ELECTRICAL DRAWINGS AND DIAGRAMS

INTRODUCTION

Complete electrical drawings showing existing systems and equipment are needed for the successful long-term operation and growth of a facility. NFPA 70B states, “The availability of up-to-date, accurate, and complete diagrams is the foundation of a successful EPM (Electrical Preventive Maintenance) program. No EPM program can operate without them.” NFPA 70B further describes the need for construction drawings, diagrams, plans, maps, layouts and supporting data.

Various types of drawings guide new construction. They are updated to record the details of installation and later changes. These drawings document electrical, mechanical, structural, fire protection, and other construction details. Normal construction practices hide or limit access to certain electrical system components. To plan changes in construction and electrical services, existing features must first be known. Only by referring to complete and up-to-date electrical drawings and equipment lists can the details of an electrical system be readily determined. Having ready access to “as-built” electrical construction drawings and diagrams can help management expedite emergency repairs, planned maintenance and changes, and electrical system analyses.

POSITION

Maintain a complete set of up-to-date electrical drawings for each facility. Include “as-built” electrical construction drawings, and as applicable, cable maps, equipment location plans, schematic diagrams, wiring diagrams, and system diagrams.

- Update or prepare new drawings when any change is made to an electrical system.
- Index these drawings. The person in charge of electrical system maintenance should maintain these records.
- File power distribution system drawings so they can be readily retrieved. Maintain a duplicate set of drawings off-site. These drawings show electrical circuitry from the point of utility power connection to the point of use. They include permanently connected lighting, receptacles, and motor controls. They also show all on-site power supplies.
- Provide the emergency coordinator with a copy of electric power distribution layout diagrams.

Assign the person in charge of maintaining electrical systems responsibility for updating electrical drawings and for updating electrical coordination and fault current analyses.

DISCUSSION

"Electrical drawings" and "electrical diagrams" are not defined terms. In practice, they are sometimes used interchangeably. Other times, drawings refer to construction or as-built layout plans, and diagrams refer to one-line diagrams and other electrical schematics.

Different types of electrical drawings have different names. Some names show the use of the drawings or what they portray. Cable maps, raceway layouts, layout diagrams, and wiring diagrams are examples.

Electrical Drawings

Electrical construction drawings show the placement and layout of on-site power, distribution, and utilization circuit components, including those in buildings and other structures. These drawings do not normally show the size or shape of specific electric equipment. The drawings typically use symbols like those in ANSI Y32.9 to show the location and arrangement of wiring systems. PRC.5.0.2.A shows commonly used symbols.

Contractors review electrical construction drawings with other drawings created by construction, design and architectural professionals. Once construction approvals are granted and the construction begins, conflicts between various drawings may arise. After these are resolved, the final electrical installation might differ from that shown on the original drawings.

When the contract stipulates "as-built" drawings shall be prepared after construction, drawings are updated to accurately reflect the installation. Although electrical codes usually do not require maintaining "as-built" drawings, well-managed facilities maintain complete up-to-date drawings to use with planned maintenance programs and future construction. The drawings are needed to identify electrical construction and services for the facility.

Electrical Diagrams

The term electrical diagram generally describes a broad category of different electrical drawings. The one-line (single-line) diagram is one of the most common types of electrical diagrams. It shows the arrangement of circuit components, but does not show their sizes, shapes, or locations. One-line diagrams can represent 3-phase power systems, single-phase or dc systems, or specialized subsystems of any power, control, or signaling circuit. They can represent lighting, heating, ventilation, air conditioning, and emergency systems. Appendix G of NFPA 70B shows a one-line diagram of a 3-phase power distribution system.

An electrical diagram may show only a limited part of a circuit, such as wiring, instrumentation, and switches between the input and output terminals of a specific enclosure. Its primary purpose is to describe wiring and cable connections so that improper installation and improper maintenance can be avoided. As an example, wiring diagrams for electric fire pump controllers typically show only internal components. After being used in the field, wiring diagrams are usually filed with installation and instruction manuals and other specific information about the devices they describe.

An elementary (schematic) diagram shows electrical connections and devices. It uses graphic symbols defined in ANSI Y32.2. Some of these symbols are shown in PRC.5.0.2.B and Appendix F of NFPA 70B. A schematic diagram identifies device functions with the numbering system identified in PRC.5.0.2.C. A boiler combustion control system is an example of a control system usually represented on a schematic or ladder diagram.

