ACCEPTANCE NOTICE

The following Industry Standardization Documents were adopted on 15 May 1967 and 15 March 1971, respectively, for mandatory use by the Department of Defense. The indicated industry group has furnished the clearances required by existing regulations. Copies of the documents are stocked by DoD Single Stock Point, U.S. Naval Publications and Forms Center, Philadelphia, Pa. 19120, for issue to Military Activities only.

Title of Documents: (a) Electrical and Electronics Diagrams*
(b) Interconnection Diagrams

Document No: (a) ANSI Y14.15-1966
(b) ANSI Y14.15a-1970

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*Sections 10 and 12 of the basic standard ANSI Y14.15-1966 were adopted on 15 May 1967 for mandatory use by the Department of Defense, but were not so identified by the acceptance notice.

Certain Provisions of this standard are the subject of international standardization agreement, ABC NAVY STD 28A – Symbols and abbreviations for Electrical and Electronic Drawings, to which the US Army also subscribes. When amendment, revision, or cancellation of this standard is proposed which will effect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through military international standardization channels including departmental standardization offices, if required.
Foreword

Subcommittee 15 — Electrical and Electronic Diagrams — was formed on April 26, 1954, as a subcommittee of Standards Committee Y14—Standards for Drawings and Drafting. When formed, this subcommittee was charged with the responsibility of preparing a drafting standard covering "electrical schematic, wiring and block diagrams for use in the communications, electronic, electric power, industrial control, telephone, telegraph and allied industries." A natural addition to this scope was the inclusion of military considerations through participation by representatives of the Department of Defense.

The creation of such a standard, acceptable to the manufacture of electrical equipment and to industrial, military and utility users, often in areas which were themselves undergoing development, has been an exercise in cooperation and compromise. The overriding purpose of all of the participants has been to issue a single American standard which could be used as a reference in purchasing equipment, cited as authority in contract and military specifications and applicable as a guide for drafting and design personnel responsible for drawings for production or for use wholly within a plant or company.

For this standard to be so widely applicable it had to be made broad and permissive; therefore compromise was essential, particularly in terminology, but such compromise had the beneficial effect of expediting its issue and of making it generally available. The preparing committee hopes its effect is to unify drafting practices and that future revisions will reflect this uniformity by eliminating material and establishing preferred methods and nomenclature.

Section 15-11 was approved on April 22, 1968 by the Standards Committee. It was later approved by the Secretariat and the American National Standards Institute, and was designated an American National Standard on November 4, 1970 to supplement the previously issued ANSI Y14.15-1966.

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15-11 Interconnection Diagrams

The following subparagraphs contain information on the preparation of Interconnection Diagrams. This material is a supplement of the general material of Section 15-3.

15-11.1 Types of Interconnection Diagrams

Interconnection Diagrams showing connections between major items (assemblies, units, equipment, etc.) may be prepared in two types, each of which may be prepared by different methods, as follows:

1. Wiring Type (showing each wire)
   (a) Diagrammatic
      1) Continuous Line
         a) Point-to-Point
         b) Highway
      2) Interrupted Line
   (b) Tabular

2. Cabling Type (showing primarily only cables)
   (a) Diagrammatic
   (b) Tabular

Within each type any one or combinations of the methods may be used. Combinations of the two types and of the methods are permitted, if clarity is maintained.

Internal connections within the major items are usually omitted on Interconnection Diagrams. For convenience or clarity, partial internal connection, schematic, or circuit function information may be included on the Interconnection Diagram.

15-11.2 General Principles

15-11.2.1 Layout

Major items shall be represented by squares, rectangles, or circles.

The arrangement of items on the diagram should provide the utmost in clarity for the detailed interconnection information.

Views should be shown as though all connections are in one plane. If the relative location of major items, terminals, terminal boards, connectors, etc. is not clear, a physical-location diagram shall accompany or be referenced on the diagram or tabular list (see 15-10.6.6).

15-11.2.2 Identification of Major Items

Each major item shall be identified by the following:

(a) Functional Title

(b) Reference Designation or equivalent notation, if assigned

(c) Nomenclature or Identification Number, if required.

Additional information, such as Schematic Diagrams or Internal Connection Diagram identifications may also be shown. Device designations on diagrams for Power Switchgear and Industrial Control shall be applied as described in 15-9.2.3. Reference designations shall be in accordance with American National Standard Y32.16.

