B4 4B22 6J9 7A8 8E7 9F7		DIS1	3Y5 6S26 7N28 8D26 10S7		MS	3N34 7M21	3AA7 6Q28 7M30 8B31			
82/5	14D7	3Z12	VG2/5	3B4 4B22 6J9 7A8 8E7 9F7		DIS2	3Y5 6S26 7N28 8D26 10S7		RA	3P32	3W8			
BS	3E37 4A10 4Z36 14C9					GTL1	4H20 8G10 7F9 8A10 9B8		RB	3P33	3W8			
BT	6B9	6A23				MAN	4H21		RC	3Q32	3W8			
C2/5	14D6	3Z12				RBT	6B5		RD	3N33	3W8			
CI	9R10 9R19 10D11 11G13 11G21 11N18 11N26 13P21 13P28	9R15 9U25 10D15 11G17 11G27 11N22 11K32 13P25				TR2	6C5	RE	3N33	3W8				
CLR	9E17	9D26				TRL	6B7	RS	3P29 6S7 7M21	3W7 6Q28 7M30 8B31				
CM3	14T22					TRLA	6B8	TH	3N29					
CMA	14Q22					TSE1		TRK LINK & CONN CKT						
CMB	14Q22							FA2	3E3 4E21 6K7 7B7 8D6 9E6	3E13 4E31 6J17 7D16 8D16 9E16				
CNC	14Q22							LV2	3E4 4E22 6K9 7B6 8D8 9E7	3G14 4D32 6G18 7F17 8B17 9D17				
CN	8B11	8C36						INTERRUPTER CKT						
CN1	9B11 9V3 11B5	9M21 10H22 11C23 13P30						ST	6A10	6A24				
CNT	13M8 13S5	13E15 13P39						GROUP BUSY CKT						
CNT1	9D11	9C24						RB1	14A85					
CNT2	9E18	9D28						RB2	14A86	14Z15				
CNT3	13U9	13P4						RB3-6	14A87	14Z16				
								RT	14Z14					

Fig. 17 - Sequence Chart Index of Operate and Release Locations

CIRCUIT REQUIREMENTS															DRAWING ISSUE	
ORIGINATING REGISTER CIRCUIT-DIAL PULSING (OR)															1	
DESIG	CODE	OPTION	FIG.	MECH REDT			CIRCUIT PREPARATION			TEST SET PREP	SEE TEST NOTE	DIRECT CURRENT FLOW REGT			REMARKS	1
				BSP FIG.	CONT PRESS	ARM TRVL	BLOCK OR INSULATE	TEST CLIP DATA	CONN DAT.			CONN GRD	TEST WDG	TEST FOR		
RELAYS																
11A	AF43		18	17			(RA)D		U(11A)	GRD			0	31	29.5	
M1B	AF57		18	21G			(RA)D		U(11B)	GRD			0	27	25.5	
11C	1/2 AKE		18	204				2U(11C)	1U(11C)	B/G			0	9.2	8.7	MOUNTED WITH (AS)
2P	AF34		13	14			(PRL)D		U(2P)	GRD			0	27	25.5	
TUBES, ELECTRON																
A0, 1, 2, 4, 7	2B5A		3										0	25		
													H	5		
													R	1		
AS	1/2 AKE		16	204				2L(AS)	1L(AS)	B/G			0	17	16	MOUNTED WITH (11C)
B0, 1, 2, 4, 7	2E5A		3										0	25		
													H	5		
													R	1		
BT	AF90		6	242					U(BT)	GRD			0	32.5	32	
C0, 1, 2, 4, 7	2E5A		3										0	25		
													H	5		
													R	1		
CI	AF52		11	21B					U(CI)	GRD			0	7.1	6.7	
CLR	28C8B		9	A				(CNT1)D 2(CNT1)	6(CNT1) 5(CNT1) 5(CNT1) 2(CN)	6(CNT1) E(CNT1) PCH H15 L(CN1)	NGB NGB NGB NGB	3 3 S P	P/S P/S C O	-12 -12 1.4 1.6	0.5 0.2 1.4 1.6	
TEST NOTES:																
1. CONNECT GROUND TO TERMINAL OF RELAY UNDER TEST (1,4,8,9,10 FOR -0,-1,-2,-4,-7 RESPECTIVELY). PROCEDURE FOR TESTING DRY REED RELAYS USED FOR REGISTERING DIGITS. PREPARATION: CONNECT DIRECT BATTERY TO TERMINAL L2 OF TEST SET. PLACE L KEY IN NEUTRAL POSITION CONNECT SLEEVE OF TEST T & R TO LOAD CONTACT (5,7,11,12,13 FOR -0,-1,-2,-4,-7 RESPECTIVELY) OF RELAY UNDER TEST. ADJUST RED RHEOSTAT 4 AND THE THREE 4 SWITCHES FOR MINIMUM RESISTANCE. CONNECT THE TIP OF THE 4W JACK TO TERMINAL (3) OF THE RELAY UNDER TEST.																
STEP PROCEDURE INDICATION CHECK																
A. CLOSE OPERATE & RELEASE KEYS. LAMP LIGHTED. CLOSURE OF LOAD CONTACT.																
B. CLOSE HOLD KEY & OPEN OPERATE KEY. LAMP REMAINS LIGHTED. HOLD OF LOAD CONTACT.																
C. CLOSE 4 KEY & OPEN HOLD & RELEASE KEYS. LAMP REMAINS LIGHTED. HOLD OF LOCKING CONTACT.																
D. CLOSE RELEASE KEY & OPEN 4 KEY. LAMP EXTINGUISHES. OPEN OR RELEASE OF LOAD CONTACT.																
E. OPERATE VOLTMETER KEY (75V). CLOSE OPERATE KEY. OPEN OPERATE KEY. CLOSE 4 KEY. FINAL VOLTAGE NOT TO EXCEED 10 VOLTS. OPEN OR RELEASE OF LOCKING CONTACT (IF VOLTAGE EXCEEDS 10 VOLTS IT INDICATES THAT LOCKING CONTACT DID NOT OPEN).																
F. OPEN 4 AND RELEASE KEYS.																
2. REMOVE ELECTRON TUBES (CR1) & (CR2), THEN CONNECT DIRECT BATTERY TO L(C1) RELAY.																
3. CONNECT 2 & 7 OF (CLR) RELAY WITH A TEMPORARY STRAP.																
ORIGINATING REGISTER CIRCUIT DIAL PULSING															SD-00000-01-F1	
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(2 PAGES) PAGE 1