A logic diagram is a schematic diagram for electronic or digital equipment. It does not always show point-to-point wiring. A block diagram is a type of electronic diagram that represents separate portions of a system as individual blocks. Each block has a basic purpose or function. These blocks are cross-referenced with other diagrams.

The Importance Of Updating Drawings

Having up-to-date as-built drawings is very important for safely managing change. At one facility, an employee used an inaccurate drawing to update a layout diagram. The old drawing should have been

destroyed. Circuits were not verified. During subsequent maintenance, an electrician was electrocuted when he came in contact with supposedly de-energized equipment that had been improperly identified.

At another facility, an outside contractor barely averted serious injury when drilling into a concrete ceiling to install anchors for sprinkler piping. The worker reviewed the original, approved, electrical construction drawings for the building. However, neither the original nor updated as-built drawings were available. Consequently, the worker was not aware that a conduit carrying energized cables was buried in the concrete where the anchor was to be installed. The drilling caused a 120 V lighting circuit to short-circuit.

Incidents like these can lead to fire, serious injury, serious interruption to business and high dollar loss. These incidents emphasize the need for programs to manage documentation of physical change as part of loss prevention and control.

Management Programs For Loss Prevention And Control

Have qualified engineering personnel provide or update drawings and diagrams whenever changes are made to electrical systems. Destroy obsolete drawings.

Projects that construct or change a property are not complete until documentation is safely filed for use with future projects. Up-to-date drawings are required for new construction and for remodeling projects, but also might be needed when equipment is changed, as can occur during normal maintenance activities. Without up-to-date drawings, future projects cannot be safely and efficiently planned.

OVERVIEW, AXA XL Risk Consulting's program for management of loss prevention and loss control, provides guidance for specific management programs and for the management of change. When properly implemented, each of the 14 interlocking programs addresses how change is to be accomplished.

OVERVIEW programs also address safe job practices. Recommended good drilling practice might require reviewing up-to-date drawings before drilling, and, might also require visually tracing existing electrical lines and using electrical wiring detection equipment along floor, wall and ceiling surfaces before drilling. *OVERVIEW* also addresses employee and outside contractor training programs to help workers perform tasks safely, to avoid catastrophic incidents. Implementing *OVERVIEW* can reduce electrical hazards and control losses.

SYMBOLS FOR ELECTRICAL CONSTRUCTION DRAWINGS

The common symbols in this appendix are from ANSI Y 32.9 and are used in layout diagrams. The symbols are listed in the following groupings: Lighting Outlets and Boxes; Receptacle Outlets; Wiring, Raceways and Ducts; Switchboards, Panelboards, Cabinets, Enclosures; and Disconnects.

Layout diagrams are usually drawn to scale, but as a minimum, they show construction dimensions. These diagrams are sometimes called electrical construction drawings. Electrical construction drawings are used to plan, install and maintain electrical systems. Loss control activities review information on these drawings before, during and after construction. Diagrams should be updated and maintained both on and off the site.

Drawings may also contain symbols taken from other standards. ANSI Y 32.2 and ANSI Y 32.9 together comprise a more complete listing of symbols than this appendix. Upper case letter abbreviations may be shown with some outlet symbols. Meanings are as follows:

- WP - Weatherproof
- VT - Vapor Tight
- WT - Water Tight
- RT - Rain Tight
- DT - Dust Tight
- EP - Explosion Proof
- G - Grounded
- R - Recessed
- UNG - Ungrounded

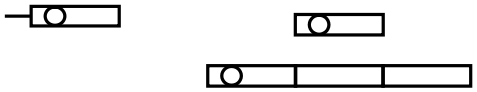
LIGHTING OUTLETS & BOXES

Wall **Ceiling**

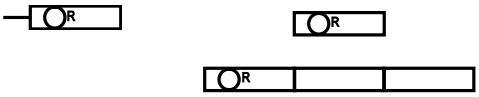
Surface or Pendant Incandescent, Mercury-Vapor, or Similar Outlet

