

LAKE SHORE ELECTRIC CORPORATION

IEEE Device Numbers and Functions For Switchgear Apparatus

The devices in switching equipments are referred to by numbers, with appropriate suffix letters when necessary, according to the functions they perform.

These numbers are based on a system adopted as standard for automatic switchgear by IEEE and incorporated in American Standard C37.2-1956. This system is used in connection diagrams, in instruction books and in specifications.

DEVICE NO.	DEFINITION AND FUNCTION
1	Master Element is the initiating device, such as a control switch voltage relay, float switch, etc. which serves either directly or through such permissive devices as protective and time-delay relays to place an equipment in or out of operation.
2	Time Delay starting or closing relay is a device which 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 described later.
3	Checking or interlocking relay is a device which 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, to stop or to provide a check of the position of these devices or of these conditions for any purpose.
4	Master contactor is a device, generally controlled by device No. 1 or equivalent and the required permissive and protective devices, that serve 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 other or abnormal conditions.
5	Stopping device functions to place and hold equipment out of operation.
6	Starting circuit breaker is a device whose principal function is to connect a machine to its source of starting voltage.
7	Anode circuit breaker is one used in the anode circuits of a power rectifier for the primary purpose of interrupting the rectifier circuit if an arc back should occur.
8	Control power disconnecting device is a disconnective device - such as a knife switch, circuit breaker or pullout fuse block - used for the purpose of connecting and disconnecting, respectively, the source of control power to and from the control bus or equipment.

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



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PAGE 1

- 9 **Reversing device** is used for the purpose of reversing a machine field or for performing any other reversing functions.
- 10 **Unit sequence switch** is used to change the sequence in which units may be placed in and out of service in multiple-unit equipment.
- 11 Reserved for future application.
- 12 **Overspeed device** is usually a direct connected speed switch which functions on machine overspeed.
- 13 **Synchronous-speed device**, such as a centrifugal-speed switch, a slip-frequency relay, a voltage relay, an undercurrent relay or any type of device, operates at approximately synchronous speed of a machine.
- 14 **Underspeed device** functions when the speed of a machine falls below a predetermined value.
- 15 **Speed or frequency matching device** functions to match and hold the speed or the frequency of a machine or of 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** serves to open or to 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 which 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 73 function which serves for the switching of resistors.
- 18 **Accelerating or decelerating device** is used to close or to cause the closing of circuits which are used to increase or to decrease the speed of a machine.
- 19 **Starting-to-running transition contactor** is a device which operates to initiate or cause the automatic transfer of a machine from the starting to the running power connection.
- 20 **Electrically operated valve** is a solenoid- or motor-operated valve which is used in vacuum, air, gas, oil, water or similar lines.
- Note: The function of the valve may be indicated by the insertion of descriptive words such as "Brake" or "Pressure Reducing" in the function name, such as "Electrically Operated Brake Valve."
- 21 **Distance relay** is a device which functions when the circuit admittance, impedance or reactance increases or decreases beyond predetermined limits.



- 22 **Equalizer circuit breaker** is a breaker which serves to control or to 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** functions to raise or to 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 which switches on a space heater in a switchgear assembly when the temperature falls to a desired value as distinguished from a device which is used to provide automatic temperature regulation between close limits and would be designated as 90T.
- 24 Reserved for future application.
- 25 **Synchronizing or synchronism-check device** operates when two AC circuits are within the desired limits of frequency, phase angle or voltage, to permit or to cause the paralleling of these two circuits.
- 26 **Apparatus thermal device** functions when the temperature of the shunt field or the armortisseur winding of a machine, or that of a load limiting or load shifting resistor or of a liquid or other medium, exceeds a predetermined value; or if the temperature of the protected apparatus, such as a power rectifier, or of any medium, decreases below a predetermined value.
- 27 **Undervoltage relay** is a device which functions on a given value of undervoltage.
- 28 **Flame detector** is 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** is used expressly for disconnecting one circuit from another for the purposes of emergency operation, maintenance or test.
- 30 **Annunciator relay** is a non-automatically reset device which gives a number of separate visual indications upon the functioning of protective devices, and which may also be arranged to perform a lockout function.
- 31 **Separate excitation device** connects a circuit such as the shunt field of a synchronous converter to a source of separate excitation during the starting sequence; or one which energizes the excitation and ignition circuits of a power rectifier.
- 32 **Directional power relay** is one which functions on a desired value of power flow in a given direction, or upon reverse power resulting from arc back in the anode or cathode circuits of a power rectifier.
- 33 **Position switch** makes or breaks contact when the main device or piece of apparatus, which has no device function number, reaches a given position.