Fig. 18 - Circuit Requirements Table

TIMING REQUIREMENTS															DRAWING ISSUE																	
ORIGINATING REGISTER CIRCUIT-DIAL PULSING (OR)															1																	
DESIG	OPTION	FIG.	BLOCK OR INSULATE	CIRCUIT PREPARATION			TEST SET PREP		SEE TEST NOTE	TIME REQ		REMARKS	1																			
				CONN BK.	CONN R	CONN W	SEND KEY	REC SW		MIN	MAX																					
CR1		11	(ON)10	GRD	U(CR1)	U(CR2)	MK	48	GRD		470	750																				
CR1		8		GRD	U(CR)	4(CR1)	MK	O.C.	GRD		500	780																				
CR2		8	(CN)0	GRD	U(ON1)	4(CR1)	MK	SRD	O.C.		470	750																				
CR2		11	(ON)10	GRD	U(CR1)	4(CR2)	MK	48	O.C.		470	750																				
CT		7																														
DT		5	(RA)10 (MST)10	GRD	U(DL)	U(MST)	MK	48	GRD		3000	4700	CONN U(DL) TO U(ON1)																			
TM		4																														
TPT		12		GRD	U(PTA)	10(2P)	MK	GRD	48		220	370																				
TEST NOTES:																																
1. TO MEASURE THE TIME OF THE (CT) TIMER, OPERATE RELAY (CNT). THE (CNT) RELAY SHOULD OPERATE IN A MIN OF 10 SECS AND A MAX OF 15 SECS.																																
2. TO MEASURE THE TIME OF THE (TM) TIMER, OPERATE RELAY (TMA). RELAY (TM) SHOULD OPERATE IN THE INTERVALS INDICATED BELOW.																																
<table border="1" style="width: 100%;"> <thead> <tr> <th rowspan="2">(PD)</th> <th rowspan="2">(GV1)</th> <th colspan="2">SEC</th> </tr> <tr> <th>MIN</th> <th>MAX</th> </tr> </thead> <tbody> <tr> <td>N.O.</td> <td>N.O.</td> <td>20</td> <td>32</td> </tr> <tr> <td>N.O.</td> <td>C</td> <td>10</td> <td>15</td> </tr> <tr> <td>C</td> <td>C</td> <td>4.5</td> <td>7.2</td> </tr> </tbody> </table>															(PD)	(GV1)	SEC		MIN	MAX	N.O.	N.O.	20	32	N.O.	C	10	15	C	C	4.5	7.2
(PD)	(GV1)	SEC																														
		MIN	MAX																													
N.O.	N.O.	20	32																													
N.O.	C	10	15																													
C	C	4.5	7.2																													
ORIGINATING REGISTER CIRCUIT DIAL PULSING															SD-00000-01-F1																	
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(2 PAGES) PAGE 2

