

# 865 Differential Protection Relay



For Motor, Transformer and Generator Differential Protection  
Bulletin 865, Series A

Specification Guide





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The differential protection system includes all the essential protection functions needed to protect transformers for distribution networks of utilities, industry, power plants and offshore applications as well as motor and generator differential protection. Further, the device will include several programmable functions, such as thermal and circuit breaker protection and communication protocols for various protection and communication situations. An optional arc flash protection feature shall also be available.

The differential relay shall be used for selective differential overcurrent, short-circuit protection of generators, transformers and motors in solidly or impedance grounded (earthed) power systems. The differential relay shall also function to protection for single, two or three-phase overcurrent and/or sensitive earth fault protection.

The differential relay's display will be operator configurable showing an active MIMIC type line diagram, six selectable measurements values and interlocking schemes with basic logic functions.

## 1.0 Protective Features

The relay shall provide the following protective features:

### **Differential Overcurrent Protection (87)**

The device will monitor the difference between three separate current reference points.

### **Overcurrent Stage (50/51)**

The overcurrent protection shall be used against short circuit faults and heavy overloads.

The relay will have at least two separately adjustable overcurrent stages: The first stage can be configured for definite time or inverse time operation characteristic. The remaining stage has definite time operation characteristics.

Thirty different statuses, measuring and warning parameters must be provided.

Detailed information shall be available on the last eight faults: Time stamp, fault type, fault current, load current before the fault, elapsed delay and setting group.

Multiple protection curve types with programmable delays.

### **Current Unbalance Protection (46)**

Current unbalance protection will be based on the negative sequence of the base frequency phase currents.

Both definite time and inverse time characteristics are available.

## 1.0 Protective Features (cont.)

### **Earth Fault Protection (50N/51G,N)**

Unidirectional earth fault protection shall be used to detect earth faults in low impedance earthed networks.

In high impedance earthed networks, compensated networks and isolated networks unidirectional earth fault can be used as back-up protection.

Multiple protection curve types with programmable delays.

### **Thermal Overload Protection (49)**

The thermal overload function protects the transformer against excessive heating. The temperature is calculated using RMS values of phase currents and a thermal model according to IEC 60255-8.

### **Circuit-breaker Failure Protection (50BF)**

The circuit breaker failure can be used to trip any upstream circuit breaker if the fault has not disappeared within a given time after the initial trip command.

A different output contact of the relay will be used for this backup trip.

Detailed information will be available for the last eight faults: time stamped and elapsed delay.

### **Arc Fault Protection (50ARC/50NARC) (Optional)**

The arc protection is used for fast arc protection. The function is based on simultaneous light and current measurement. Special arc sensors are used to measure the light of an arc.

### **Programmable Stages (99)**

For special applications, the user can build custom protection stages by selecting the supervised signal and the comparison mode.

The following parameters shall be available: Priority, Link, Cmp, Pick-up, t, Hyster and NoCmp.

### **Inverse Time Operation**

The device will be configurable for definite time or inverse time protection characteristics.

## 2.0 Measuring and Monitoring

The relay shall also provide the following measurement and monitoring functions:

### Measured Data

- Frequency (Hz)
- Phase currents
- 15-minute average for all phase currents
- Primary value of two zero sequence/residual current CTs
- Positive and Negative sequence currents
- Negative sequence current related to positive sequence current (for unbalance protection)
- Total harmonic distortion of phase currents
- 14 inputs and 9 outputs

### Event Logs

The event log buffer should have enough room to record the last 50 events.

For each trip function, a total of 8 historic events shall be logged

### Disturbance Recorder

A 12-channel disturbance recorder will record all the measured signals, such as, currents, voltages and the status information of digital inputs and outputs. The recording time shall be up to 12,000 minutes.

### Current Transformer Supervision

The device supervises the external wiring between the device terminal and current transformers (CT) and the CT themselves.

### Circuit Breaker Condition Monitoring

The relay will have a condition monitoring function that supervises the wearing of the circuit breaker. The condition monitoring can give an alarm for the need of circuit-breaker maintenance before the circuit-breaker condition is critical.

### System Clock and Synchronization

The internal clock of the relay is used to time stamp events and disturbance recordings.

### Running Hour Counter

This function calculates the total active time of the selected digital input, virtual I/O or output matrix output signal.

### **Programmable Timers**

The relay is to include four programmable timers that can be used together with the user's programmable logic or to control setting groups and other applications that require actions based on calendar time.

### **Combined Overcurrent Status**

The relay shall include the function to collect faults, faults types and registered fault current of all enabled overcurrent stages.

### **Self Supervision**

The relay will also have the functions of micro controller and the associated circuitry, as well as the program executions are supervised by means of a separate watchdog circuit.

## **3. Communication**

The relay shall also have the following optional added features:

- Expandable Communications Protocols
  - Ethernet
  - Modbus TCP
  - Modbus RTU
  - Ethernet I/P
  - DeviceNet
  - Profibus DP
  - IEC 61850
  - SPA-Bus
  - DNP 3.0

## **4. Arc Flash Protection (Optional)**

The relay shall have the following Arc Flash protection features:

- Expandable Arc Flash Protection
  - Personal Sensors
  - Fixed Mount Sensors

## 5. Load Panel User Interface

The relay is to provide a Local Panel User Interface, LPUI, shall include the following:

- A backlit 128 x 64 LCD dot matrix display. The display will enable showing 21 characters in one row and eight rows at the same time. The display will be capable of showing a single line diagram of the relay with the object status, measurement values, identification etc.
- Eight LED type indicators on the front panel which shall provide a quick visual indication unit status.
- Three user programmable LED type indicators on the front panel
- A front and back panel RS232 serial port for communications with a PC.
- The LPUI will have a keypad to navigate in the menu and set the required parameter values used the keypad and the guidance given in the display.
- The relay will come with three level password protected for these operating levels: User Level, Operator Level and Configurator Level.
- The relay will be capable of being set up with user friendly software package.

## 6. General Information

The relay shall have full digital signal handling capabilities with a 16-bit microprocessor and high measuring accuracy on all setting ranges using a 16-bit A/D conversion technique. The relay shall also be capable in controlling up to six different objects at the same time. The relay shall also be able to indicate the status of eight objects at the same time.





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