

IEEE Device Numbers and Functions

PRODUCT DATA

Bulletin 1500

Description

The devices in switching equipment 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 by a standard for automatic switchgear by IEEE, and incorporated in American Standard C37.2-1991. This system is used in connection diagrams found in instruction books and in specifications.

Device No.	Definition and Function	Device No.	Definition and Function
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.	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 excludes the function of electrical lockout [see device function 86] on abnormal conditions.)
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.	6	Starting circuit breaker – A device whose principal function is to connect a machine to its source of starting voltage.
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, to stop, or to provide a check of the position of these devices or conditions for any purpose.	7	Rate-of-rise relay – A relay that functions on an excessive rate-of-rise of current.
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.	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 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 which 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.

Device No.	Definition and Function	Device No.	Definition and Function
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.	20	Electrically operated valve – An electrically operated, controlled or monitored valve in a fluid, air, gas or vacuum line. NOTE: The function of the valve may be more completely indicated by the use of the suffixes as discussed in 3.2.
11	Reserved for future application.	21	Distance relay – A relay that functions when the circuit admittance, impedance or reactance increases or decreases beyond a predetermined value.
12	Overspeed device – Usually, a direct-connected speed switch that functions on machine overspeed.	22	Equalizer circuit breaker – A breaker that 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.
13	Synchronous-speed device – A device such as a centrifugal-speed switch, a slip-frequency relay, a voltage relay, an undercurrent relay, or any other type of device that operates at approximately the synchronous speed of a machine.	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.
14	Underspeed device – A device that functions when the speed of a machine falls below a predetermined value.	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.
15	Speed or frequency matching device – A device that 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.	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 to cause the paralleling of these two circuits.
16	Reserved for future application.	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.
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.		

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27	Undervoltage relay – A relay that operates when its input voltage is less than a predetermined value.	36	Polarity or polarizing voltage device – A device that operates, or permits the operation of, another device on a predetermined polarity only, or verifies the presence of a polarizing voltage in equipment.
28	Flame detector – A device that monitors the presence of the pilot or main flame as in such apparatus as a gas turbine or a steam boiler.	37	Undercurrent or underpower relay – A relay that functions when the current or power flow decreases below a predetermined value.
29	Isolating contactor – A device that is used expressly for disconnecting one circuit from another for the purposes of emergency operation, maintenance or test.	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.
30	Annunciator relay – A non-automatically reset device that gives a number of separate visual indications upon the functioning of protective devices, and which may also be arranged to perform a lockout function.	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 excessive vibration, eccentricity, expansion, shock, tilting, or seal failure.
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.	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.
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.	41	Field circuit breaker – A device that functions to apply or remove the field excitation of a machine.
33	Position switch – A switch that makes or breaks contact when the main device or piece of apparatus, which has no device function number, reaches a given position.	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.
34	Reversing 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.	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.
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.	44	Unit sequence starting relay – A relay that functions to start the next available unit in multiple-unit equipment upon the failure or non-availability of the normally preceding unit.

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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.	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.
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.	55	Power factor relay – A relay that operates when the power factor in an AC circuit rises above or falls below a predetermined value.
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.	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.
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.	57	Short-circuiting or grounding device – A primary circuit switching device that functions to short-circuit or to ground a circuit in response to automatic or manual means.
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.	58	Rectification failure relay – A relay that functions if a power rectifier fails to conduct or block properly.
50	Instantaneous overcurrent relay – A relay that functions instantaneously on an excessive value of current.	59	Overvoltage relay – A relay that operates when its input voltage is more than a predetermined value.
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.	60	Voltage or current balance relay – A relay that operates on a given difference in voltage, or current input or output, of two circuits.
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.	61	Density switch or sensor – A device that operates on a given value, or a given rate of change, of gas density.
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.	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.

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64	<p>Ground detector relay – A relay that operates upon failure of machine or other apparatus insulation to ground.</p> <p>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.</p>	71	<p>Level switch – A switch that operates on given values, or on a given rate of change, of level.</p>
65	<p>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.</p>	72	<p>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.</p>
66	<p>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.</p>	73	<p>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.</p>
67	<p>AC directional overcurrent relay – A relay that functions on a desired value of AC overcurrent flowing in a predetermined direction.</p>	74	<p>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.</p>
68	<p>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.</p>	75	<p>Positioning 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.</p>
69	<p>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.</p>	76	<p>DC overcurrent relay – A relay that functions when the current in a DC circuit exceeds a given value.</p>
70	<p>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.</p>	77	<p>Telemetry 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.</p>
		78	<p>Phase-angle measuring or out-of-step protective relay – A relay that functions at a predetermined phase angle between two voltages or between two currents, or between voltage and current.</p>
		79	<p>AC reclosing relay – A relay that controls the automatic reclosing and locking out of an AC circuit interrupter.</p>
		80	<p>Flow switch – A switch that operates on given values, or on a given rate of change of flow.</p>

Device No.	Definition and Function	Device No.	Definition and Function
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.	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.
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.	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.
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.	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.
84	Operating mechanism – The complete electrical mechanism or servomechanism, 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.	93	Field-changing contactor – A contactor that functions to increase or decrease, in one step, the value of field excitation on a machine.
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.	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.
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.	95 to 99	Used only for specific applications on individual installations if none of the functions assigned to the numbers from 1 to 94 is suitable
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, magnetic lock, etc.)		

