

Device function numbers standardized by IEEE and updated from time to time are used in many countries. Each number with its corresponding function name and the general description of each function is listed below. For more information the relevant standards are to be consulted.

Standard device Function numbers:

1. master element. The initiating device, such as a control switch, etc., that serves, either directly or through such permissive devices as protective and time-delay relays, to place equipment in or out of operation.

NOTE: This number is normally used for a hand-operated device, although it may also be used for an electrical or mechanical device for which no other function number is suitable.

2. time-delay starting or closing relay. A device that functions to give a desired amount of time delay before or after any point of operation in a switching sequence or protective relay system, except as specifically provided by device functions 48, 62, and 79.

3. checking or interlocking relay. A relay that operates in response to the position of a number of other devices (or to a number of predetermined conditions) in equipment to allow an operating sequence to proceed, stop, or provide a check of the position of these devices or conditions for any purpose.

4. master contactor. A device, generally controlled by device function 1 or the equivalent and the required permissive and protective devices, that serves to make and break the necessary control circuits to place equipment into operation under the desired conditions and to take it

out of operation under abnormal conditions.

5. stopping device. A control device used primarily to shut down equipment and hold it out of operation. (This device may be manually or electrically actuated, but it excludes the function of electrical lockout [see device function 86] on abnormal conditions.)

6. starting circuit breaker. A device whose principal function is to connect a machine to its source of starting voltage.

7. rate-of-rise relay. A relay that functions on an excessive rate-of-rise of current.

8. control power disconnecting device. A disconnecting device, such as a knife switch, circuit breaker, or pull-out fuse block, used for the purpose of respectively connecting and disconnecting the source of control power to and from the control bus or equipment.

NOTE: Control power is considered to include auxiliary power that supplies such apparatus as small motors and heaters.

9. reversing device. A device that is used for the purpose of reversing a machine field or for performing any other reversing functions.

10. unit sequence switch. A switch that is used to change the sequence in which units may be placed in and out of service in multiple-unit equipment.

11. multifunction device. A device that performs three or more comparatively important functions that could only be designated by combining several of these device function numbers. All of the functions performed by device 11 shall be defined in the drawing legend or device function definition list.

NOTE: If only two relatively important functions are performed by the device, it is preferred that both function numbers be used, as described in 3.6.

12. overspeed device. Usually, a direct-connected speed switch that functions on machine overspeed.

13. synchronous-speed device. A device such as a centrifugal-speed switch, a slip-frequency relay, a voltage relay, an under-current relay, or any other type of device that operates at approximately the synchronous speed of a machine.

14. underspeed device. A device that functions when the speed of a machine falls below a pre-determined value.

15. speed or frequency matching device. A device that functions to match and hold the speed or frequency of a machine or a system equal to, or approximately equal to, that of another machine, source, or system.

16. Reserved for future application.

17. shunting or discharge switch. A switch that serves to open or close a shunting circuit around any piece of apparatus (except a resistor), such as a machine field, a machine armature, a capacitor, or a reactor.

NOTE: This excludes devices that perform such shunting operations as may be necessary in the process of starting a machine by devices 6 or 42 (or their equivalent) and also excludes device function 73 that serves for the switching of resistors.

18. accelerating or decelerating device. A device that is used to close or cause the closing of circuits that are used to increase or decrease the speed of a machine.

19. starting-to-running transition contactor. A device that operates to initiate or cause the automatic transfer of a machine from the starting to the running power connection.

20. electrically operated valve. An electrically operated, controlled, or monitored valve used in a fluid, air, gas, or vacuum line.

NOTE: The function of the valve may be more completely indicated by the use of suffixes as discussed in 3.2.

21. distance relay. A relay that functions when the circuit admittance, impedance, or reactance increases or decreases beyond a predetermined value.

22. equalizer circuit breaker. A breaker that serves to control or make and break the equalizer or the current-balancing connections for a machine field, or for regulating equipment, in a multiple-unit installation.

23. temperature control device. A device that functions to raise or lower the temperature of a machine or other apparatus, or of any medium, when its temperature falls below or rises above a predetermined value.