15-11.2.3 Graphic Symbols

Graphic symbols shall be in accordance with 15-3.6. A selection of symbols frequently used to designate cabling details is shown in Figure 10-8. (See also 15-10.3.19.) On wiring type diagrams, for multi-conductor or shielded cable, coaxial cable, and waveguide, the transmission path recognition symbol shall be shown at least once on each path and at additional points as needed for clarity.

15-11.2.4 Connecting Lines

Connecting lines (whether representing wires individually, grouped, or cabled) shall be drawn as straight lines running vertically or horizontally. Parallel lines shall be spaced at intervals which will not be less than 0.06 inches when the diagram is reduced to ultimate use size. The longer parallel lines shall be arranged in groups, preferably three to a group, with approximately double spacing between groups. Routing should be shown in a direct and logical path between terminals.

15-11.2.5 Terminals

Terminals may be shown in symbol form or the symbols may be omitted and the individual connecting lines terminated at the item outline. In either case, the terminal shall be identified. Reference designations, if assigned, shall be shown for individual terminals, terminal boards, connectors, etc. Individual terminals of a device shall be identified:

(a) According to the markings on the device, if assigned.

(b) According to the markings assigned on the Schematic or Connection Diagrams if designations have been arbitrarily assigned.
(c) If no prior assignment exists, according to an arbitrary system explained in the interconnection information.

15-11.2.6 Connector Identification
Each connector shall be identified by its reference designation, if assigned, or by its part number or an equivalent identification adjacent to its symbol unless:

(a) The connectors are part of a prefabricated or field fabricated cable assembly whose reference designation, part number or other identification is referenced in the interconnection information and this supplementary information is available to fully identify the connectors at each end of the cable.

(b) The connectors are of only one type covered by an explanatory note in the interconnection information.

If cable assembly numbers are not referenced or not made available with the interconnection information, the information provided for each connector shall include identification of its accessories such as adaptors, cable clamps, sealing cups, etc. together with any special assembly instructions which may be required.

Connector reference designations need not be shown consecutively. See ANSI Y32.16.

15-11.2.6.1 Connector Contact Identification
Connector contacts shall be identified:
(a) According to the markings on the connector, if assigned,

(b) According to the markings assigned on the Schematic or Connection Diagrams if designations have been arbitrarily assigned,

(c) If no prior assignment exists, according to an arbitrary system explained in the interconnection information.

15-11.2.7 Wire and Cable Identification
Interconnection Diagrams shall, when required, include the following:
For individual wires:
(a) Wire color information if the wire is so identified.

(b) Wire size (area).

(c) Wire type (voltage rating, construction, shielding, specification, etc.).

For cables:
(a) Nomenclature, if assigned, or part number.

(b) Reference designation or equivalent identification if assigned.

(c) Cable type designation.

Where this information is common to a large number of connections, it may be more convenient to put it in general notes. In other cases, the information may be shown inserted in a break in the individual connecting lines, once (in the center) if the lines are short, near each end for moderate length connecting lines, or if the lines are long as many times as necessary to preserve continuity. The highway or interrupted methods may also be used or the information may be shown in tabular form on the diagram.

See ANSI Y32.16 for more extensive information on the use of reference designations to identify cables under various conditions.

15-11.2.7.1 Wire Color Information
Wire colors shall be identified in accordance with 15-3.11. Equivalent designations printed on the wire may also be used. On highway and point-to-point diagrams, this data shall be shown inserted in a break in the connecting lines, or keyed to a tabular list shown or referenced on the diagram.

15-11.2.7.2 Wire Size (area)
The wire size shall be stated using the gauge size (for example AWG) or for larger sizes, the area in thousands of circular mils followed by the multiplier symbol k (e.g. 300k, 1500k). For thermocouple leads add the wire type. For coaxial cables, wave guides, etc., the wire size should be replaced by a type designation.

15-11.2.8 Supplementary Information
Supplementary data, such as wire lengths, wire end preparation requirements, installation instructions, etc., may also be included in the interconnection information.

