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Application for low voltage with 400 V measurement without voltage transformer

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SIPROTEC 5 Application

Application for low voltage with 400 V measurement without voltage transformer

APN-056, Edition 1

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1 Application for low voltage with 400 V measurement without voltage transformer

1.1 Introduction

Protection relays designed for medium-voltage use are regularly used in low voltage because the medium-voltage protection device has many functions that otherwise have to be built up discretely- via individual components. This reduces product variance, engineering costs, maintenance costs, and so on.
A voltage measurement is required at low voltage, if systems have more than one infeed respectively systems are operated coupled together. This is the case within many industrial plants.
The direct connection of a medium-voltage protection relay to the low voltage is usually not supported, so that voltage transformers are used to adapt the low voltage to the measuring voltage range of the protection device. Such voltage transformers are comparatively expensive and large.
This application describes a cost-effective and space-saving alternative to using voltage transformers.

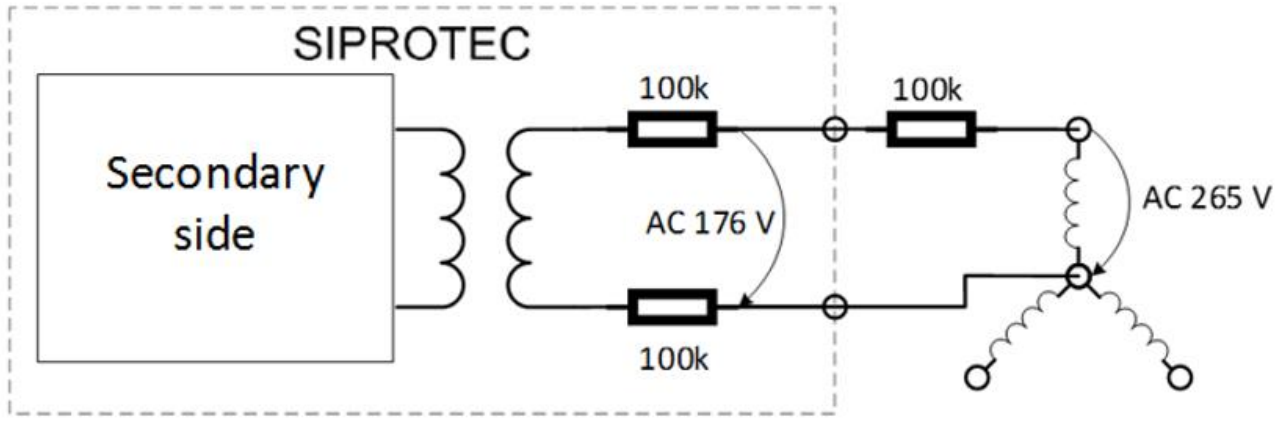
1.2 Initial situation

SIPROTEC 5 devices comply with the Low Voltage Directive 2014/35 / EU. The voltage measurement inputs have a maximum rated insulation voltage of 300V according to EN 60255-27: 2014 (Measuring relays and protection equipment; Part 27: Product safety requirements). The voltage measuring range of the devices is approx. 210V. The voltage measuring inputs of the SIPROTEC 5 devices must therefore not be connected directly to the 400V measuring voltage in low-voltage switchgear.
In medium-voltage and high-voltage switchgear, voltage transformers with a secondary voltage of mostly 100V or 110V are used for protection and measurement purposes. The use of voltage transformers in the low-voltage distribution causes comparatively high additional costs and is space-intensive. Therefore, alternatives to the use of voltage transformers are sought.

1.3 Solution

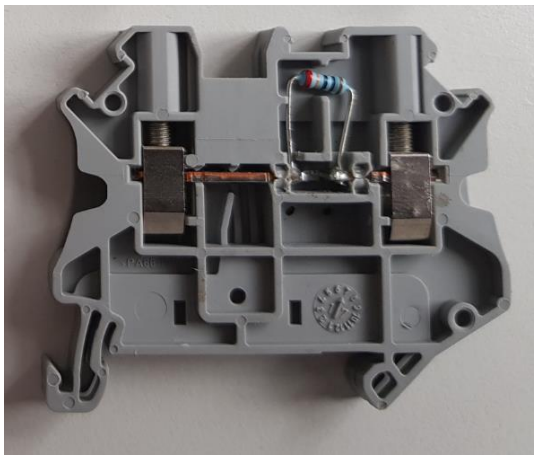
By using an external resistor (EMC-safe resistor which also complies with the EMC Directive 2014/30/EU), the measuring voltage on the SIPROTEC 5 device can be reduced to a value within the permissible rated voltage and measuring range of the device.

