PS - 005

Load Protection Module

Overview

In the design of electrical power systems, the ANSI Standard Device Numbers ANSI/IEEE Standard denote what features a protective device supports such as a relay or circuit breaker. These types of devices protect electrical systems and components from damage when an unwanted event occurs, such as an electrical fault. Device numbers are used to identify the functions of devices. This module introduces trainees to ways of protection of different types of loads (static & dynamics). It is connected before Loads Module and after Step Down Substation Protection Module.



Specifications

- Phase under voltage protection (ANSI Standard: 27P)
- Power factor / under power protection (ANSI Standard: 37P)
- Phase inversion protection (ANSI Standard: 47)
- Thermal overload protection (ANSI Standard: 49)
- Non-directional instantaneous overcurrent protection (ANSI Standard: 50P)
- Phase over-voltage protection (ANSI Standard: 59P)

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Technical Data

Phase under voltage protection (ANSI Standard: 27P)

- Continuously monitors the three-phase output voltage of synchronous generator to warn against under-voltage condition during synchronization process
- If measured voltage moves below the set point limit, the relay contacts will change-over after the selected "Delay-OFF" has elapsed, giving an alarm or initiation signal.
- If voltage measured exceeds threshold (set point), the relay contacts will return to original state only after the reset time ("Delay-ON") has elapsed.
- Can be used in 3-wire and 4-wire network
- Offers user adjustable trip point (set point) and time delay settings.
- The set point adjustment for under-voltage is in the range of 25%
- As soon as the monitored signal moves outside of the set point limit, the time delay is activated, after which a trip will occur. The time delay prevents the relay from tripping for a predetermined period to prevent nuisance tripping.
- The relay is automatically reset once the monitored voltage rises above the set point.
- Adjustable off-delay: 0.1 …20sec
- Adjustable reset-delay: 0.1…20sec
- Adjustable under-voltage trigger range: 70% …95% (corresponding to 270V…370V AC)
- LED indicators for relay activation during under-voltage condition
- Relay output: Single change-over contact
- Contact rating: 250V AC, 8A

Power factor / under power protection (ANSI Standard: 37P)

- Load monitoring relay for under-power, over-power or window
- Works in 1-phase and 3-phase networks
- The operating states are indicated using colored LEDs:
  - «U/t» LED: Supply voltage and starting override
  - «MAX» LED: Upper threshold value
  - «MIN» LED: Lower threshold value
  - «I=0» LED: Load switched off
  - «REL» LED: Output relay
- Mode of operation can be chosen using «FUNCTION» rotary switch
- Set of potentiometers to adjust:
  - Response delay
  - Lower threshold power factor value
  - Upper threshold power factor value
  - Starting override
- Adjustable starting override: 1…100sec
- Adjustable response delay: 0.1…40sec
- Input current range: 0.5…10A AC
- Max switching threshold P.F: 0.2 to 1
- Min switching threshold P.F: 0.1 to 0.99
- Operating voltage: 415V AC
- If the measured power factor exceeds the value set at the «MAX» controller, the set response delay (DELAY) starts (red «MAX» LED flashes). After the delay time has elapsed (red «MAX» LED is ON), output relay «R» drops out (yellow «REL» LED is OFF).
- If the measured power factor falls below the value set at the «MIN» controller (red «MAX» LED is OFF), output relay «R» picks up again (yellow «REL» LED is ON).
- If the error memory has been activated (OVER + LATCH) and the measured power factor has exceeded the value set at the «MAX» controller for longer than the set response delay, output relay «R» does not pick up if the power factor falls below the value set at the «MIN» controller. Once the error has been reset, output relay «R» picks up when the supply voltage is applied again and the measuring cycle starts again once the set starting override (START) has elapsed.
- Relay output: 2x changeover contacts
- Contact ratings: 250V-3A (AC)

Phase inversion protection (ANSI Standard: 47)

- Phase Sequence Relay monitors the order of 3 phases feeding motors.
- If R,S and T phases are in correct order, ON LED on the front panel is turned on.

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- If the phase order is wrong, ON LED is turned off and the output relay is switched to OFF.
- Relay output: Single change-over switch
- Contact rating: 250V AC, 8A (resistive)

Thermal overload protection (ANSI Standard: 49)

- Differential thermal overload relay
- Phase failure sensitive
- Reset mode can either be manual or automatic.
- Pushbutton for simulating relay tripping
- Pushbutton for "Stop" and manual Reset
- Trip flag indicating overload relay tripped.
- Rated operational voltage: 0…400V AC
- Thermal protection adjustment range: 1.6A…2.5A AC
- Phase failure sensitivity tripping current: 130 % of "In" on two phase, the last phase at 0 current or 30 % of "In" on one phase, the others at "In".
- Auxiliary contact: 1 NO + 1 NC
- Tripping threshold: (1.14 +/- 0.06) x I**n**

Non-directional instantaneous overcurrent protection (ANSI Standard: 50P)

- This combined short circuit and over-current relay is applied for protection of generators against both over-currents and short circuit currents (I> and I>>).
- The relay measures the highest of the 3-phase currents, providing an RMS measurement at sinusoidal currents.
- The measurement is based on average values for I>, peak values for I>>
- The set point values are set on the front of the relays by means of potentiometers.
- If a current exceeds a set point, the output is activated.
- If exceeded, a fault signal is generated, and the associated yellow LED is lit.
- Measurement of 3-phase currents
- LED indication of fault condition
- Timer-controlled tripping
- LED indication for activated relay
- When the set point is exceeded, its timer starts and will run as long as the fault condition prevails.
- If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.
- Short circuit current setting: 1.0 to 4.0 × In
- Tripping delay time for short-circuit current: 0 to 1sec
- Over-current setting: 0.5 to 1.5 × In
- Tripping delay time for over-current: 0 to 20sec
- Number of contacts: Single change-over switch per relay type
- Contact ratings: 250 V AC/24 V DC, 8 A (200,000 change-overs at resistive load)

Phase over-voltage protection (ANSI Standard: 59P)

- Continuously monitors the three-phase output voltage of synchronous generator to warn against over-voltage condition to warn against over-excitation condition
- If measured voltage moves above the set point limit, the relay contacts will change-over after the selected "Delay-OFF" has elapsed, giving an alarm or initiation signal.
- If voltage measured falls below threshold (set point), the relay contacts will return to original state only after the reset time ("Delay-ON") has elapsed.
- Can be used in 3-wire and 4-wire network
- User can adjust trip point (set point) and time delay settings.
- The set point adjustment for over-voltage is in the range of 25%
- As soon as the monitored signal moves outside of the set point limit, the time delay is activated, after which a trip will occur. The time delay prevents the relay from tripping for a predetermined period to prevent nuisance tripping.
- The relay is automatically reset once the monitored voltage falls below the set point.
- Adjustable off-delay: 0.1 …20sec
- Adjustable reset-delay: 0.1…20sec
- Adjustable over-voltage trigger range: 105% …130% (corresponding to 410V…510V AC)
- LED indicators for relay activation during over-voltage condition
- Relay output: Single change-over contact
- Contact rating: 250V AC, 8A

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Experiments

- Preventing induction motor from rotating under no-load
- Under-power Overcurrent Protection of a Three-Phase Induction Motor
- Asymmetric voltage unbalance protection for three phase induction
- Prohibiting motor reverse rotation

Scope of Delivery

- Load Protection Module (PS - 005)

Required for Operation

- Three-phase Complex Load Module (PS-001.5)

Options

- Digital content (BI-01)

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