Supervisory Control and Indication

A similar series of numbers prefixed by the letters RE (for “remote”) shall be used for the interposing relays performing functions that are controlled directly from the supervisory system. Typical examples of such device functions are: RE1, RE5, and RE94.

Note: The use of the “RE” prefix for this purpose in place of the former 200 series of numbers now makes it possible to obtain increased flexibility of the device function numbering system. For example, in pipeline pump stations, the numbers 1 through 99 are applied to device functions that are associated with the overall station operation. A similar series of numbers, starting with 101 instead of 1, are used for those device functions that are associated with unit 2, and so on, for each unit in these installations.

Devices Performing More Than One Function

If one device performs two relatively important functions in an equipment so that it is desirable to identify both of these functions, this may be done by using a double function number and name such as:

50/51 Instantaneous and Time Overcurrent Relay

Suffix Numbers

If two or more devices with the same function number and suffix letter (if used) are present in the same equipment, they may be distinguished by numbered suffixes as for example, 52X-1, 52X-2 and 52X-3, when necessary.

Suffix Letters

Suffix letters are used with device function numbers for various purposes. In order to prevent possible conflict, each suffix letter should have only one meaning in an individual equipment. All other words should use the abbreviations as contained in American Standard Z32.13-1950, or latest revision thereof, or should use some other distinctive abbreviation, or be written out in full each time they are used.

The meaning of each single suffix letter or combination of letters, should be clearly designated in the legend on the drawings or publications applying to the equipment. In cases where the same suffix (consisting of one letter or a combination of letters) has different meanings in the same equipment, depending upon the device function number with which it is used, then the complete device function number with its suffix letter or letters and its corresponding function name should be listed in the legend in each case, as follows: 90V, Voltage Regulator.

Lower case (small) suffix letters are used in practically all instances on electrical diagrams for the auxiliary, position and limit switches. Capital letters are generally used for all other suffix letters.

The letters should generally form part of the device function designation, and are usually written directly after the device function number, as for example, 52CS, 71W or 49D. When it is necessary to use two types of suffix letters in connection with one function number, it is often desirable for clarity to separate them by a slanted line or dash, as for example, 20D/CS or 20D-CS.

The suffix letters which denote parts of the main device, and those which cannot or need not form part of the device function designation, are generally written directly below the device function number on drawings, as for example:

$\frac{52}{CC}$ or $\frac{43}{A}$

Auxiliary Devices

These letters denote separate auxiliary devices such as:

- C – Closing relay/contactor
- CL – Auxiliary relay, closed (energized when main device is in closed position)
- CS – Control Switch
- D – “Down” position switch relay
- L – Lowering relay
- O – Opening relay/contactor
- OP – Auxiliary relay, open (energized when main device is in open position)
- PB – Push button
- R – Raising relay
- U – “UP” position switch relay
- X – Auxiliary relay
- Y – Auxiliary relay
- Z – Auxiliary relay

NOTE: In the control of a circuit breaker with so-called X-Y relay control scheme, the X relay is the device whose main contacts are used to energize the closing coil or the device that in some other manner, such as by the release of stored energy, causes the breaker to close. The contacts of the Y relay provide the antipump feature of the circuit breaker.

Actuating Quantities

These letters indicate the condition or electrical quantity to which the device responds, or the medium in which it is located, such as:

A	– Air/amperes/alternating
C	– Current
D	– Direct/discharge
E	– Electrolyte
F	– Frequency/flow/fault
H	– Explosive
J	– Differential
L	– Level/liquid
P	– Power/pressure
PF	– Power factor
O	– Oil
S	– Speed/suction/smoke
T	– Temperature
V	– Voltage/volts/vacuum
VAR	– Reactive power
VB	– Vibration
W	– Water/watts

Main Devices

These letters denote the main device to which the numbered device is applied or is related:

A	– Alarm/auxiliary power
AN	– Anode
B	– Battery/blower/bus
BK	– Brake
BL	– Block (valve)
BP	– Bypass
BT	– Bus tie
C	– Capacitor/condenser/compensator/carrier current/case/compressor
CA	– Cathode
CH	– Check (valve)

D	– Discharge (valve)
DC	– Direct current
E	– Exciter
F	– Feeder/field/filament/filter/fan
G	– Generator/ground ❶
H	– Heater/housing
L	– Line/logic
M	– Motor/metering
MOC	– Mechanism operated contact ❷
N	– Network/neutral ❸
P	– Pump/phase comparison
R	– Reactor/rectifier/room
S	– Synchronizing/secondary/strainer/sump/suction (valve)
T	– Transformer/thyratron
TH	– Transformer (high-voltage side)
TL	– Transformer (low-voltage side)
TM	– Telemeter
TOC	– Truck-operated contacts ❹
TT	– Transformer (tertiary-voltage side)
U	– Unit

- ❶ Suffix “N” generally used in preference to “G” for devices connected in the secondary neutral of current transformers, or in the secondary of a current transformer whose primary winding is located in the neutral of a machine or power transformer, except in the case of transmission line relaying, where the suffix “G” is more commonly used for those relays that operate on ground faults.
- ❷ MOC denotes a circuit breaker mechanism-operated auxiliary switch that is mounted on the stationary housing of a removable circuit breaker.
- ❸ See note ❶ above.
- ❹ TOC denotes a circuit breaker truck-operated auxiliary switch that is mounted on the stationary housing of a removable circuit breaker.

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