The following illustration shows the principle.



Series connection of an external 100 kΩ resistor divides the low voltage (e.g. 265 V phase-earth = 230 V + 15%) by a factor of 1.5, so that a suitable or permissible voltage is applied to the device terminals (e.g. 176 V = 265 V / 1.5).

The external EMC-safe 100 kΩ resistor is permanently integrated into a component terminal block (solder connection). The component terminal is a terminal block for DIN rail mounting, see the following pictures.



The external voltage division (factor 1.5) can be corrected or recalculated by the SIPROTEC 5 device by a corresponding voltage gain (magnitude correction) by the same factor (1.5) (the required setting is described in chapter 1.4). The magnitude correction is done on a sample level so that all voltage values formed in the device or values based on the voltage measurement (e.g., power) represent the correct and natural values of the low voltage network. At no point the user must consider the factor 1.5 for conversion.

1.4 Device configuration (parameter settings)

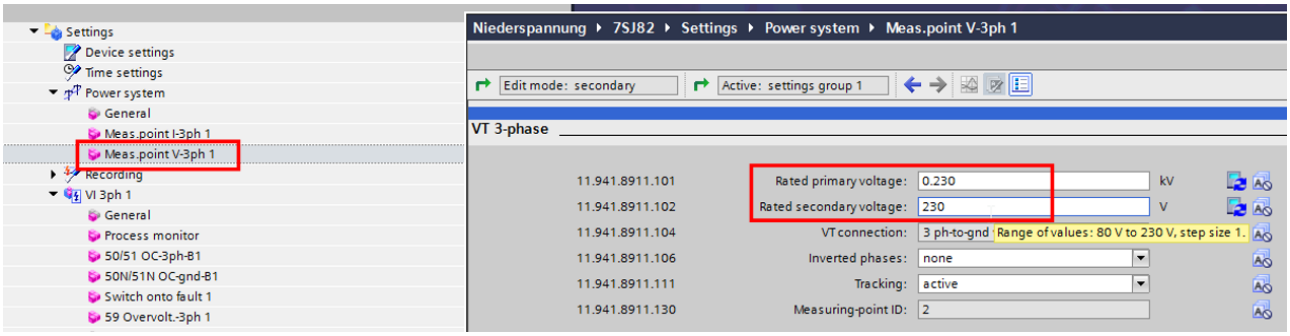
Below, the few necessary settings are described in order to adapt the device to the low-voltage measurement.

1.4.1 Power system

Within the power system data, the following settings are necessary.