NOTE: An example is a thermostat that switches on a space heater in a switchgear assembly when the temperature falls to a desired value. This should be distinguished from a device that is used to provide automatic temperature regulation between close limits and would be designated as device function 90T.

24. volts per hertz relay. A relay that functions when the ratio of voltage to frequency exceeds a preset value. The relay may have an instantaneous or a time characteristic.

- 25. synchronizing or synchronism-check device.** A device that operates when two ac circuits are within the desired limits of frequency, phase angle, and voltage to permit or cause the paralleling of these two circuits.
- 26. apparatus thermal device.** A device that functions when the temperature of the protected apparatus (other than the load-carrying windings of machines and transformers as covered by device function number 49) or of a liquid or other medium exceeds a predetermined value; or when the temperature of the protected apparatus or of any medium decreases below a predetermined value.
- 27. undervoltage relay.** A relay that operates when its input voltage is less than a predetermined value.
- 28. flame detector.** A device that monitors the presence of the pilot or main flame in such apparatus as a gas turbine or a steam boiler.
- 29. isolating contactor.** A device that is used expressly for disconnecting one circuit from another for the purposes of emergency operation, maintenance, or test.
- 30. annunciator relay.** A nonautomatically reset device that gives a number of separate visual indications upon the functioning of protective devices and that may also be arranged to perform a lockout function.
- 31. separate excitation device.** A device that connects a circuit, such as the shunt field of a synchronous converter, to a source of separate excitation during the starting sequence.
- 32. directional power relay.** A relay that operates on a predetermined value of power flow in a given direction or upon reverse power flow such as that resulting from the motoring of a generator upon loss of its prime mover.
- 33. position switch.** A switch that makes or breaks contact when the main device or piece of apparatus that has no device function number reaches a given position.
- 34. master sequence device.** A device such as a motor-operated multicontact switch, or the equivalent, or a programming device, such as a computer, that establishes or determines the operating sequence of the major devices in equipment during starting and stopping or during other sequential switching operations.
- 35. brush-operating or slip-ring short-circuiting device.** A device for raising, lowering, or shifting the brushes of a machine; short-circuiting its slip rings; or engaging or disengaging the contacts of a mechanical rectifier.
- 36. polarity or polarizing voltage device.** A device that operates, or permits the operation of, another device on a predetermined polarity only or that verifies the presence of a polarizing voltage in equipment.
- 37. undercurrent or underpower relay.** A relay that functions when the current or power flow decreases below a predetermined value.
- 38. bearing protective device.** A device that functions on excessive bearing temperature or on other abnormal mechanical conditions associated with the bearing, such as undue wear, which may eventually result in excessive bearing temperature or failure.
- 39. mechanical condition monitor.** A device that functions upon the occurrence of an abnormal mechanical condition (except that associated with bearings as covered under device function 38), such as exces-

