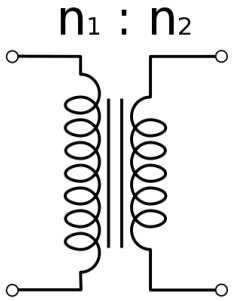
- Application Note -

How To Measure a Transformer Turns Ratio Using TRT Instruments

The turns ratio of a transformer is the ratio of number of winding turns on each side of the transformer. Sometimes you need to find out the turns ratio and winding configuration of a transformer without a nameplate.

The transformer turns ration is labeled as follows

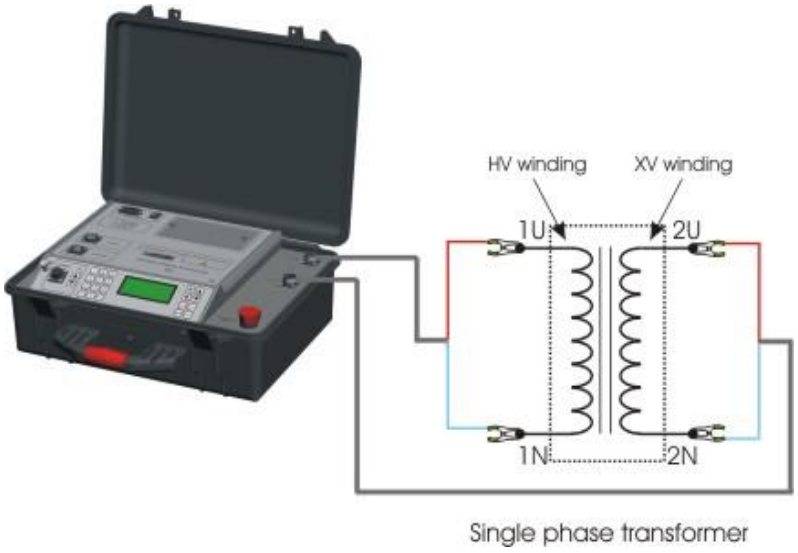
$n_1:n_2$



Transformers can have multiple windings for multiple voltages. Generally it is specified by:
$n_1:n_2$ or n_1/n_2
$n_1:n_3$ or n_1/n_3

Measuring the voltage to find the ratio

A transformer converts one AC Voltage to another. Applying an AC Voltage to one side (with higher number of turns) and measuring the output Voltage will provide the turns ratio.
$V_{in}/V_{out} = n_1:n_2$

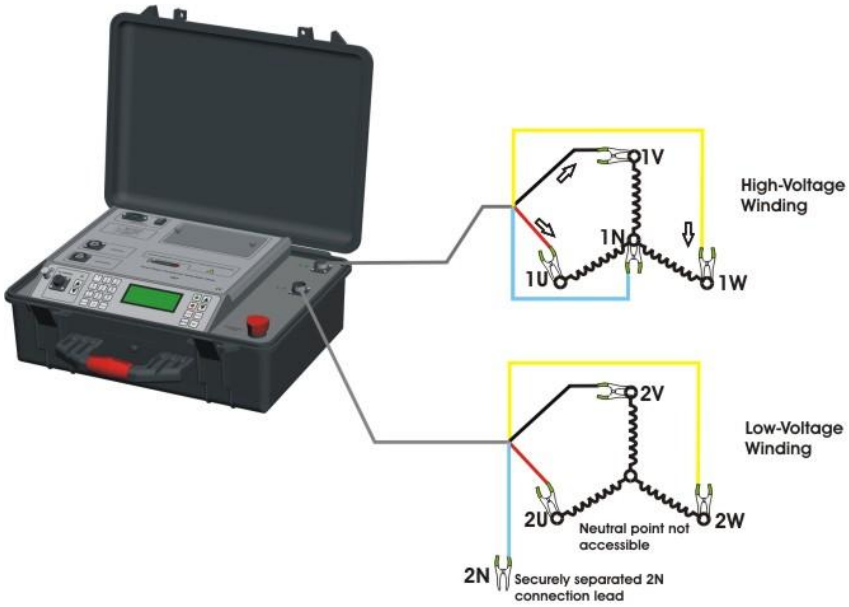


Single phase transformer

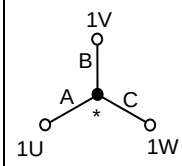
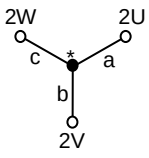
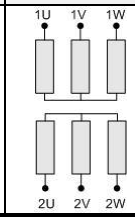
For a three-phase measurement, the test set is connected to all three phases of the transformer to be tested. The TRT generates single-phase and true three phase test voltage. The TRT will run a specific test for each transformer type (i.e., single phase, Delta to y, Y to delta, Delta to delta, or Y to y) without the need to switch test hookup cables.

When generating a single-phase excitation voltage, the TRT supplies in turn single-phase excitation test voltage to each of the three transformer primary windings. The induced voltages across each of the corresponding unloaded transformer windings are then measured; the ratio of these voltages is calculated and shown on the display. It is repeated for all three phases.

When generating a true three phase voltage, the TRT generates and applies a true three-phase excitation test voltage to the three transformer primary windings. The induced three phase voltages across the unloaded transformer windings are measured and the transformer turns ratio is calculated for all three phases.



One example of the testing is shown in the table below

Vector group	*Winding connections*		*Scheme*	*Phase*	*Limb*	*Short circuit*	*Tested winding*		*Calculated ratio*
Yy6				**A** **B** **C**	**II-I** **II-III** **I-III**	**-** **-** **-**	**1V-1U** **1W-1V** **1U-1W**	**2U-2V** **2V-2W** **2W-2U**	$\frac{U_1}{U_2}$

Note:

Something to be cautious about is creating too high voltage on the transformer that may be very dangerous. For instance, if you apply 100 V and the turns ratio is 1:100, then the induced voltage on the secondary side would be 10 kV.

The TRT generates very low voltage at the beginning of the test to check if the cables on the transformer sides are exchanged. If primary and secondary cables are correctly placed, the TRT will continue the test. Otherwise it will show a message “Turns Ratio Too Low” and stop the test; high/dangerous voltage will not be generated on the transformer.