Recessed Incandescent, Mercury-Vapor, or Similar Outlet

Surface or Pendant Fluorescent Outlet



Recessed Fluorescent Outlet



Blanked Outlet

Junction Box

RECEPTACLE OUTLETS

Grounded **Ungrounded**

Single Receptacle Outlets

Duplex Receptacle Outlets

Triplex Receptacle Outlets

Quadruplex Receptacle Outlets

Hanging Fan Receptacle Outlets

Grounded **Ungrounded**

Special-Purpose Receptacle Outlets

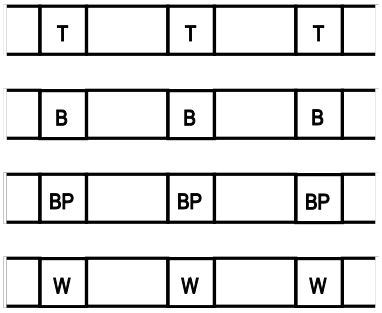
*Use is typically identified

In-Floor Receptacle Outlets

WIRING, RACEWAYS & DUCTS

Trolly Ducts; Busway; Cable Trough, Ladder, or Channel; Wireway

Identified by notation

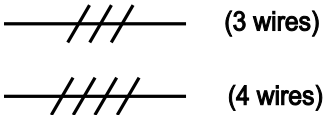


Wiring Concealed in Ceiling or Wall (2 wires)

Exposed Wiring (2 wires)

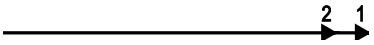
Wiring Concealed in Floor (2 wires)

Typical conduit - identify number of wires with cross-hatching when more than 2 wires



WIRING, RACEWAYS & DUCTS (Cont'd.)

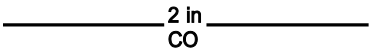
Branch Circuit Home Run to Panel Board Number of arrows indicates number of circuits. (A numeral at each arrow may be used to identify circuit number.)



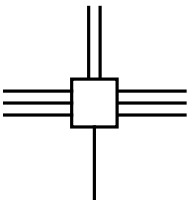
Wiring Turned Up

Wiring Turned Down

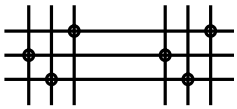
Empty Raceway
Identify size and "CO" (conduit only)



Underfloor Duct and Junction Box for Triple, Double, or Single Duct System (as indicated by the number of parallel lines)



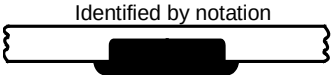
Cellular Floor Header Duct



SWITCHBOARDS, PANELBOARDS, CABINETS, ENCLOSURES

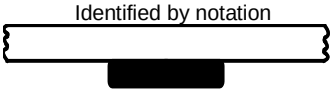
Flush-Mounted Panelboard and Cabinet

Identified by notation



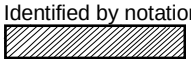
Surface-Mounted Panelboard and Cabinet

Identified by notation



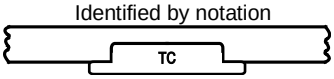
Switchboard, Power Control Center, Unit Substations (Drawn to scale)

Identified by notation



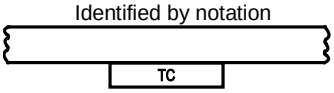
Flush-Mounted Terminal Cabinet

Identified by notation



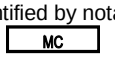
Surface-Mounted Terminal Cabinet

Identified by notation



Motor or Other Power Controller

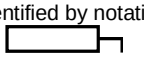
Identified by notation



DISCONNECTS

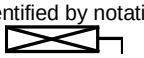
Externally Operated Disconnect Switch

Identified by notation



Combination Controller and Disconnect Switch

Identified by notation



SYMBOLS FOR ELECTRICAL DIAGRAMS

The symbols in this appendix are from IEEE Std 315 and IEEE Std 315A. These symbols are commonly used on electrical diagrams reviewed by loss control personnel.

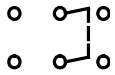
This appendix lists the symbols in the following groupings: Switches, Contacts, Rotating Machinery, Transformers, Connections and Miscellaneous.

The symbols diagrammatically show the functions of devices and circuit interconnections. They are used on single-line, schematic or elementary diagrams, and on connection and wiring diagrams.