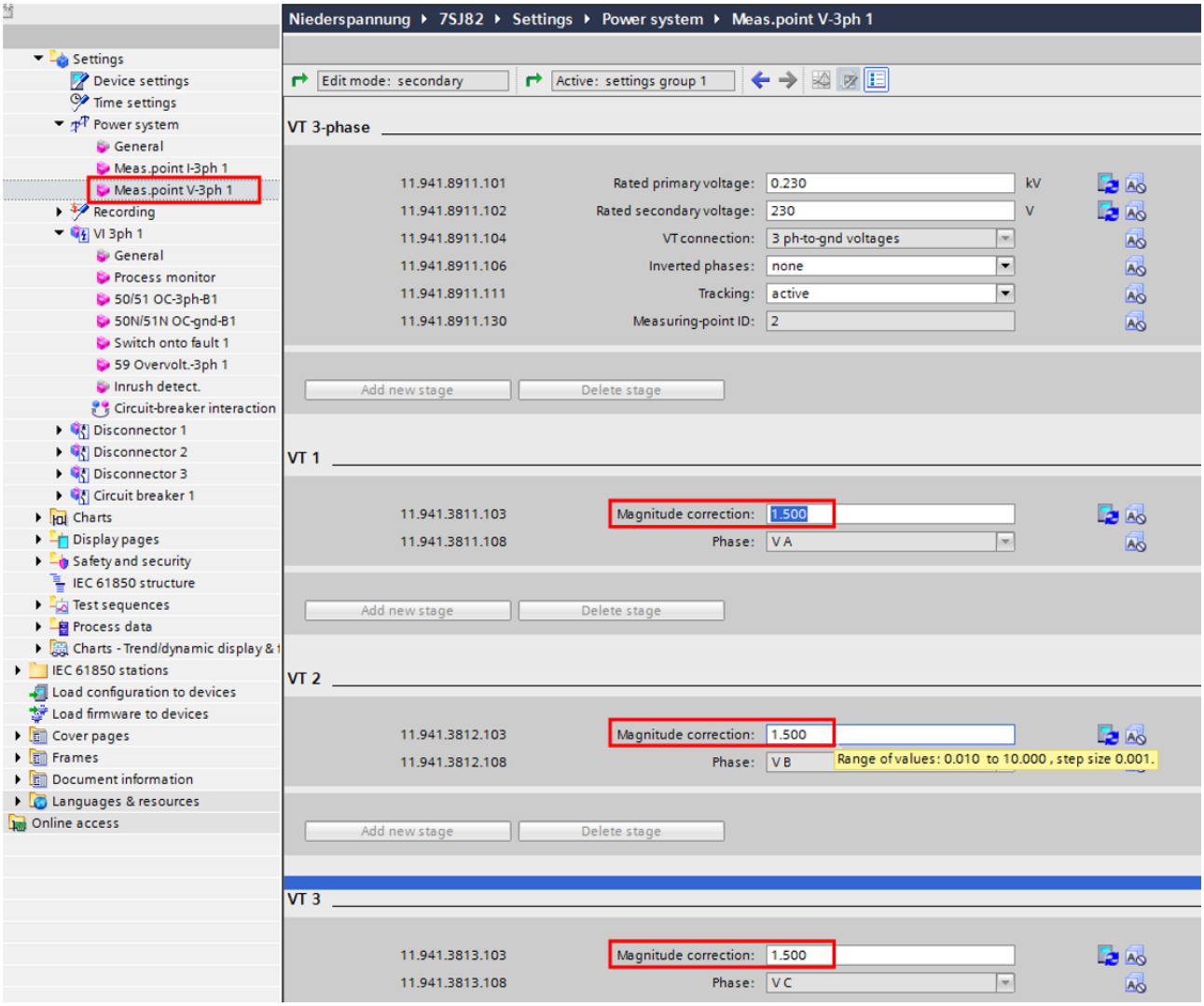
Settings for the voltage transformer (transformation ratio)

In the 3-phase voltage measuring point, the transformation ratio of the voltage transformer is to be set to rated voltages (L-N) of 0.230 kV primary and 230 V secondary.
This corresponds to a ratio of 1/1.



Setting of the magnitude correction

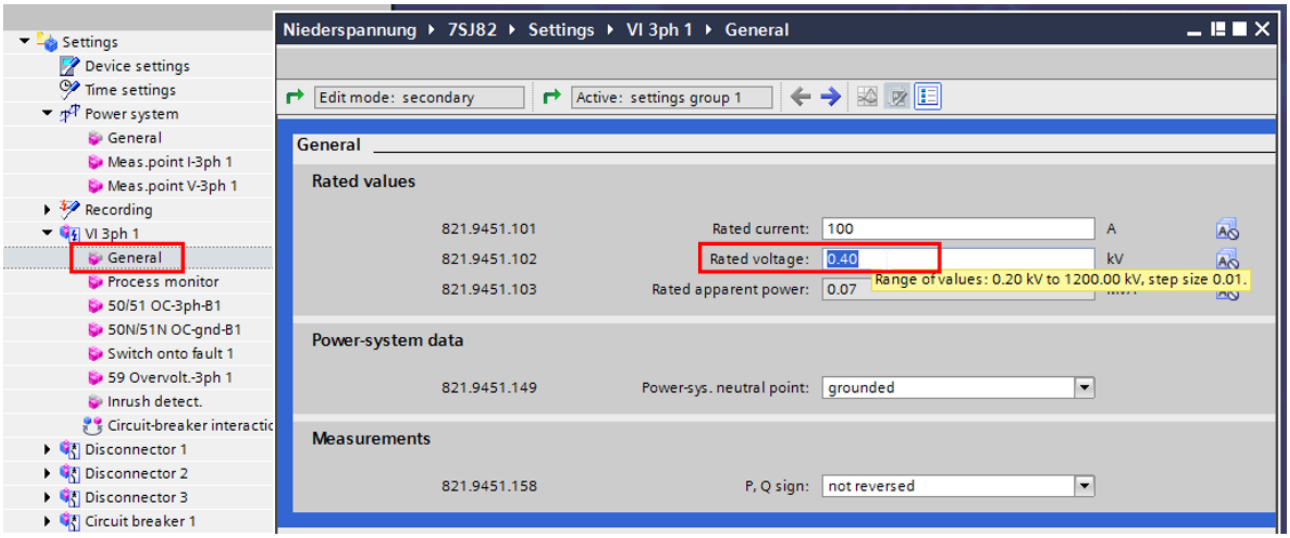
The parameter "Magnitude correction" must be set to 1.5 for the three voltage transformers, see the following figure. This corrects the external voltage division (ratio 2/3) device internally back, to the true low voltage value.
The magnitude correction is done on a sample level, so that all voltage values formed in the device or values based on the voltage measurement (e.g., power) represent the correct and natural values of the low voltage network. At no point does the user have to consider the factor 1.5 for conversion.