- sive vibration, eccentricity, expansion, shock, tilting, or seal failure.
- 40. field relay.** A relay that functions on a given or abnormally low value or failure of machine field current, or on an excessive value of the reactive component of armature current in an ac machine indicating abnormally low field excitation.
- 41. field circuit breaker.** A device that functions to apply or remove the field excitation of a machine.
- 42. running circuit breaker.** A device whose principal function is to connect a machine to its source of running or operating voltage. This function may also be used for a device, such as a contactor, that is used in series with a circuit breaker or other fault-protecting means, primarily for frequent opening and closing of the circuit.
- 43. manual transfer or selector device.** A manually operated device that transfers the control circuits in order to modify the plan of operation of the switching equipment or of some of the devices.
- 44. unit sequence starting relay.** A relay that functions to start the next available unit in multiple-unit equipment upon the failure or nonavailability of the normally preceding unit.
- 45. atmospheric condition monitor.** A device that functions upon the occurrence of an abnormal atmospheric condition, such as damaging fumes, explosive mixtures, smoke, or fire.
- 46. reverse-phase or phase-balance current relay.** A relay that functions when the polyphase currents are of reverse-phase sequence or when the polyphase currents are unbalanced or contain negative phase-sequence components above a given amount.
- 47. phase-sequence or phase-balance voltage relay.** A relay that functions upon a predetermined value of polyphase voltage in the desired phase sequence, when the polyphase voltages are unbalanced, or when the negative phase-sequence voltage exceeds a given amount.
- 48. incomplete sequence relay.** A relay that generally returns the equipment to the normal, or off, position and locks it out if the normal starting, operating, or stopping sequence is not properly completed within a predetermined time.
- 49. machine or transformer thermal relay.** A relay that functions when the temperature of a machine armature winding or other load-carrying winding or element of a machine or power transformer exceeds a predetermined value.
- 50. instantaneous overcurrent relay.** A relay that functions instantaneously on an excessive value of current.
- 51. ac time overcurrent relay.** A relay that functions when the ac input current exceeds a predetermined value, and in which the input current and operating time are inversely related through a substantial portion of the performance range.
- 52. ac circuit breaker.** A device that is used to close and interrupt an ac power circuit under normal conditions or to interrupt this circuit under fault or emergency conditions.
- 53. exciter or dc generator relay.** A relay that forces the dc machine field excitation to build up during starting or that functions when the machine voltage has built up to a given value.
- 54. turning gear engaging device.** An electrically operated, controlled, or monitored device that functions to cause the turning

gear to engage (or disengage) the machine shaft.

- 55. power factor relay.** A relay that operates when the power factor in an ac circuit rises above or falls below a predetermined value.
- 56. field application relay.** A relay that automatically controls the application of the field excitation to an ac motor at some predetermined point in the slip cycle.
- 57. short-circuiting or grounding device.** A primary circuit switching device that functions to short-circuit or ground a circuit in response to automatic or manual means.
- 58. rectification failure relay.** A device that functions if a power rectifier fails to conduct or block properly.
- 59. overvoltage relay.** A relay that operates when its input voltage is more than a predetermined value.
- 60. voltage or current balance relay.** A relay that operates on a given difference in voltage, or current input or output, of two circuits.
- 61. density switch or sensor.** A device that operates on a given value, or a given rate of change, of gas density.
- 62. time-delay stopping or opening relay.** A time-delay relay that serves in conjunction with the device that initiates the shutdown, stopping, or opening operation in an automatic sequence or protective relay system.
- 63. pressure switch.** A switch that operates on given values, or on a given rate of change, of pressure.
- 64. ground detector relay.** A relay that operates upon failure of machine or other apparatus insulation to ground.
- NOTE:** This function is not applied to a device connected in the secondary circuit of current transformers in a normally grounded power system, where other device numbers with the suffix G or N should be used; that is, 51N for an ac time overcurrent relay connected in the secondary neutral of the current transformers.
- 65. governor.** The assembly of fluid, electrical, or mechanical control equipment used for regulating the flow of water, steam, or other media to the prime mover for such purposes as starting, holding speed or load, or stopping.
- 66. notching or jogging device.** A device that functions to allow only a specified number of operations of a given device or equipment, or a specified number of successive operations within a given time of each other. It is also a device that functions to energize a circuit periodically or for fractions of specified time intervals, or that is used to permit intermittent acceleration or jogging of a machine at low speeds for mechanical positioning.
- 67. ac directional overcurrent relay.** A relay that functions on a desired value of ac overcurrent flowing in a predetermined direction.
- 68. blocking relay.** A relay that initiates a pilot signal for blocking of tripping on external faults in a transmission line or in other apparatus under predetermined conditions, or that cooperates with other devices to block tripping or to block reclosing on an out-of-step condition or on power swings.
- 69. permissive control device.** Generally, a two-position device that in one position permits the closing of a circuit breaker, or the placing of an equipment into operation, and in the other position prevents the circuit breaker or the equipment from being operated.