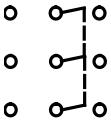
SWITCHES

Single-Throw

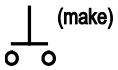
2-Pole Double-Throw Switch

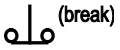


3-Pole Double-Throw Switch



Pushbutton Switch



OR


Selector Switch


OR


Normally Open Limit Switch


OR


Normally Closed Limit Switch


OR


OR


Open switch with time-delay closing (TDC) feature

OR


Closed switch with time-delay opening (TDO) feature

OR


Flow Switch - Closes on increased flow

Flow Switch - Opens on increased flow

Liquid Level Switch - Closes on increased level

Liquid Level Switch - Opens on increased level

Pressure Switch - Closes on increased pressure

Pressure Switch - Opens on increased pressure

Temperature Switch - Closes on increased temperature


OR


Temperature Switch - Opens on increased temperature


OR

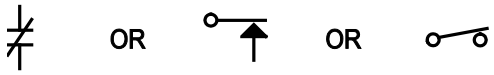

Centrifugal Force (Speed) Switch - Closes on increased speed

Centrifugal Force (Speed) Switch - Opens on increased speed

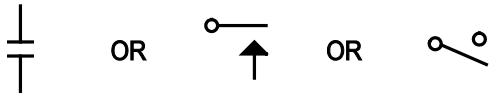
CONTACTS

(Actuating device and set point may be specified.)

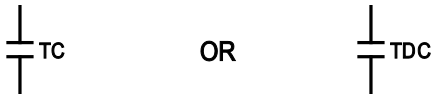
Closed (Break)



Open (Make)

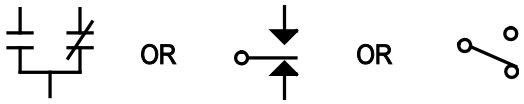


Open with Timed Closing

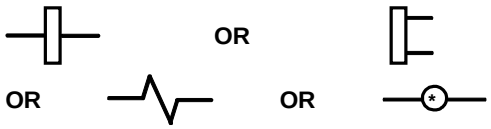


Closed with Timed Opening

Transfer Switching



Relay Coil (Actuator)



*Number identifying the device. See Appendix C.

ROTATING MACHINERY**

Electric Motor

Motor – General

Motor - Direct-current

Motor - Alternating-current

Motor - Synchronous

Electric Generator

Generator - General

Generator - Direct-current

Generator - Alternating-current

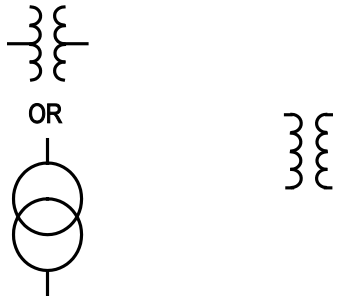
Generator - Synchronous

**Plus many combinations with series/shunt/ compensating windings - Not shown

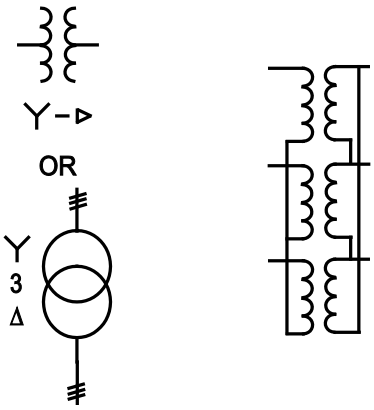
TRANSFORMERS

Single-Line Diagrams	**Complete Diagrams**

1-phase, 2-winding Transformer



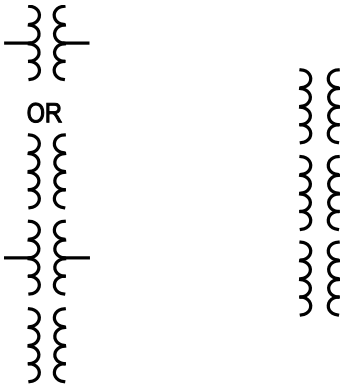
3-phase Bank of 1-phase, 2-winding Units Showing Wye-delta Connections



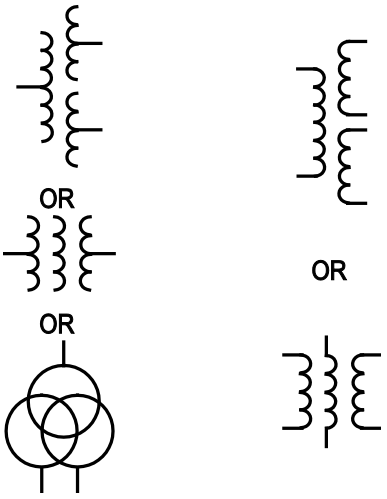
TRANSFORMERS (Cont'd.)