- 34 **Master sequence device** is a device such as a motor-operated multi-contact 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** is used for raising, lowering, or shifting the brushes of a machine, or for short-circuiting its slip rings, or for engaging or disengaging the contacts of a mechanical rectifier.
- 36 **Polarity or polarizing voltage device** operates or permits the operation of another device on a predetermined polarity only or verifies the presence of a polarizing voltage in equipment.
- 37 **Undercurrent or underpower relay** functions when the current or power flow decreases below a predetermined value.
- 38 **Bearing protective device** functions on excessive bearing temperature, or on other abnormal mechanical conditions, such as undue wear, which may eventually result in excessive bearing temperature.
- 39 **Mechanical condition monitor** is 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 excessive vibration, eccentricity, expansion, shock, tilting, or seal failure.
- 40 **Field relay** 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** is a device which functions to apply, or to remove, the field excitation of a machine.
- 42 **Running circuit breaker** is a device whose principal function is to connect a machine to its source of running voltage after having been brought up to the desired speed on the starting connection.
- 43 **Manual transfer or selector device** transfers the control circuits so as to modify the plan of operation of the switching equipment or of some of the devices.
- 44 **Unit sequence starting relay** is a device which functions to start the next available unit in a multiple-unit equipment on the failure or on the non-availability of the normally preceding unit.
- 45 **Atmospheric condition monitor** is 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** is a relay which 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 voltage relay** is a device which functions upon a predetermined value of polyphase voltage in the desired phase sequence.
- 48 **Incomplete sequence relay** is a device which 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** is a relay which functions when the temperature of a machine armature, or other load carrying winding or element of a machine, or the temperature of a power rectifier or power transformer (including a power rectifier transformer) exceeds a predetermined value.
- 50 **Instantaneous overcurrent**, or rate-of-rise relay is a relay that functions instantaneously on an excessive value of current, or on an excessive rate of current rise, thus indicating a fault in the apparatus of circuit being protected.
- 51 **AC time overcurrent relay** is a relay with either a definite or inverse time characteristic that functions when the current in an ac circuit exceeds a predetermined value.
- 52 **AC circuit breaker** is 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** is a relay that forces the dc machine field excitation to build up during starting or which functions when the machine voltage has built up to a given value.
- 54 **High-speed dc circuit breaker** is a device which starts to reduce the current in the main circuit in 0.01 second or less, after the occurrence of the dc overcurrent or the excessive rate of current rise.
- 55 **Power factor relay** is a relay that operates when the power factor in an ac circuit rises above or below a predetermined value.
- 56 **Field application relay** is 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** is a power or stored energy operated device that functions to short-circuit or to ground a circuit in response to automatic or manual means.
- 58 **Power rectifier misfire relay** is a device which functions if one or more of the power rectifier anodes fail to fire.
- 59 **Overvoltage relay** is a relay that functions on a given value of overvoltage.
- 60 **Voltage or current balance relay** is a relay that operates on a given difference in voltage or current input or output of two circuits.
- 61 **Current balance relay** is a device which operates on a given difference in current input or output of two circuits.