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- 70. rheostat.** A variable resistance device used in an electric circuit when the device is electrically operated or has other electrical accessories, such as auxiliary, position, or limit switches.
- 71. level switch.** A switch that operates on given values, or on a given rate of change, of level.
- 72. dc circuit breaker.** A circuit breaker that is used to close and interrupt a dc power circuit under normal conditions or to interrupt this circuit under fault or emergency conditions.
- 73. load-resistor contactor.** A contactor that is used to shunt or insert a step of load limiting, shifting, or indicating resistance in a power circuit; to switch a space heater in circuit; or to switch a light or regenerative load resistor of a power rectifier or other machine in and out of circuit.
- 74. alarm relay.** A relay other than an annunciator, as covered under device function 30, that is used to operate, or that operates in connection with, a visual or audible alarm.
- 75. position changing mechanism.** A mechanism that is used for moving a main device from one position to another in equipment; for example, shifting a removable circuit breaker unit to and from the connected, disconnected, and test positions.
- 76. dc overcurrent relay.** A relay that functions when the current in a dc circuit exceeds a given value.
- 77. telemetering device.** A transmitter used to generate and transmit to a remote location an electrical signal representing a measured quantity, or a receiver used to receive the electrical signal from a remote transmitter and convert the signal to represent the original measured quantity.
- 78 phase-angle measuring or out-of-step protective relay.** A relay that functions at a predetermined phase angle between two voltages, between two currents, or between voltage and current.
- 79. ac reclosing relay.** A relay that controls the automatic reclosing and locking out of an ac circuit interrupter.
- 80. flow switch.** A switch that operates on given values, or on a given rate of change, of flow.
- 81. frequency relay.** A relay that responds to the frequency of an electrical quantity, operating when the frequency or rate of change of frequency exceeds or is less than a predetermined value.
- 82. dc load-measuring reclosing relay.** A relay that controls the automatic closing and reclosing of a dc circuit interrupter, generally in response to load circuit conditions.
- 83. automatic selective control or transfer relay.** A relay that operates to select automatically between certain sources or conditions in equipment or that performs a transfer operation automatically.
- 84. operating mechanism.** The complete electrical mechanism or servo mechanism, including the operating motor, solenoids, position switches, etc., for a tap changer, induction regulator, or any similar piece of apparatus that otherwise has no device function number.
- 85. carrier or pilot-wire receiver relay.** A relay that is operated or restrained by a signal used in connection with carrier-current or dc pilot-wire fault relaying.
- 86. lockout relay.** A hand or electrically reset auxiliary relay that is operated upon the occurrence of abnormal conditions to maintain associated equipment or devices inoperative until it is reset.

- 87. differential protective relay.** A protective relay that functions on a percentage, phase angle, or other quantitative difference between two currents or some other electrical quantities.
- 88. auxiliary motor or motor generator.** A device used for operating auxiliary equipment, such as pumps, blowers, excitors, rotating magnetic amplifiers, etc.
- 89. line switch.** A switch used as a disconnecting, load-interrupter, or isolating switch in an ac or dc power circuit. (This device function number is normally not necessary unless the switch is electrically operated or has electrical accessories, such as an auxiliary switch, a magnetic lock, etc.)
- 90. regulating device.** A device that functions to regulate a quantity or quantities, such as voltage, current, power, speed, frequency, temperature, and load, at a certain value or between certain (generally close) limits for machines, tie lines, or other apparatus.
- 91. voltage directional relay.** A relay that operates when the voltage across an open circuit breaker or contactor exceeds a given value in a given direction.
- 92. voltage and power directional relay.** A relay that permits or causes the connection of two circuits when the voltage difference between them exceeds a given value in a predetermined direction and causes these two circuits to be disconnected from each other when the power flowing between them exceeds a given value in the opposite direction.
- 93. field-changing contactor.** A contactor that functions to increase or decrease, in one step, the value of field excitation on a machine.
- 94. tripping or trip-free relay.** A relay that functions to trip a circuit breaker, contactor, or equipment; to permit immediate tripping by other devices; or to prevent immediate reclosing of a circuit interrupter if it should open automatically, even though its closing circuit is maintained closed.
- 95-99.** Used only for specific applications in individual installations if none of the functions assigned to the numbers from 1 to 94 is suitable.