

# **Protection and Control Device Numbers and Functions**

Bulletin Numbers 1500, 7000, 7760, 7762

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## **Summary of Changes**

This publication contains new and updated information as indicated in the following table.

Торіс	Page
Changed title to specify Protection and Control	1
Added additional Bulletin numbers	1
Updated year to C37.2-1996	2
Added definition and function for device numbers 11 and 16	2
Changed device number 34 definition to Master Sequence Device	3
Added clarification to AC circuit breaker	4
Added section IEC 60617 Standard Series Symbols and Designations	9
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## **Description**

The protection and control devices in electrical equipment can be referred to by numbers, with appropriate suffix letters when necessary, according to the functions they perform.

These numbers are based on a system that is adopted by a standard for automatic switchgear by Institute of Electrical and Electronics Engineers (IEEE), and incorporated in American Standard C37.2-1996. This system is used with diagrams that are found in instruction books and in specifications. The International Electrotechnical Commission (IEC) standards 617 and 60617 also provide different symbols and terminology for most of the device numbers that are defined by C37.2. The second portion of this document provides a brief overview of a few of the more common IEC symbols used.

Device Number	Definition	Function	
1	Master Element	The initiating device, such as a control switch, that directly or indirectly places equipment in or out of operation.	
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 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, to stop, or to provide a check of the position of these devices or conditions for any purpose.	
4	Master contactor	A device, which is controlled by device function 1 or the equivalent, and the required permissive and protective devices which 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 abnormal conditions.	
5	Stopping device	A control device shuts 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.)	
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 that is used for connecting and disconnecting the source of control power to and from the control bus or equipment.  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 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	Multi-function device	A single, microprocessor-based product which has the capabilities to support three or more protection and control elements.	
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 undercurrent 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 predetermined value.	
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.	
16	Data Communications device	Used to label Communication Networking Devices. This element also uses a unique set of suffixes that are applicable only to Device 16. The first suffix letter is to be either S for serial devices or E for Ethernet devices.  The subsequent suffix letters are used to more completely describe the device — with multiple suffix letters allowed:  • C — Security processing function (VPN, encryption, etc.)  • F — Firewall or message filter function  • M — Network managed function (e.g., configured via SNMP)  • R — Router  • S — Switch (Examples: port switch on a dial up connection is 16SS, an Ethernet switch is 16ES)  • T — Telephone component (Example: auto answer modem)  A combination example is '16ERFCM' - an Ethernet router with firewall and VPN capability, which can be remotely managed via the connected network.	

Device Number	Definition	Function	
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.  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 in a fluid, air, gas, or vacuum line. The function of the valve may be more completely indicated by the use of the 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 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	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.  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 to 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 as in such apparatus as a gas turbine or a steam boiler.	
29	Isolating switch or 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 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.	
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, which has no device function number, reaches a given position.	
34	Master Sequence device	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	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 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 that are 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 excessive vibration, eccentricity, expansion, shock, tilting, or seal failure.	

Device Number	Definition	Function
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 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 non-availability 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. The use of a contact symbol with an adjacent 'M' should be used to identify medium voltage contactors, rather than the device number 52. Medium voltage contactors should not be defined using this device number.
53	Exciter or DC generator relay	A relay that forces the DC machine field excitation to build up during startup, 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 to ground a circuit in response to automatic or manual means.
58	Rectification failure relay	A relay 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 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.  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 must 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.

Device Number	Definition	Function
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 equipment into operation, and in the other position prevents the circuit breaker or the equipment from being operated.
70	Rheostat	A variable resistance device that is 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 with a visual or audible alarm.
75	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.
76	DC overcurrent relay	A relay that functions when the current in a DC circuit exceeds a given value.
77	Telemetering device	A transmitter that is used to generate and transmit to a remote location an electrical signal representing a measured quantity, or a receiver that is 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 or 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 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.
85	Carrier or pilot-wire receiver relay	A relay that is operated or restrained by a signal that is used with carrier-current or DC pilot-wire fault relaying.
86	Lockout relay or device	A hand or electrically reset auxiliary or electronic device 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 that is used for operating auxiliary equipment, such as pumps, blowers, exciters, or rotating magnetic amplifiers.
89	Line switch	A switch that is 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, or magnetic lock)
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 (close) limits for machines, tie lines, or other apparatus.

Device Number	Definition	Function	
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 devi or to prevent immediate reclosing of a circuit interrupter if it should open automatically, even though its closing cir is maintained closed.	
9599	_	Used only for specific applications on individual installations if none of the functions that are assigned to the numbers from 194 is suitable.	