1.4.2 Rated voltage in the protection function group

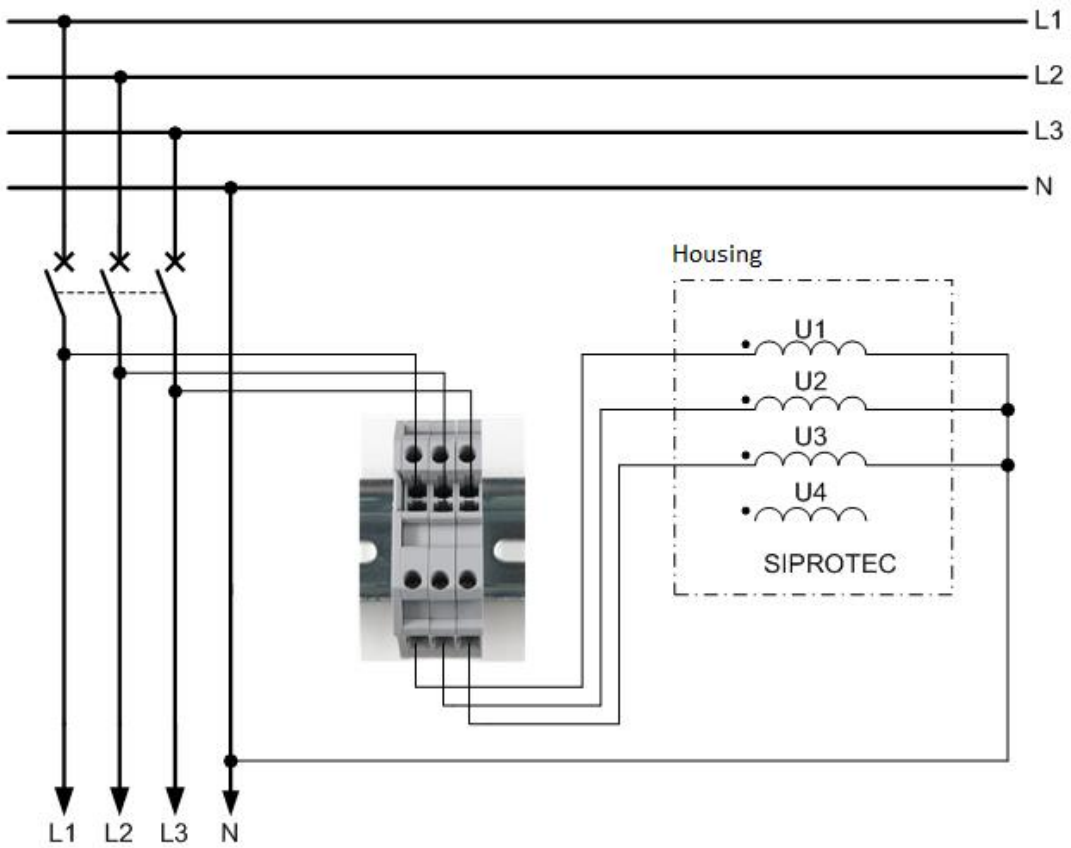
Setting the rated voltage in the function group

The setting of the nominal values in the function group is used for the formation of % values (% setting values, % operational measured values). Consequently, the rated voltage must be set to 0.400 kV.



