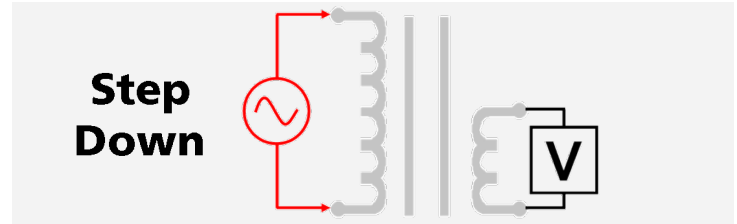


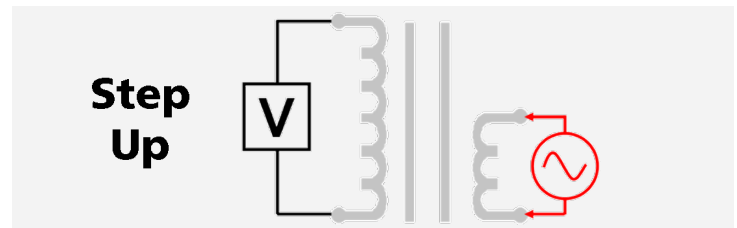
## Transformer Turns Ratio

### Primary vs Secondary Excitation | Step Down vs Step Up

Transformer turns ratio is measured by applying line frequency AC voltage to one winding of a transformer and measuring the induced voltage on the corresponding winding. Historically, most transformer turns ratiometers excite the primary winding and measure the induced voltage on the secondary. This is referred to as the step down method since the induced voltage is lower than the excitation voltage.



The **TTRU3** is capable of inducing voltage that is higher than the excitation voltage - also known as the step up method. But what are the benefits to this method of excitation?



#### Less Voltage, More Flux

By exciting the secondary, more flux is generated with a smaller, low voltage power supply.



#### Accuracy

Sufficient flux is required for to overcome voltage dependence, which is possible by stepping up low voltage.

### Example

The transformer tested below is voltage dependent. Using the step down method, 100V was applied to primary winding. As a result, the max deviation exceeded the acceptable limit as defined in the ratio testing standards.

When 20V was applied to the tertiary, more flux was generated than 100V step down, overcoming the voltage dependence, and bringing the measurement within acceptable limits ( $\pm 0.5\%$ ).

Single Phase 448 MVA Auto w/Tertiary 288KV:26.4KV				100V Step Down Applied on Primary		250V Step Up Measurement Voltage ~20V Applied to Tertiary	
Primary to Tertiary Ratio Results				Measured Ratio	Max Dev	Measured Ratio	Max Dev
Tap	HV L-G	TV L-L	Calc Ratio	12.089	0.51%	12.0666	0.32%
1	317543	26400	12.02814				