15-11.3 Wiring Type Diagrams
The wiring type of an Interconnection Diagram shall show individually, each connection to be made between major items represented on the diagram to facilitate the tracing of an electrical circuit from one major item to another. It may also be used as a planning guide for establishing interconnecting cable requirements. It may also be prepared for any type of circuit (signal, power, or control) or level of a system; in its simplest form it may show the wiring between only two major items. See Figures 11-1 and 11-7. Special requirements for the point-to-point, highway, interrupted line, and tabular methods are given in the following paragraphs. A combination of diagrammatic and tabular methods may be used.

15-11.3.1 Continuous Line Point-to-Point
In continuous line (point-to-point) diagrams, an individual connecting line shall be shown between each pair of terminals to be connected. Each connecting line shall be identified according to 15-11.2.7 and may include a Wire Run Code (or an explanatory note describing the
destination of the wires) and the circuit function of the connection (if applicable). These identifications shall be placed in breaks in the connecting line. This method is primarily useful for simple circuits with few connections. See Figures 11-1 and 11-3.

In Figure 11-3, the wire designations W1, W2 and W3 were included only to relate the wires with the interconnecting wires on the Schematic Diagram in Figure 11-2.

15-11.3.2 Continuous Line — Highway

In continuous line (highway diagrams), each connecting line shall be brought out from its termination for a short distance, identified as specified in the following paragraphs and then gathered or grouped with others having the same general destination, into a single common line. Highway lines may be branched or unbranched. The use of the highway method is preferred when there is a large number of point-to-point interconnecting lines which would otherwise clutter the drawing and make it difficult to follow.

15-11.3.2.1 Branched Highways

Each connection shall have near one termination, shown in separate breaks, the following type of information:

(a) Wire run code
(b) Opposite end destination
(c) Function (if applicable)

Near the other termination, the wire run code and opposite end destination only shall be shown in separate breaks. See Figure 11-4.

15-11.3.2.2 Unbranched Highways

Each connection shall have near one termination, shown in separate breaks, the following type of information:

(a) Wire run code
(b) Function (if applicable)

Near the other termination, the Wire Run Code only shall be shown in a break. See Figure 11-5.

For Power Switchgear and Industrial Control Diagrams, designations may be assigned arbitrarily and shown inside or adjacent to the grouping symbol as shown in Figure 11-6. These arbitrary designations may also be used to indicate wire or cable route numbers, specific conduits or raceways, etc. If the terminal designations at each end are different, wire designations shall be assigned.

15-11.3.3 Interrupted Line

In interrupted line diagrams, each connecting line shall be brought out from its termination for a short distance and at the end of each connecting line identified as follows:

(a) According to 15-11.2.7
(b) With its opposite end destination, and with additional optional information such as wire run code or function.

Interrupted line methods require convenient destination designations to precede actual terminal designations. Either of the following may be used:

(a) If reference designations are assigned, complete or partial reference designations (as required for clarity) may be shown prominently at each major item. The destination reference designation shall precede the terminal designation, thus: 1A7TB3-24.
(b) An arbitrary letter or number may be assigned and shown prominently at each major item. The destination letter or number shall precede the terminal designation, thus: E-24 or 5-24.

15-11.3.4 Tabular

Connections between terminals may be prepared as lines of information in a list. The recommendations of 15-10.6 also apply to tabular Interconnection Diagrams.

Figure 11-7 and 11-8 are examples of unit oriented and circuit oriented tabular Interconnection Diagrams respectively.

The information in the two illustrations is not for the same equipment.

An illustration of the tabular method applied in the Power Switchgear or Industrial Control Field is shown in Figure 11-9. This is for the same circuits shown in Figures 11-2 and 11-6.

Tabular listings should be supplemented (as required) by the data listed in 15-10.6.6.

15-11.3.5 Wire Run Code

A wire run code may be used to identify each electrical wire, and its circuit function. The code may range from a simple number used for reference between diagrams, tabular lists, and other instructions, to a combination of letters and numbers assigned according to an organized system. It may include some or all of the information required by 15-11.2.7. Wire run codes are normally assigned on an overall systems basis. When used they shall be in agreement with the information shown on the Schematic Diagram, and the Internal Connection Diagrams. For examples of wire run codes see Figure 11-1, 11-4, and 11-5.
15-11.4 Cabling Type Diagrams

The diagram shall show each cable to be run between the various major items represented. Special requirements for diagrammatic and tabular methods are given in the following paragraphs. A combination of diagrammatic and tabular methods may be used, if appropriate. Incidental information primarily of a wiring form may also be included, if desired.