1.5 Connection example

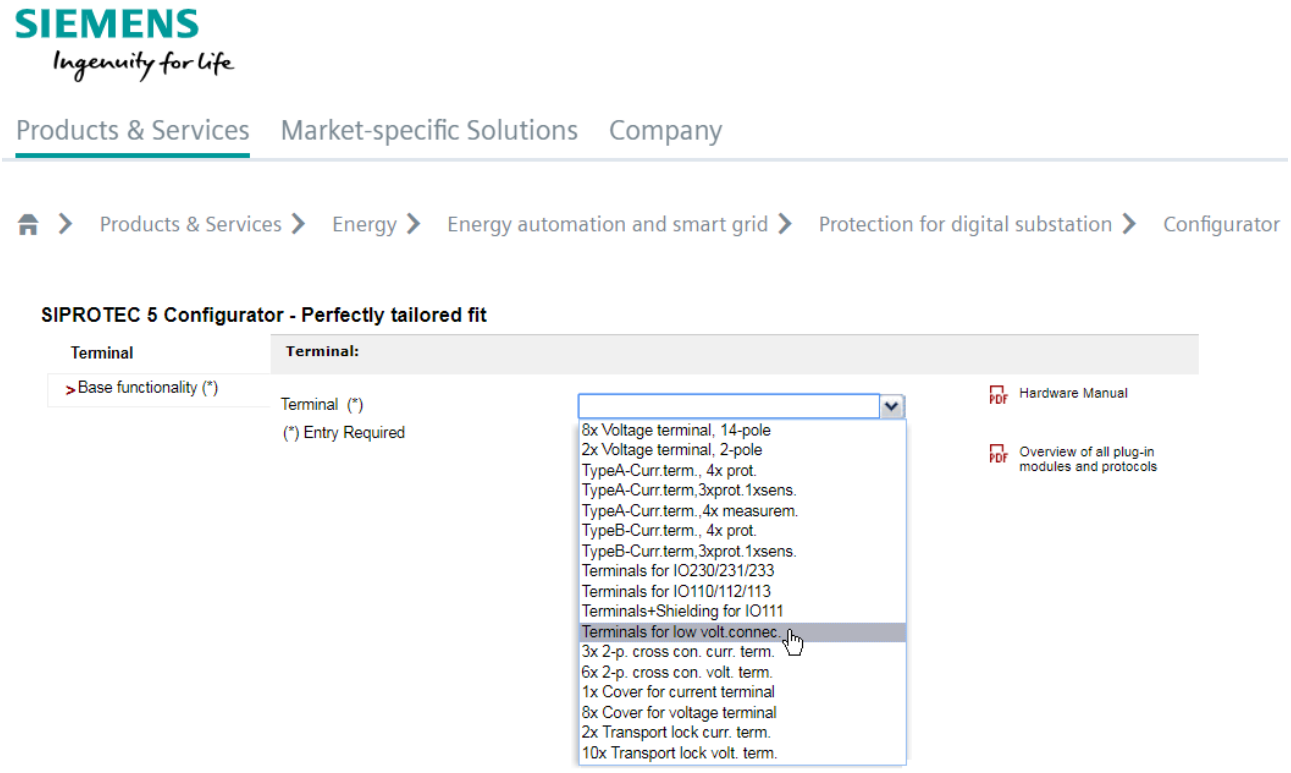
The 3 terminal blocks (with integrated resistors) replace 3 star-connected voltage transformers.



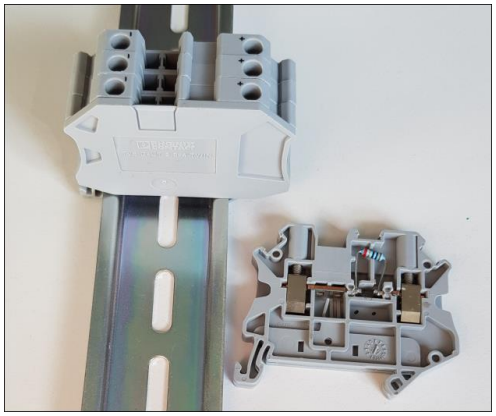
1.6 Ordering data and scope of delivery

Product code / SIPROTEC 5 configurator

The terminals for the low voltage connection are located in the SIPROTEC 5 configurator under:
"Part" => "Terminal" => "Terminals for low volt.connec."
The product code is: "P1X301".



Scope of delivery:
4 terminal blocks (screw connection) with integrated pulse withstanding 100 kΩ resistor plus 1 end cover.
For the application, 3 terminals are required (1 per phase).
Note: The 4th terminal is in reserve and must not be switched to the neutral conductor! (see connection example).



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