Single-Line Diagrams	Complete Diagrams

3-phase Transformer



1-phase, 3-winding Transformer

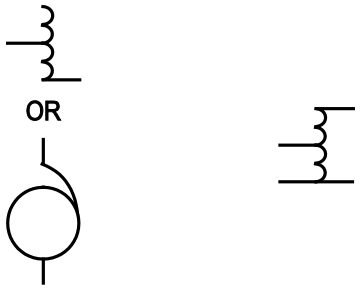


Bushing Type Current Transformer

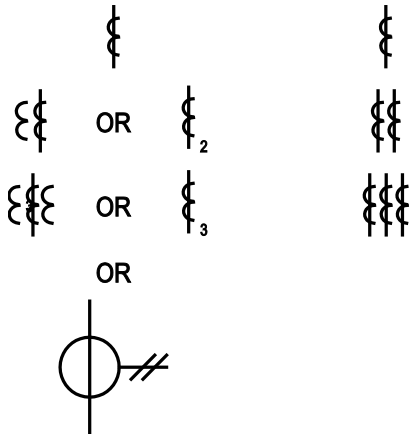
1-phase 2-winding Transformer with Taps

Single-Line Diagrams	Complete Diagrams

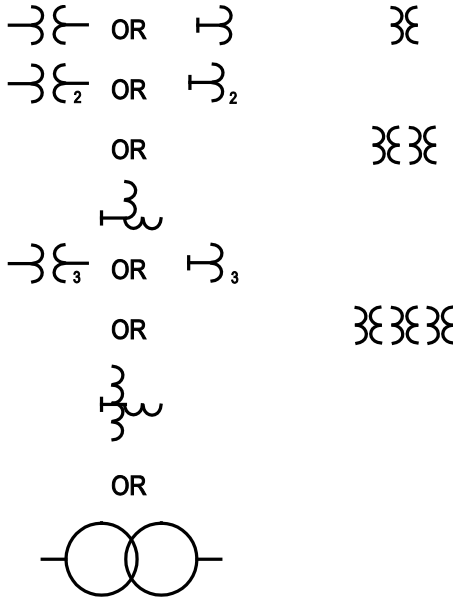
1-phase Autotransformer



Current Transformer (For Instruments and Controls)



Potential Transformer



CONNECTIONS

Ground (general use)

Ground for specific safety function

Low-noise ground

3-phase, open-delta, ungrounded

3-phase, 3-wire delta, ungrounded

3-phase, 4-wire delta, ungrounded

3-phase, 3-wire delta, grounded

3-phase, 4-wire delta, grounded

3-phase wye or star, ungrounded

3-phase, 4-wire wye, ungrounded

3-phase wye, grounded neutral

Chassis or frame connection

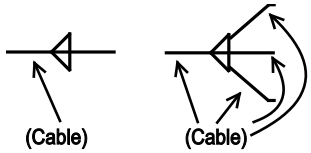
Jack, plug or receptacle - female contact

Jack, plug or receptacle - male contact

Separable connectors

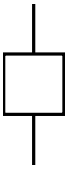
MISCELLANEOUS

Pothead (Cable Termination)



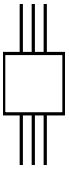
Circuit Breaker - General

Circuit Breaker - Other Than General

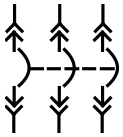


Circuit Breaker - Switchgear and Controlgear

Circuit Breaker - 3-Pole

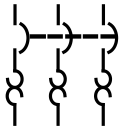


Circuit Breaker - 3-Pole Drawout Type



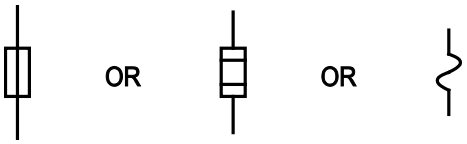
Circuit Breaker - 3-Pole with Magnetic Overload

Circuit Breaker - 3-Pole with Thermal Overload



MISCELLANEOUS (Cont'd.)

