VAMP 265, VAMP 140 and VAMP 40 motor differential protection schemes

1. Differential Protection using 6 CT's

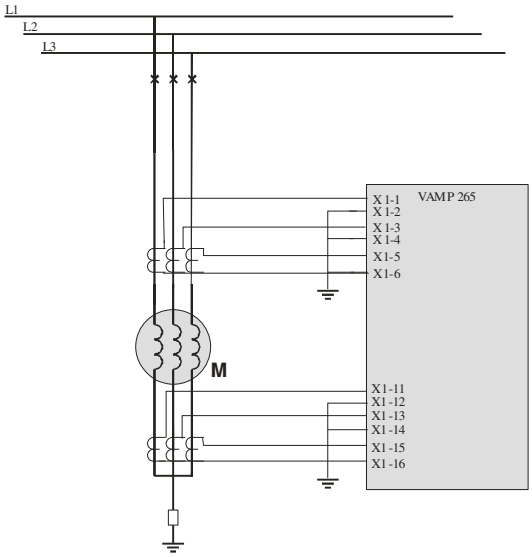

Figure 1 VAMP 265 connected as a motor differential protection using 6 CT's.

In this application mode the settings in VAMP 265 relay's menu SCALING should be set as described in the following section.

CT settings

Here the motor high and low side primary and secondary CT ratings are set according to the actual CT ratios.

Transformer Settings

Here the motor name plate settings must be calculated using below formula:

$S_{MOT} = I_{MOT} \times U_N \times \sqrt{3}$

where:
I_{MOT} = motor nominal current
U_N = motor nominal voltage
S_{MOT} = motor nominal power

Given settings in VAMP 265 relay:
I_L Side Nominal Voltage = U_N
I'_L Side Nominal Voltage = U_N
Transformer nom Power = P_{MOT}

Transformer connection group has to be set as Yy0.

I_0 compensations have to be set OFF.

Settings of the differential protection
ΔI> 87 function shall be enabled for differential protection.
ΔI> pick-up setting range is user selectable from 5 % to 50 % .

Slope 1 can be set to 5 %
I_{BIAS} for start of slope 2 can be set to 3 x I_N
Slope 2 can be set to 50 %
If CTs are saturating at through faults, the Slope 2 settings must be changed accordingly.

ΔI> 2nd harmonic block enable can be set OFF (disabled).
ΔI> 2nd harmonic block limit can be disregarded and the factory default setting can be left intact.

2. Motor differential protection using flux balancing principle

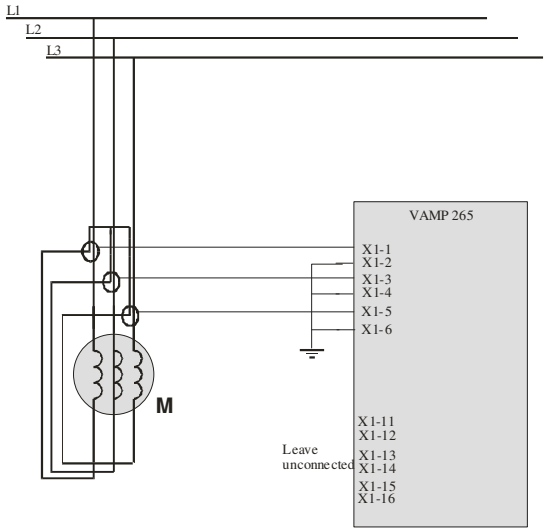

Figure 2 VAMP 265 connected as a motor differential protection using 3 core balance CT's connected using flux balancing principle.

In this application mode the settings in VAMP 265 relay's menu SCALING should be set as described in the following section.

CT Settings
CT Primary and CT Secondary settings shall be set according to the actual core balance CT ratios.
CT' Primary and CT' Secondary settings can be disregarded and the factory default settings can be left intact.

Transformer Settings
Here the motor name plate settings must be calculated using below formula:

$S_{MOT} = I_{MOT} \times U_N \times \sqrt{3}$

where:
I_{MOT} = motor nominal current
U_N = motor nominal voltage
S_{MOT} = motor nominal power

Given settings in VAMP 265 relay:

I_L Side Nominal Voltage = U_N
I'_L Side Nominal Voltage = U_N
Transformer nom Power = P_{MOT}

Transformer connection group has to be set as Yy0.
I_0 compensations have to be set OFF.

Settings of the differential protection
ΔI> 87 function shall be enabled for differential protection.
ΔI> pick-up setting range is user selectable from 5 % to 50 %.

Slope 1 can be set to 5 %
I_{BIAS} for start of slope 2 can be set to 3 x I_N
Slope 2 can be set to 50 %

ΔI> 2nd harmonic block enable can be set OFF (disabled).

ΔI> 2nd harmonic block limit can be disregarded and the factory default setting can be left intact.

Setting Example 1:
Motor name plate ratings:
P_{MOT} = 200 kW
I_{MOT} = 352 A
U_N = 380 V
CT ratio 100/5 A

S_{MOT} = 352 x 380 x √3 = 232 kVA
Target ΔI> pick-up level 18 A → (18/352) x 100 = 5 %

I_L Side Nominal Voltage = 380 V
I'_L Side Nominal Voltage = 380 V
Transformer nom Power = 232 kVA
pick-up 5 %

Setting Example 2:
Motor name plate ratings:
P_{MOT} = 3 MW
I_{MOT} = 305 A
U_N = 6.6 kV
CT ratio 100/5 A

S_{MOT} = 305 x 6600x √3 = 3487 kVA
Target ΔI> pick-up level 20 A → (20/305) x 100 = 7 %

I_L Side Nominal Voltage = 6600 V
I'_L Side Nominal Voltage = 6600 V
Transformer nom Power = 3487 kVA
pick-up 7 %

3. VAMP 40 applied as motor differential protection

Alternatively VAMP 40 unit may be applied as a differential protection in a flux balancing connection (see figure 2) instead of VAMP 265.

The three core balance CT inputs shall be connected to VAMP 40 terminals' X6:1, X6:3, X6:5 and the common shall be connected to X6:2, X6:4, X2:6 respectively.

Three programmable stages with coupling to IL1, IL2 and IL3 can be used for differential protection in order to achieve the sensitivity of 5 %.

4. VAMP 140 applied as motor differential protection

Alternatively VAMP 140 unit may be applied as a differential protection in a flux balancing connection (see figure 2) instead of VAMP 265.

The three core balance CT inputs shall be connected to VAMP 140 terminals' X1:1, X1:3, X1:5 and the common shall be connected to X1:2, X1:4, X1:6 respectively.

Note: when VAMP 140 unit is applied the minimum differential current setting is 10 %.

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