Technical University of Košice
Faculty of Electrical Engineering and
Computer Science

# Problems of protection of industrial networks with a high share of renewable energy sources

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# Introduction

A significant challenge in microgrid systems is the design of a suitable protection system for the increasing share of renewable energy sources.

Photovoltaic stations units have the most significant effect on short-circuit currents in the island mode of microgrid systems.

The issue of protection of photovoltaic stations is most evident especially in the island mode, because of reduced short-circuit currents.

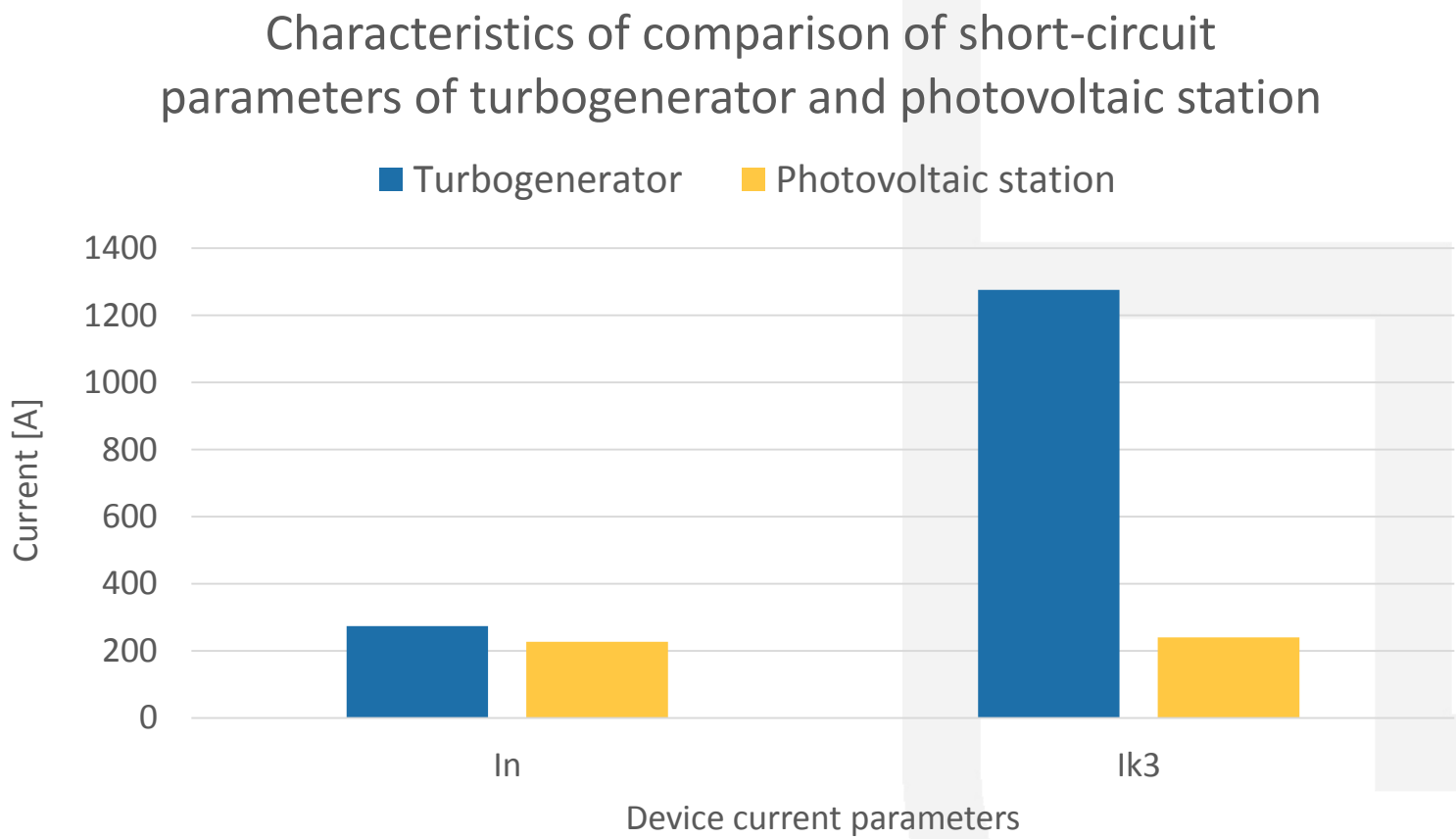
# Calculation of short circuit currents

The calculation of short-circuit currents was carried out in accordance with the valid standard STN 60909.

