Numerical High Impedance Relay with CT Supervision

Description
The overall differential protection uses the high impedance circulating current principle. The protection consists of instantaneous/Definite time over-current elements 87/50 and CT50, 87/50 is set for tripping and the CT50 element is utilized for CT supervision.

Transient stability under through fault condition is a problem with many forms of differential protection, due to variations in CT magnetising characteristics. When saturation is approached, the current transformer output waveforms become increasingly distorted, with a high percentage of 3rd and other harmonics, the algorithms employed in the overall differential protection ensure complete harmonic rejection, thus improving overall protection stability.

In addition the settings for high impedance differential protection are calculated assuming that one CT is completely saturated. Using this worst case condition the voltage, (determined by the value of the stabilising resistor), and current settings for the 87/50 elements can be precisely calculated, with known stability margins. Intermediate conditions where the CT is only partially saturated, increases the stability margin. This approach enables schemes to be engineered with relatively low knee-point voltages.

CT Supervision Protection
The overall Differential elements also incorporate supervision of CT secondary circuits. This supervision provides a desirable safety feature. When carrying load current an open circuit of CT secondary circuits. This supervision provides a desirable safety feature. The waveform record feature stores analogue and digital signals which are associated with the time tagging of any change in state. This integration of protection, CT supervision and associated timers considerably simplifies system design and secondary wiring.

Waveform Records
The waveform record feature stores analogue and digital information for the current inputs, digital (status) inputs and output relays and LED’s.

Fault Records
The LED flag configuration, date and time of the last five faults are recorded.

Event Records
The event record feature allows the time tagging of any change of state (Event) of the relay. As an event occurs the actual event condition is logged as a record along with a time and date stamp to a resolution of 1 millisecond. There is capacity for a maximum of 500 event records that can be stored in the relay and when the event buffer is full any new record will overwrite the oldest.

Communications
Two fibre optic communication ports, COM1 and COM2 are provided at the rear of the relay, which give superior EMC performance. An isolated RS232 port, Com 2a is provided under the front of the relay for local access using a PC.

Communication is compatible with the IEC870-5-103 FT 1.2 transmission and application standards. For communication with the relay via a PC (personal computer) a user-friendly software package, REYDISP EVOLUTION.

Applications
• High impedance busbar zone protection with CT supervision

Features
• High impedance, phase segregated overall differential protection

Control
The relay has expandable I/O up to 27 digital (status) inputs and 29 output relay replaces the need for external trip lockout relays.

Software
• High impedance, phase segregated overall differential protection

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Cutout Details

Qualification
ISO 9001 - 2000

The policy of Easun Reyrolle is one of continuous improvement and development. The company therefore reserves the right to supply equipment, which may differ slightly from that described and illustrated in this publication.
**Technical Information**

**CT input rating**
AC current: 1A/5A, 50/60Hz

**Settings**

<table>
<thead>
<tr>
<th>Description</th>
<th>Range</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT 50 Element</td>
<td>Disabled, Enabled</td>
<td>Disabled</td>
</tr>
<tr>
<td>CT 50 Setting</td>
<td>0.010, 0.015...2.00xIn</td>
<td>0.10xIn</td>
</tr>
<tr>
<td>CT 50 Delay</td>
<td>0.1, 0.2...60S</td>
<td>10.00S</td>
</tr>
<tr>
<td>87/50 Element</td>
<td>Disabled, Enabled</td>
<td>Disabled</td>
</tr>
<tr>
<td>87/50 Setting</td>
<td>0.020, 0.025...2.00xIn</td>
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<tr>
<td>87/50 Delay</td>
<td>0.001...60S</td>
<td>0.005</td>
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**87/50 Overall Differential Element**
Phase segregated High impedance Overall Differential scheme using external stabilizing resistors. Function is insensitive to third harmonic currents.

**CT 50 CT Supervision Element**
Phase segregated High Impedance CT Supervision for the Overall Differential scheme using external stabilising resistors. Function is insensitive to third harmonic currents.