Fig. 19 - Timing Requirements Table

Fig. 18, 19

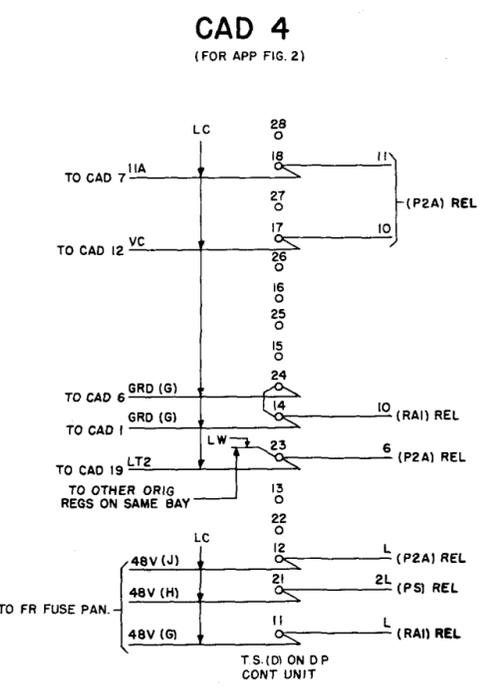
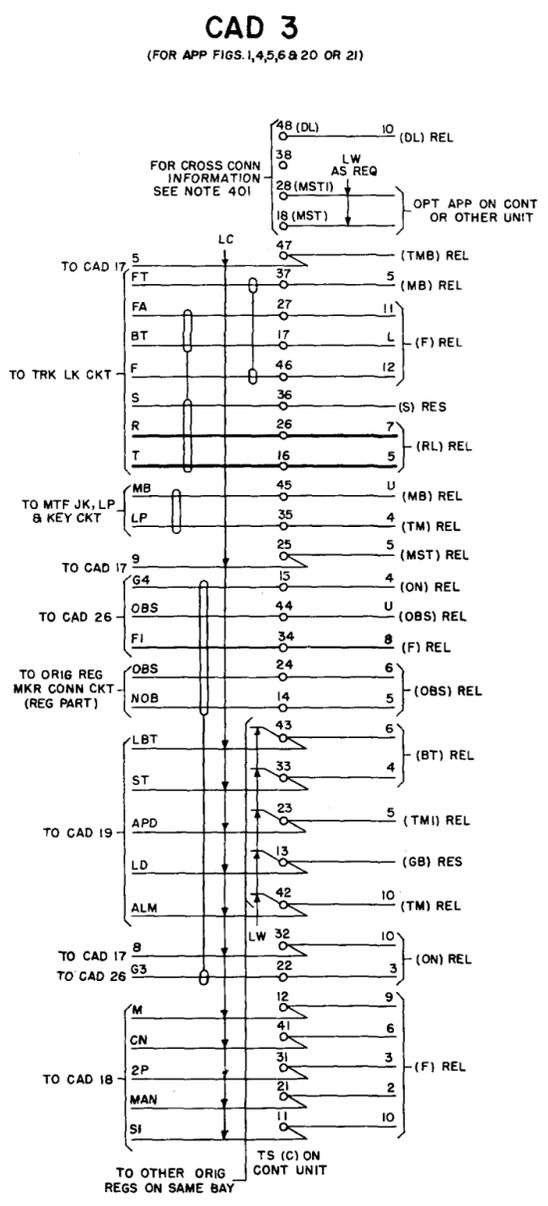