The standard neglects the increments from RES, because they have a small short-circuit increment compared to conventional power plants.

When comparing a standard turbogenerator with a power of 10 MVA and a photovoltaic station with a power of 5 MVA, the current ratios will be as follows according to characteristic of comparison of short-circuit parameters.

# Calculation of short-circuit currents



# Design of the model scheme

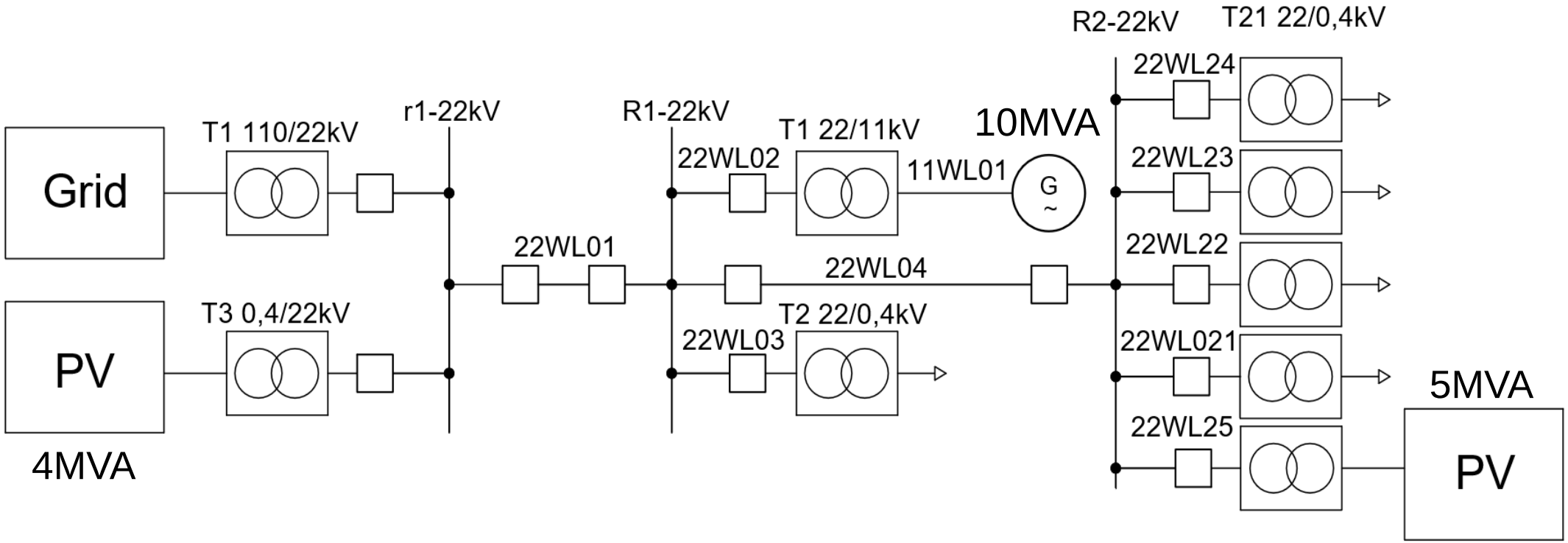



Figure 1 Model diagram of a protection system with a radial topology for an industrial enterprise