### **Supervisory Control and Indication**

Interposing relays must use a similar series of numbers that are prefixed by the letters RE (for 'remote') if they perform functions that are controlled directly from the supervisory system. Typical examples of such device functions are: RE1, RE5, and RE94.

Using the 'RE' prefix in place of the former 200 series of numbers makes it possible to obtain increased flexibility of the device function numbering system.

For example, in pipeline pump stations, the numbers 1...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 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 are distinguished by numbered suffixes as, for example, 52X-1, 52X-2 and 52X-3.

#### **Suffix Letters**

Suffix letters are used with device function numbers for various purposes. To prevent possible conflict, each suffix letter should have only one meaning in an individual equipment. All other words must use the abbreviations as contained in American Standard Z32.13-1950, or latest revision, or 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, must be clearly designated in the legend on the drawings or publications applying to the equipment. If 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, 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 used for all other suffix letters.

The letters should generally form part of the device function designation, and are 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 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 that denote parts of the main device, and those that cannot or need not form part of the device function designation, are written directly below the device function number on drawings, as shown.

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

### **Auxiliary Devices**

These letters denote separate auxiliary devices.

C	Closing relay/contactor	РВ	Push button
CL	Auxiliary relay, closed (energized when main device is in closed position)	R	Raising relay
CS	Control Switch	U	"UP" position switch relay
D	"Down" position switch relay	Х	Auxiliary relay
L	Lowering relay	Υ	Auxiliary relay
0	Opening relay/contactor	Z	Auxiliary relay
OP	Auxiliary relay, open (energized when main device is in open position)		

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.

A	Air/amperes/alternating	PF	Power factor
С	Current	0	Oil
D	Direct/discharge	S	Speed/suction/smoke
E	Electrolyte	T	Temperature
F	Frequency/flow/fault	٧	Voltage/volts/vacuum
Н	Explosive	VAR	Reactive Power
J	Differential	VB	Vibration
L	Level/liquid	W	Water/watts
Р	Power/pressure		

#### **Main Devices**

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

Symbol	Description	Symbol	Description
A	Alarm/auxiliary Power	Н	Heater/housing
AN	Anode	L	Line/logic
В	Battery/blower/bus	М	Motor/metering
BK	Brake	MOC	Mechanism operated contact <sup>(2)</sup>
BL	Block (valve)	N	Network/neutral <sup>(1)</sup>
BP	Bypass	Р	Pump/phase comparison
BT	Bus tie	R	Reactor/rectifier/room
С	Capacitor/condenser/compensator/carrier current/case/ compressor	S	Synchronizing/secondary/strainer/sump/suction (valve)
CA	Cathode	T	Transformer/thyratron
СН	Check (valve)	TH	Transformer (high voltage side)
D	Discharge (valve)	TL	Transformer (low voltage side)
DC	Direct current	TM	Telemeter
E	Exciter	TOC	Truck-operated contacts <sup>(3)</sup>
F	Feeder/field/filament/filter/fan	TT	Transformer (tertiary voltage side)
G	Generator/ground <sup>(1)</sup>	U	Unit

<sup>(1)</sup> Technical DataSuffix 'N' is used in preference to 'G' for devices that are connected in the secondary neutral of current transformers, or in the secondary of a current transformer whose primary winding is 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.

<sup>(2)</sup> MOC denotes a circuit breaker mechanism-operated auxiliary switch that is mounted on the stationary housing of a removable circuit breaker.

<sup>(3)</sup> TOC denotes a circuit breaker truck-operated auxiliary switch that is mounted on the stationary housing of a removable circuit breaker.

## **IEC 60617 Standard Series Symbols and Designations**

These are the general parameters and functions that are used within IEC 60617.

Symbol	Description	Symbol	Description
I	Current	Z	Impedance
I	Reverse current	f	Frequency
$I_{d}$	Differential current	n	Rotational speed
$I_{d}/I$	Percentage differential current (current restraint)	F	Magnetic flux
$I_{nf}$	Current of <i>n</i> th harmonic	j	Phase angle
<i>I</i> <sub>1</sub> , ( <i>I</i> <sub>p</sub> )	Positive sequence current component	SYNC	Synchronizing (check)
I <sub>2</sub> , (I <sub>n</sub> )	Negative sequence current component	BLOCK	Element is blocked from operating
$I_{0'}(I_{h})$	Zero sequence current component	LO	Lock-out
$I_{rsd}$	Residual current	TCS	Trip circuit supervision
I	Earth fault current	START	Protection element is engaging (Same as ALARM in ANSI)
I	Current to frame	TRIP	Protection element settings have been met
$I_{N}$	Current in the neutral conductor	X/Y	Translation of signal
$I_{N-N}$	Current between neutrals of two	A/D or /#	Analog to digital conversion
l <sub>ub</sub>	Polyphase systems	>	Operation above a set value e.g. overcurrent
U	Current unbalance	<	Operation below a set value e.g. undervoltage
d <sub>P</sub> /d <sub>t</sub>	Voltage	>>	Operation well above a high set stage
Q	Reactive power	<<	Operation well below a low set stage
R	Resistance	>>>	Operation above a very high set stage
Х	Reactance	<<<	Operation very below a low set stage