- 62 **Time-delay stopping or opening relay** is a time-delay relay that serves in conjunction with the device which initiates the shutdown, stopping or opening operation in an automatic sequence.
- 63 **Liquid or gas pressure, level or flow relay** is a relay that operates on given values of liquid or gas pressure, flow or level, or on a given rate of change of these values.
- 64 **Ground protective relay** is a relay that functions on failure of the insulation of a machine, transformer or of other apparatus to ground, or on flashover of a dc machine to ground.
- Note: This function is assigned only to a relay which detects the flow of current from the frame of a machine or enclosing case or structure of a piece of apparatus to ground, or detects a ground on a normally ungrounded winding or circuit. It is not applied to a device connected in the secondary circuit or secondary neutral of a current transformer, connected in the power circuit of a normally grounded system.
- 65 **Governor** is the equipment which controls the gate or valve opening of a prime mover.
- 66 **Notching or jogging device** 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 also 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** is a relay that functions on a desired value of ac overcurrent flowing in a predetermined direction.
- 68 **Blocking relay** is 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 cooperates with other devices to block tripping or to block reclosing on a out-of-step condition or on power swings.
- 69 **Permissive control device** is generally a two-position, manually operated switch that, in one position, permits the closing of a circuit breaker or the placing of equipment into operation and, in the other position, prevents the circuit breaker or the equipment from being operated.
- 70 **Electrically operated rheostat** which is used to vary the resistance of a circuit in response to some means of electrical control.
- 71 **Level switch** is a switch which operates on given values, or on a given rate of change, of level.
- 72 **DC circuit breaker** 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** is used to shunt or insert a step of load limiting, shifting or indicating resistance in a power circuit, or 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** is a device other than an annunciator, as covered under device No. 30, which is used to operate, or to operate in connection with, a visual or audible alarm.
- 75 **Position changing mechanism** is a mechanism that is used for moving a main device from one position to another in equipment; as for example, shifting a removable circuit breaker unit to and from the connected, disconnected and test positions.
- 76 **DC overcurrent relay** is a relay that functions when the current in a dc circuit exceeds a given value.
- 77 **Pulse transmitter** is used to generate and transmit pulses over a telemetering or pilot-wire circuit to the remote indicating or receiving device.
- 78 **Phase angle measuring or out-of-step protective relay** is a relay that functions at a predetermined phase angle between two voltages or between two currents or between voltage and current.
- 79 **AC reclosing relay** is a relay that controls the automatic reclosing and locking out of an ac circuit interrupter.
- 80 **Flow switch** is a switch which operates on given values, or on a given rate of change, of flow.
- 81 **Frequency relay** is a relay that functions on a predetermined value of frequency - either under or over or on normal system frequency - or rate of change of frequency.
- 82 **DC reclosing relay** is 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** is a relay that operates to select automatically between certain sources or conditions in equipment, or performs a transfer operation automatically.
- 84 **Operating mechanism** is 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 which has no device function number.
- 85 **Carrier or pilot-wire receiver relay** is a relay that is operated or restrained by a signal used in connection with carrier-current or dc pilot-wire fault directional relaying.
- 86 **Locking-out relay** is an electrically operated hand or electrically reset relay that functions to shut down and hold an equipment out of service on the occurrence of abnormal conditions.



- 87 **Differential protective relay** is a protective relay that functions on a percentage or phase angle or other quantitative difference of two currents or of some other electrical quantities.
- 88 **Auxiliary motor or motor generator** is one used for operating auxiliary equipment such as pumps, blowers, exciters, rotating magnetic amplifiers, etc.
- 89 **Line switch** is used as a disconnecting load interrupter or isolating switch in an ac or dc power circuit, when this device is electrically operated or has electrical accessories, such as an auxiliary switch, magnetic lock, etc.
- 90 **Regulating device** functions to regulate a quantity, or quantities, such as voltage, current, power, speed, frequency, temperature, and load at a certain value or between certain limits for machines, tie lines or other apparatus.
- 91 **Voltage directional relay** is 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** is 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** functions to increase or decrease in one step the value of field excitation on a machine.
- 94 **Tripping or trip-free relay** functions to trip a circuit breaker, contactor, or equipment, or to permit immediate tripping by other devices; or to prevent immediate reclosure of a circuit interrupter, in case it should open automatically, even though its closing circuit is maintained closed.
- 95
96 Used only for specific applications on individual
97 installations where none of the assigned numbered
98 functions from 1 to 94 is suitable.
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