Fuse



Fuse Cutout and Fuse Switch

General

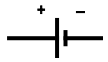
For Off-Load Switching

For On-Load Switching

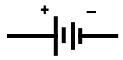
High-voltage primary fuse cutout, oil

Battery

One Cell

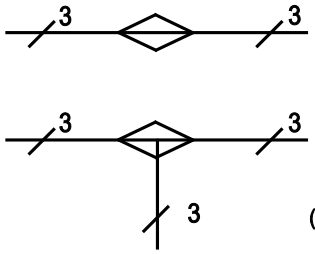


Multi-Cell

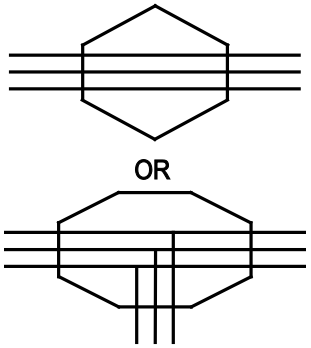


Junction Box (Not lighting circuits)

Single-line Representation



Multiline Representation



Network Protector

DEVICE FUNCTION NUMBERS

Numbers and letters are used in electrical drawings, diagrams, instruction books, and specifications to describe the purpose of certain switchgear. A device function number, with suffix letters and a prefix where appropriate, identifies what the device is expected to accomplish.

Figure 1 is a one-line diagram showing a 3-phase transformer arranged with an ac circuit breaker on the incoming power line. A manual disconnect or switch is shown on the secondary distribution line.

A differential relay provides fault detection for any short occurring within the “zone of protection.“ The segment of the power system between the sensing points used by device “87” defines this zone. Any fault in the circuit breaker, transformer, disconnect or cable between sensing points will be detected by this differential relay. The relay will detect any imbalance between supplied current and output current (corrected for the transformer turns ratio). Device function numbers shown in electrical diagrams help in “picturing” the protection.

The following listing identifies device function numbers, prefixes, and selected suffix letters. Explanatory comments are provided for some devices. A more detailed description of these devices and their functions is in ANSI C37.2.

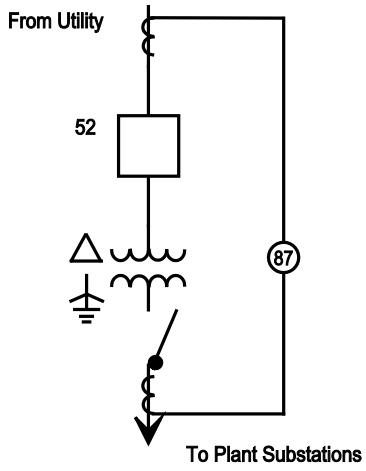


Figure 1. Example Of Device Function Numbers.

NUMBER	DEVICE
1	**Master Element** - generally used with switching devices on hand operated equipment, as for a control switch on a hand tool
2	**Time-Delay Starting or Closing Relay** - provides a time delay between two designated switching points in the switching sequence other than for device functions 48, 62, and 79
3	**Checking or Interlocking Relay** - responds to the position of other devices or to preset conditions; allows an operating sequence to proceed
4	**Master Contactor** - generally controlled by device function 1
5	**Stopping Device** - the normal power control function, for other than abnormal conditions described by the device 86 function
6	**Starting Circuit Breaker** - connects a machine to its power circuit of source of voltage
7	**Rate of Change Relay / Anode Circuit Breaker**
8	**Control Power Disconnecting Device** - includes devices like circuit breakers and knife switches that connect and disconnect a control bus or control equipment to a power supply
9	**Reversing Device**
10	**Unit Sequence Switch**
11	**Multi-Functioned Device**
12	**Overspeed Device** - directly connected to function on machine overspeed
13	**Synchronous-Speed Device** - centrifugal-speed switch, slip-frequency relay, voltage relay, undercurrent relay and any similar devices operating at approximately synchronous speed
14	**Underspeed Device** - functions when machine speed falls below a set value
15	**Speed or Frequency Matching Device** - holds speed/frequency to set values
16	**Data Communication Device** – Suffix letters further define the device; S=Serial; E=Ethernet; C=Security Processing Function VPN/Encryption; F Firewall or Message Filter; M=Network Manager Function; R=Router; S=Switch; T=Telephone Component. Example: 16ESM= Ethernet Switch
17	**Shunting or Discharge Switch** - excludes device functions 6, 42, and 73
18	**Accelerating or Decelerating Device** - for machine speed control
19	**Starting-to-Running Transition Contactor** - transfers power to a machine to a separate power source
20	**Electrically Operated Valve** - in fluid or gas piping systems
21	**Distance Relay** - actuates upon shifts in admittance, impedance, or reactance beyond set values
22	**Equalizer Circuit Breaker**
23	**Temperature Control Device** - excludes regulating-type function 90 devices
24	**Volts per Hertz Relay**
25	**Synchronizing or Synchronism-check Device** - causes or allows paralleling of two ac circuits when frequency, phase angle, and voltage are within limits
26	**Apparatus Thermal Device**
27	**Undervoltage Relay**