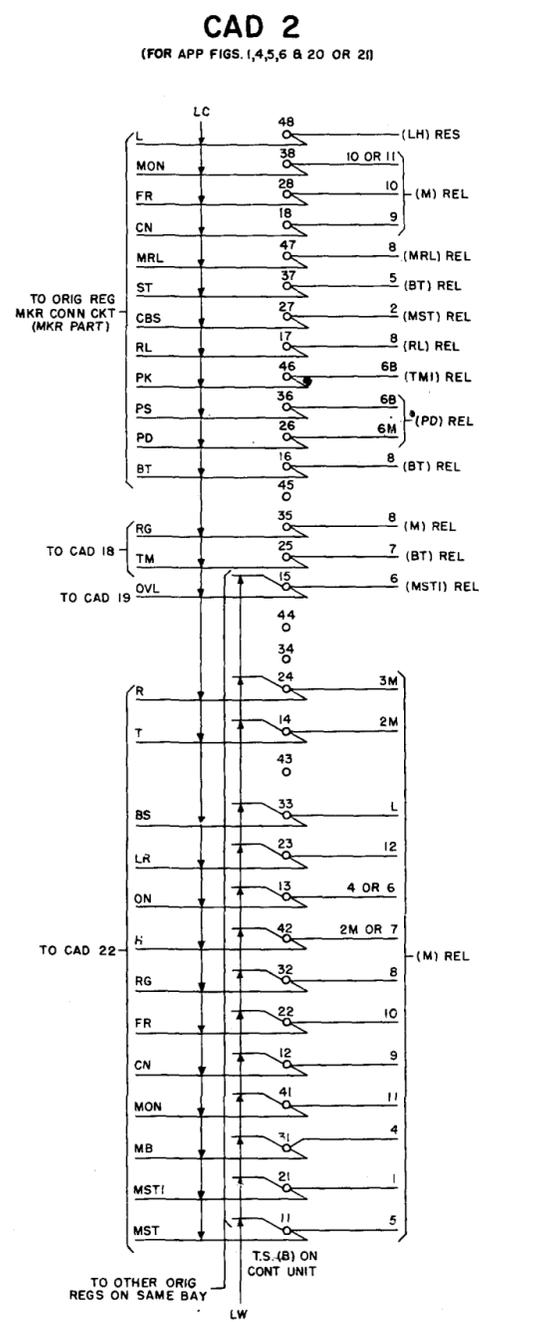
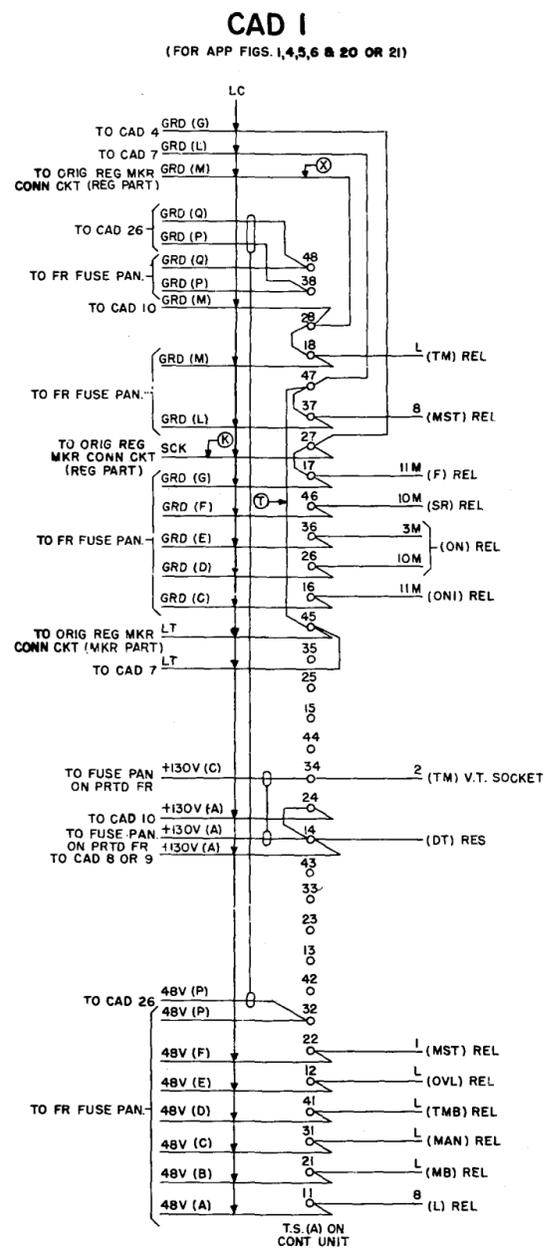


Fig. 20 - Cabling Diagrams — Methods of Showing Information