# Comparison of ANSI/IEEE with IEC Symbols

ANSI	IEC 60617	Description	
12	(0)>	Over speed relay	
14	ω<	Under speed relay	
21FL	FLOC	Fault locator	
21G	Z<	Under impedance	
24	U/f>	Over excitation	
25	SYNC	Synchronization check	
27	U<	Undervoltage	
32	P< P>	Directional under power relay Directional over power relay	
32P	P	Active power	
32Q	Q	Reactive power	
37	I<	Non-directional undercurrent	
40	X<	Under excitation	
46	I <sub>2</sub> >	Negative-phase sequence (UNBALANCE)	
47	<i>I</i> <sub>2</sub> >> U <sub>2</sub> >	Phase Sequence Protection Phase-sequence voltage protection	
48	$I_{st}$	Start-up supervision for motors (STALL)	
49F	T> or $I_{st}$ >	Thermal protection for cables	
49M 49G 49T	T>	Three-phase thermal protection for machines  • M - motor  • G - generators  • T - transformer	
50	<i>I&gt;, I&gt;&gt;, I&gt;&gt;&gt;</i>	Instantaneous non-directional overcurrent	
50ARC		Arc fault protection	
50BF		Circuit Breaker Failure Protection	
50N/51N/51G	<i>I</i> <sub>0</sub> >, <i>I</i> <sub>0</sub> >>, <i>I</i> <sub>0</sub> >>>	Non-directional definite time earth-fault / Inverse time overcurrent	
50NARC		Earth-fault arc fault protection	
51	<i>I&gt;,I&gt;&gt;,I&gt;&gt;&gt;</i>	Non-directional inverse time overcurrent	
51C	<i>I&gt;,I&gt;&gt;,I&gt;&gt;&gt;</i>	Shunt capacitors overcurrent	
51LR	$I_{ m lr}>$	Non-directional locked rotor overcurrent	
51V	I <sub>(U)</sub> >	Voltage restrained/controlled overcurrent	
59	U>, I>>, U>>>	Overvoltage	
59N	$U_0 >, U_0 >>$	Neutral point (residual) overvoltage	
66	N>	Excessive Start Protection	
67	$I_{\varphi}$ >	Directional overcurrent	
67N	$I_{\text{O}\phi}$ >	Directional earth-fault overcurrent	
67NI	$I_{oint} >$	Directional transient intermittent earth fault overcurrent protection	
68	<i>I</i> <sub>2</sub> >	Transformer/motor inrush current	
68F2	I <sub>f2</sub> >	Magnetizing in-rush, 2nd harmonic	
68F5	I <sub>f5</sub> >	Transformer over excitation, 5th harmonic	
79	AR	Auto-reclose	

ANSI	IEC 60617	Description
81	f	Frequency relay
81L/81U	f<	Under frequency
810	f>	Over frequency
86		Protection Lockout
87	Δ <i>I</i> >	Differential protection;  - 87G, $\Delta I >$ - generator  - 87M, $\Delta I >$ - motor  - 87T, $\Delta I >$ - transformer  - 87N, $\Delta I_0 >$ - restricted earth fault

## **Additional Resources**

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description			
Industrial Automation Wiring and Grounding Guidelines, publication <u>1770-4.1</u>	Provides general guidelines for installing a Rockwell Automation industrial system.			
Product Certifications website, <a href="http://www.rockwellautomation.com/global/certification/overview.page">http://www.rockwellautomation.com/global/certification/overview.page</a>	Provides declarations of conformity, certificates, and other certification details.			

You can view or download publications at <a href="http://www.rockwellautomation.com/global/literature-library/">http://www.rockwellautomation.com/global/literature-library/</a> overview.page. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

## **Rockwell Automation Support**

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase			
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support- now.page			
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct- dial.page			
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature			
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page			

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