28 **Flame Detector** - generally used in gas turbine and steam boiler applications

29 **Isolating Contactor** - allows isolation for emergency operation, maintenance, and tests

30 **Annunciator Relay** - a manually reset signaling relay which may also be arranged to perform a lockout function

31 **Separate Excitation Device**

32 **Directional Power Relay**

33 **Position Switch** - makes or breaks a circuit based on the position of a machine or component having no device number

34 **Master Sequence Device** - examples include a computer or a motor-operated multi-contact switch

35 **Brush-operating or Slip-ring Short-circuiting Device** - shifts brush position or bypasses slip ring

36 **Polarity or Polarizing Voltage Device** - verifies polarity between points

37 **Undercurrent or Underpower Relay**

38 **Bearing Protective Device** - senses high bearing temperature or other bearing-specific problems

39 **Mechanical Condition Monitor** - senses mechanical problems other than those described for device function 38; includes vibration, eccentricity, tilting, expansion, and seal failure

40 **Field Relay** - monitors field or armature current

41 **Field (Excitation) Circuit Breaker** - applies or removes field excitation in a machine

42 **Running Circuit Breaker** - supplies power to machinery; includes contactors and similar devices in series with the breaker used to frequently open and close the circuit

43 **Manual Transfer or Selector Device**

44 **Unit Sequence Starting Relay** - directs the starting of a default unit when a primary unit fails

45 **Atmospheric Condition Monitor** - detects vapors, smoke, fire, etc.

46 **Reverse-Phase or Phase-Balance Current Relay**

47 **Phase-Sequence Voltage Relay**

48 **Incomplete Sequence Relay** - commonly refers to a relay that deenergizes and locks out equipment power upon a faulty operating sequence; 48A describes “alarm only” usage

49 **Machine or Transformer Thermal Relay**

50 **Instantaneous Overcurrent or Rate-of-Rise Relay**

51 **ac Time Overcurrent Relay**

52 **ac Circuit Breaker**

53 **Exciter or dc Generator Relay**

54 **Turning Gear Engaging Device**

55 **Power Factor Relay**

56 **Field Application Relay**

57 **Short-Circuiting or Grounding Device** - shorts or grounds a circuit upon some manual or automatic signal

58 **Rectification Failure Relay**

59 **Overvoltage Relay**

60 **Voltage or Current Balance Relay**

61 **Density Switch or Sensor**

62 **Time-delay Stopping or Opening Relay** - starts a time delay when some other device activates

63 **Pressure Switch** - operates at set pressures or rate-of-change of pressure

64 **Ground Detector Relay**

65 **Governor** - regulates the flow of water, steam, or other medium used as a prime mover, e.g., steam flow for a steam turbine

66 **Notching or Jogging Device** - limits the number of operations within a time period; or controls the intermittent energizing or acceleration of equipment typically at low speeds for synchronizing or positioning

67 **ac Directional Overcurrent Relay**

68 **Blocking Relay (or "Out-of-Step")** - sends a signal to block the operation of switching or tripping protective devices, by bypassing fault signals when certain conditions are met; is often actuated in power transmission and distribution systems during storms

69 **Permissive Control Device** - can be set to permit or prevent an operation, such as closing a circuit breaker or powering the equipment

70 **Rheostat** - permits establishing settings by varying circuit resistance

71 **Level Switch** - operates at set levels or rate-of-change of level

72 **dc Circuit Breaker**

73 **Load-Resistor Contactor** - switches loads or portions of loads in and out of a power circuit

74 **Alarm Relay** - other than an annunciator relay, device function 30

75 **Position Changing Mechanism**

76 **dc Overcurrent Relay**

77 **Pulse Transmitter / Telemetering Device** - transmits pulses over telemetering (remote metering) or pilot-wire circuits, particularly those used to operate remotely-located controls

78 **Phase-Angle Measuring or Out-Of-Step Protective Relay** - senses the phase angle between two ac voltages, between two ac currents or between ac voltage and current

79 **ac Reclosing Relay** - controls automatic reclosing and locking-out of ac circuit interrupters

80 **Flow Switch** - operates at a set flow rate or rate-of-change

81 **Frequency Relay** - responds to set frequency or rate-of-change

82 **dc Reclosing Relay** - controls automatic reclosing of a dc circuit interrupter