15-11.4.1 Diagrammatic

This may be a continuous line or an interrupted line diagram (see Figure 11-10 for continuous line type). Each cable shall be represented by a single line running between two or more items connected by the cable. Connectors, terminal boards, etc. shall be represented by the single-line form of graphic symbols. Identification of individual terminals of a connector, terminal board or other device are usually omitted.

15-11.4.2 Tabular

Each cable shall be represented by one or more lines of data in a list. The recommendations of 15-10.6 in part also apply to tabular cabling information. The connection data for the individual wires of the cable are normally not included as this tabular list is primarily a summary of interconnection cables. Figure 11-11 is an example of an Interconnection Cabling Diagram in tabular form. The tabular listings should be supplemented (as required) by the data listed in 15-10.6.6.

15-11.4.3 Identification of Cables

Each cable assembly or field prepared cable shall be fully identified in accordance with 15-11.2.6 and 15-11.2.7. If the information is not provided on the diagram, the diagram shall reference the documents containing the information.

FIGURE 11-1
SIMPLE CONTINUOUS LINE (POINT-TO-POINT) INTERCONNECTION DIAGRAM (ELECTRONICS OR COMMUNICATION APPLICATION ILLUSTRATED)
115 VAC CONTROL SOURCE

DEVICE FUNCTION DESIGNATION
EQUIPMENT LOCATION
INTERCONNECTION WIRE DESIGNATION

TERMINAL DESIGNATION

DEVICE LOCATIONS:
1M-A ON PANEL A
2M-A ON PANEL A
TR-A ON PANEL A
CR-B ON PANEL B
M-C ON PANEL C

FIGURE 11-2 – TYPICAL INDUSTRIAL CONTROL SCHEMATIC DIAGRAM SHOWING TERMINAL AND INTERCONNECTION DESIGNATIONS (POWER SWITCHGEAR OR INDUSTRIAL CONTROL APPLICATION ILLUSTRATED)

FIGURE 11-3 – TYPICAL CONTINUOUS LINE (POINT-TO-POINT) INTERCONNECTION DIAGRAM (POWER SWITCHGEAR OR INDUSTRIAL CONTROL APPLICATION ILLUSTRATED)
FIGURE 11-4 – SIMPLE CONTINUOUS LINE (HIGHWAY BRANCHED) INTERCONNECTION DIAGRAM (ELECTRONICS OR COMMUNICATION APPLICATION ILLUSTRATED)

FIGURE 11-5 – SIMPLE CONTINUOUS LINE (HIGHWAY UNBRANCHED) INTERCONNECTION DIAGRAM (ELECTRONICS OR COMMUNICATION APPLICATION ILLUSTRATED)

FIGURE 11-6 – TYPICAL HIGHWAY INTERCONNECTION DIAGRAM WITH CABLE ROUTE NUMBERS (POWER SWITCHGEAR OR INDUSTRIAL CONTROL APPLICATION ILLUSTRATED)
### FIGURE 11-7 — PORTION OF TYPICAL TABULAR WIRING INFORMATION — UNIT ORIENTED
(ELECTRONICS OR COMMUNICATION APPLICATION ILLUSTRATED)
### FIGURE 11-8 – PORTION OF TYPICAL TABULAR WIRING INFORMATION – CIRCUIT ORIENTED
(ELECTRONICS OR COMMUNICATION APPLICATION ILLUSTRATED)

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|     |       |         |   |     |       |               |              |       |                 |       |      |              |     |

#### FIGURE 11-9 – PORTION OF TYPICAL TABULAR FORM OF INTERCONNECTION WIRING INFORMATION
(POWER SWITCHGEAR OR INDUSTRIAL CONTROL APPLICATION ILLUSTRATED)

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#### FIGURE 11-9 – PORTION OF TYPICAL TABULAR FORM OF INTERCONNECTION WIRING INFORMATION
(POWER SWITCHGEAR OR INDUSTRIAL CONTROL APPLICATION ILLUSTRATED)
FIGURE 11.10 – INTERCONNECTION CABLING INFORMATION IN DIAGRAMMATIC FORM
(ELECTRONICS OR COMMUNICATION APPLICATION ILLUSTRATED)

FIGURE 11.11 – INTERCONNECTION CABLING INFORMATION IN TABULAR FORM
(ELECTRONICS OR COMMUNICATION APPLICATION ILLUSTRATED)