**DC Auxiliary Supply**
Nominal Operating Range
- 24/30V: 18V to 37.5V DC
- 50/110V: 37.5V to 137.5V DC
- 220/250V: 175V to 286V DC

**Output Relays**
The DAD-N relay contains 5 programmable output relays. Further output contacts may be added in a modular format.

**Contact Ratings**
- Carry continuously: 5A AC or DC
- Make and carry: 30A AC or DC for 0.2 sec
- Resistive break: 75W DC, 1250W AC

**DC Digital (status) input**
The DAD-N relay contains 3 programmable digital (status) inputs and additional inputs can be added in a modular format.

**Burdens**
- AC Current
  - 1A tap: ≤0.1 VA
  - 5A tap: ≤0.3 VA
- DC Voltage
  - Quiescent (Typical): 15W
  - Max: 27W

**Indications**
- LEDs for trip, starter and protection healthy status indications
- LCD - Alphanumeric display for setting, instruments and fault data

**Environmental**
- Temperature: IEC 68-2-1/2
  - Operating range: -10°C to +55°C
- Storage range: -25°C to +70°C
- Humidity: IEC 68-2-3
- Vibration: IEC 255-21-1 class I
- Shock and bump: IEC 255-21-2 class I
- Seismic: IEC 255-21-3 class I
- Insulation: IEC 255-5
- 2kVrms for 1 min between all terminals and earth.
- 2kVrms for 1 min between independent circuits.
- 1kVrms for 1 minute across NO contacts.
- Transient overvoltage: IEC 255-5 class III
- 5kV 1.2/50µs, 0.5J between all terminals and earth without damage or flashover.
- High frequency disturbance: IEC 255-22-1 class III
  - 2.5kV common mode <5% deviation
  - 1.0kV series mode <5% deviation
- Electrostastic discharge: IEC 255-22-2 class III
- 8kV direct without maloperation or damage
- Radio frequency disturbance: IEC 255-22-3
  - 20MHz to 1GHz at 10V/m <5% deviation
- Fast transient: IEC 255-22-4 class IV
  - 4kV 5/50ns <3% deviation

**Mechanical Classification**
- Durability: 10⁷ operations
Technical Information

CT Input Rating
- AC current: 1A/5A, 50/60Hz

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  - 1A tap ≤0.1 VA
  - 5A tap ≤0.3 VA
- DC Voltage
  - Quiescent (Typical) 15W
  - Max 27W

Monitoring

- Open circuit current transformer supervision
- Trip circuit supervision
- Storage of 500 time-tagged event records
- Storage of 10 waveform records

Metering

- Differential primary currents
- Differential secondary currents
- Differential nominal currents

User Interface

- User-friendly settings and indications
- Backlit liquid crystal alpha-numeric display with 20 characters, 2 lines
- Push buttons for programming and resetting

Communication

- RS232 or Fibre-Optic communication port
- Data communication using IEC 60870-5-103 protocol
- IRIG-B time synchronisation

Environmental

- Temperature: IEC 60721-2-1/2
  - Operating range: -10°C to + 55°C
  - Storage range: -25°C to + 70°C
- Humidity: IEC 60721-2-3
- Vibration: IEC 255-21-1 class I
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Radio frequency disturbance

- 20MHz to 1GHz at 10V/m ≤5% deviation
- Fast transient: IEC 255-22-4 class IV
- 4kV 500ns <5% deviation

Mechanical Classification

- Durability: 109 operations

Notes

1. CT circuits shown connected to 1A inputs, 5A rated CTs use alternative inputs.
2. Spare slots may be occupied by either additional I/O modules (IO2, IO3) up to a maximum of 29o, 27i.
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CT Supervision Protection

The overall Differential elements also incorporate supervision of CT secondary circuits. This supervision provides a desirable safety feature. When carrying load current an open circuit CT will cause unbalance in any current balance group. As this can cause instability it is normal practice to use a sensitive relay, with an associated relatively long time delay, to detect this condition. This integration of protection, CT supervision and associated timers considerably simplifies system design and secondary wiring.

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