PowerFactory 2021

Technical Reference

DIgSILENT Motor protection Sim Generic Relay

POWER SYSTEM SOLUTIONS
MADE IN GERMANY

November 15, 2019
PowerFactory 2021
Revision 924

Contents

1   Motor protection Sim

1.1   Intent

To model the most common protective functions used to protect (small/medium size) asynchronous motors which can be reproduced only running a simulation.

1.2   Functionality

The following protective functions are modeled:

- Start detector.
- Too prolonged starting.
- Too prolonged stall.
- Too many startups.
- Minimum time between two startups.

Start detector   The *start condition* is detected by a minimum current element (an undercurrent set with a delayed reset i.e. 90 ms) and by an overcurrent element with an user configurable threshold (i.e. 150% I_n). The start is declared when the output signal of both the minimum current element and the overcurrent element are *on*. It means that a start condition is declared if the current values jump from a value smaller than the minimum current element current threshold to a value greater than the overcurrent element threshold in less than the minimum current element reset time.

Too prolonged starting   If the start condition lasts for a time greater than an user configurable time the *Too prolonged starting* protective functions pickup ups.

Too prolonged stall   If the relay has not detected a *start condition* and the current is above a given threshold for a time longer than a given time the *Too prolonged stall* protective functions pickup ups.

Too many startups   The number of times the *start condition* has been declared is counted and if, in a *given period of time*, the counter is greater than a given number the *Too many startups* protective functions pickup ups. Up to 6 starts can be counted.

It detects a motor start using the "Up delay" and the "UpDetector" block.
The *given period of time* is checked by the "Reference period x" (with x = 1...6) timer block: after each motor starting a different timer keep on a flag signal for the *given period of time*. All flag signals are connected to a logic element ("Number of Starts" block) which compares the number of flag signals with the number of allowed motor starts.

Minimum time between two startups   The time between two consecutive *Start detector* pickups is counted and if smaller than a given time (*Reference Time*) the *Minimum time between two startups* protective functions pickup ups.

1.3   Inputs

- One 3 phase CT ("Phase Ct" block, [*StaCt* class]).

1.4   **Available Units**

Measurement

- One 3phase measurement element ("Measurement" block, *RMS Calculation* enabled, *Filter* disabled [RelMeasure class]).

Protective elements

Start detector

- One 3 phase undecurrent element ("Start detector no I" block, [*Relloc* class]).
- One 3 phase overcurrent element ("Start detector Current Set" block, [*Relloc* class]).

Too prolonged starting

- One holder element ("Prolonged start logic" block, [*RelTimer* class] timer set with infinite time delay reset).
- One timer ("Prolonged start max time" block, [*RelTimer* class]).
- One logic block ("Negate start", [*RelLogdip* class] internal logic).

Too prolonged stall

- One holder element ("Prolonged stall logic" block, [*RelTimer* class] timer set with infinite time delay reset).
- One timer ("Prolonged stall max time" block, [*RelTimer* class]).
- One logic block ("Negate start2", [*RelLogdip* class] internal logic).

Too many startups

- Seven timers ("Reference period 1", "Reference period 2", "Reference period 3", "Reference period 4", "Reference period 5", "Reference period 6" and "Inhibition time" block).
- One logic element ("Number of Starts" block).
- Six ancillary timers ("Delay 1", "Delay 2", "Delay 3", "Delay 4", "Delay 5" and "Up delay" block).
- Six ancillary logic blocks ("Start 2 And", "Start 3 And", "Start 4 And", "Start 5 And", "Start 6 And" and "UpDetector" block).

Please notice that the *given period of time* must be loaded inside the "Reference period 1", "Reference period 2", "Reference period 3", "Reference period 4", "Reference period 5", "Reference period 6" and "Inhibition time" block.

Minimum time between two startups

- Two timers ("Minimum time between two startups" and "Start 1 Hold" block, [*RelTimer* class).

- Two ancillary logic blocks ("Start 1 neg" and "Start 2 And" block, [*RelLogdip* class] internal logic).

Output logic

- One relay trip element ("Output logic" block, *RelLogdip* class).

1.5   Outputs

- *yout* associated by default to any protective function trip.

The output logic can be configured in the "Logic" tab page of the "Output Logic" block.