

TechTopics Topic: Selection of Current Transformer Ratio in Medium Voltage Control

Selection of the appropriate current transformer (CT) ratio for motor controllers is relatively straightforward, but must consider a number of factors. The CT ratio is selected to provide proper overload protection to the machine. Short-circuit protection considerations are not a factor, as the short-circuit protection in a NEMA Class E2 controller is provided by the current limiting fuses (see TechTopics No. 45). The application procedure that we use to select the current transformer ratio is as follows:

- a. Multiply motor full load current (FLA) X 1.5. Select the standard CT primary rating closest to the 1.5 X FLA figure as a first approximation.
Example: motor FLA = 72A
 $72 \times 1.5 = 109\text{A}$, select 100:5 CT.
- b. Calculate the CT secondary current at motor FLA.
Example: $73\text{A}/(100/5) = 3.65\text{A}$.
- c. Calculate the CT secondary current at motor locked rotor current (LRA).
Example: motor LRA = 650% FLA
 $(6.5 \times 73\text{A})/(100/5) = 23.7\text{A}$
- d. The CT secondary current at motor FLA (see step b) should be no higher than 4.0A.
- e. The CT secondary current at motor LRA (see step c) should be no higher than 24.0A
- f. If the conditions in steps d and e are both satisfied, and the CT secondary wire length (total loop distance) is under 20' and the wire size is at least #14AWG, the selected CT ratio is OK.
- g. If the conditions in either steps d or e are violated, the engineer must specifically evaluate the accuracy of the CT to assure that the CT will have the necessary accuracy for the application. This requires calculation of secondary burden, including the burden of the protective device, in order to make a decision.

Since the individual evaluation per step g is pretty rare, I will not discuss it further in this example.

Our methodology is much simplified (i.e., very conservative), so that the maximum number of applications will be met by the standard CT selected from steps a-f, and it is seldom necessary to perform a more extensive individual evaluation per step g. Our methodology assumes all 'worst case' conditions (old mechanical relays, multiple devices in CT circuit, longest wire circuit in any controller configuration, etc.)

Since our base calculation starts from 150% of the motor FLA, this seldom yields a CT ratio of less than 125% of the motor FLA. In fact, step d essentially requires that the CT primary current rating be at least 125% of motor FLA. Step e is used to avoid issues when the motor LRA is something other than 600%.

T. W. (Ted) Olsen
Manager, Technology