83 **Automatic Selective Control or Transfer Relay**

84 **Operating Mechanism** - applies to components of a tap changer, induction regulator, or any similar apparatus not having a unique function number

85 **Carrier or Pilot-Wire Receiver Relay** - signals excessive carrier-current or a dc pilot-wire fault

86 **Lockout (Auxiliary) Relay** - maintains a power shut-off until reset

87 **Differential Protective Relay**

88 **Auxiliary Motor or Motor Generator** - operates auxiliary equipment, such as a fan, exciter, or pump

89 **Line Switch** - performs a disconnect or isolating function, but the switch itself is electrically operated

90 **Regulating Device** - routine regulation within generally close limits

91 **Voltage Directional Relay** - responds to excessive voltage of a specified polarity

92 **Voltage and Power Directional Relay**

93 **Field-Changing Contactor**

94 **Tripping or Trip-Free Relay** - trips a circuit-opening device; or prevents circuit reclosure even where a closing circuit is maintained closed

95 **Special Use**

96 **Special Use**

97 **Special Use**

98 **Special Use**

99 **Special Use**

PREFIXES

Device functions 1 through 99 may be preceded by numbers (hundred-series) that identify the “unit” system or machine. Device 1 (Master Element) protecting unit #1 may be device 101. The same device may be device 201 on unit #2. A field relay on unit #2 may be device 240.

Devices that directly input a supervisory and control system rather than switchgear are prefixed by the letters RE. These letters designate “remote.”

SUFFIX LETTERS

Separate Auxiliary Devices

PB Push button

C Closing relay or contactor

O Opening relay or contactor

CS Control Switch

D “Down position” switch relay

U “Up position” switch relay

Actuating condition or mode

A Air or Amperes or Alternating

BU Back UP

C Current

D Direct or Discharge

DCB	Directional Comparison Blocking
DUTT	Direct Underreaching Transfer Trip
E	Electrolyte
F	Frequency or Flow or Fault
GC	Ground Check
H	Explosive
J	Differential
L	Level or Liquid
P	Power or Pressure
PF	Power Factor
POTT	Permissive Overreaching Transfer Trip
PUTT	Permissive Underreaching Transfer Tripp
Q	Oil
S	Speed or Suction or Smoke
SOTF	Switch On To Fault
T	Temperature
TD	Tim Delay
V	Voltage or Vacuum
VAR	Reactive Power
VB	Vibration
Z	Impedance

Main Device

A	Alarm or Auxiliary Power
AN	Anode
B	Battery or Blower or Bus
BK	Brake
BL	Block
BP	Bypass
BT	Bus Tie
C	Capacitor or Condenser or Compensator or Carrier Current or Case or Compressor
CA	Cathode
DC	Direct Current
E	Exciter
F	Feeder or Field or Filament or Filter or Fan
G	Generator or Ground
H	Heater or Housing
M	Motor or Metering

N	Network or Neutral
P	Pump or Phase Comparison
R	Reactor or Rectifier or Room
S	Synchronizing or Secondary or Strainer or Sump or Suction
T	Transformer
TH	Transformer - high voltage side
TL	Transformer - low voltage side

Main Device Parts

C	Coil or Condenser or Capacitor
CC	Closing Coil
HC	Holding Coil
LS	Limit Switch
M	Operating Motor
MS	Speed Adjusting or Synchronizing Motor
S	Solenoid
TC	Trip Coil
V	Valve
a	Normally open contact
b	Normally closed contact

Functions (added in 2008)

AFD	Arc Flash Detector
CLK	Clock or timing source
DDR	Dynamic Disturbance Recorder
DFR	Digital Fault Recorder
ENV	Environmental data
HIZ	High Impedance Fault Detector
HMI	Human Machine Interface
HST	Historian
LGC	Scheme logic (the function, as in a RAS–not a device like a PLC)
MET	Substation Metering
PDC	Phasor Data Concentrator
PMU	Phasor Measurement Unit (the function)
PQM	Power Quality Monitor
RIO	Remote Input/OutputDevice
RTU	Remote Terminal Unit / Data Concentrator
SER	Sequence of Events Recorder
TCM	Trip Circuit Monitor

Other Device Features

A	Accelerating or Automatic
E	Emergency
H	Hot or High
HR	Hand Reset
HS	High Speed
M	Manual
TDC	Time-delay Closing
TDO	Time-delay Opening