# Model network protection system

Used Overcurrent relay to protect the feeder

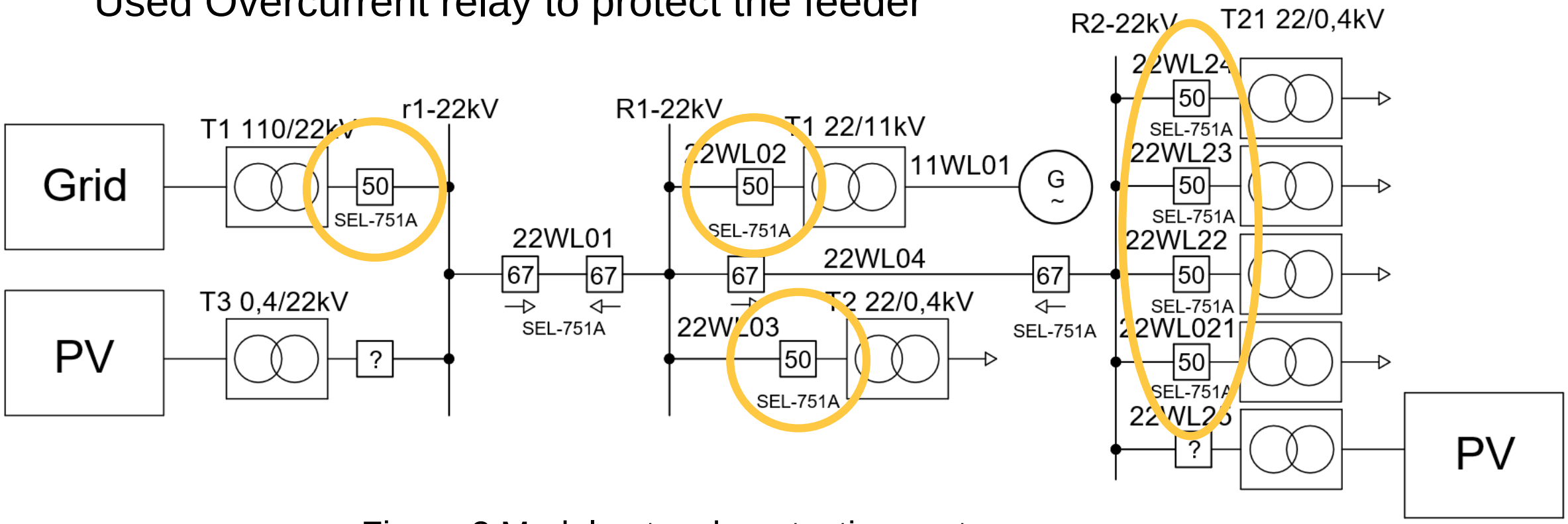



Figure 2 Model network protection system

# Model network protection system

Used Overcurrent directional relays for the protection of interconnectors

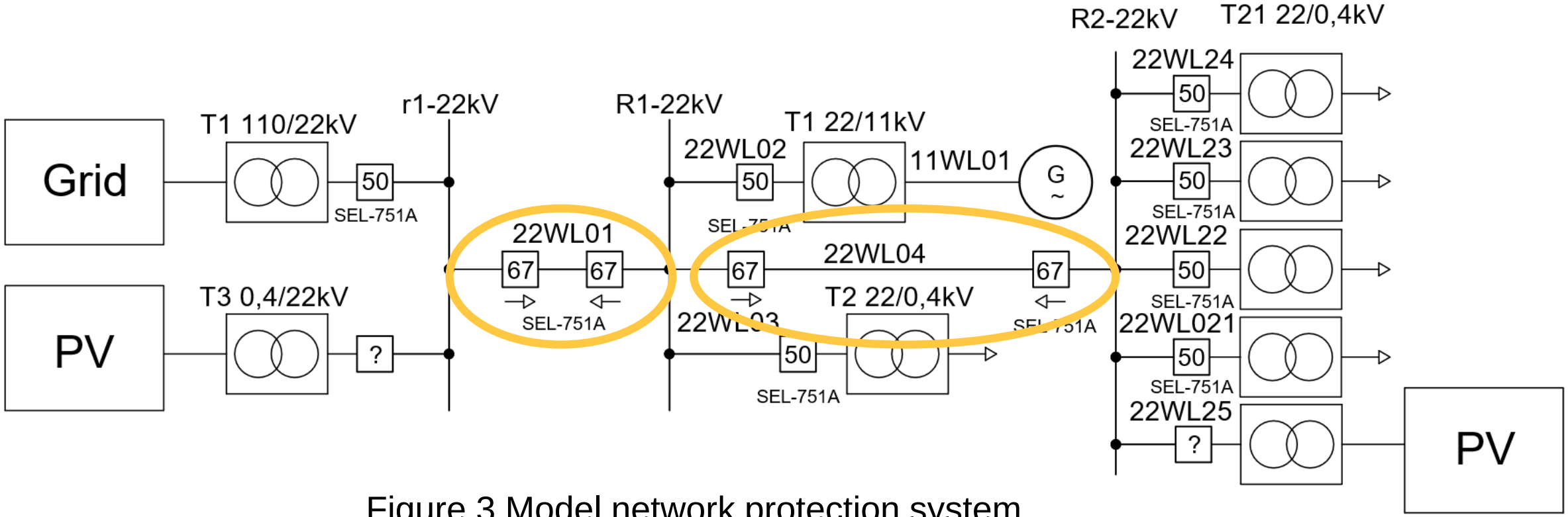



Figure 3 Model network protection system

# Model network protection system

Photovoltaic stations protection system

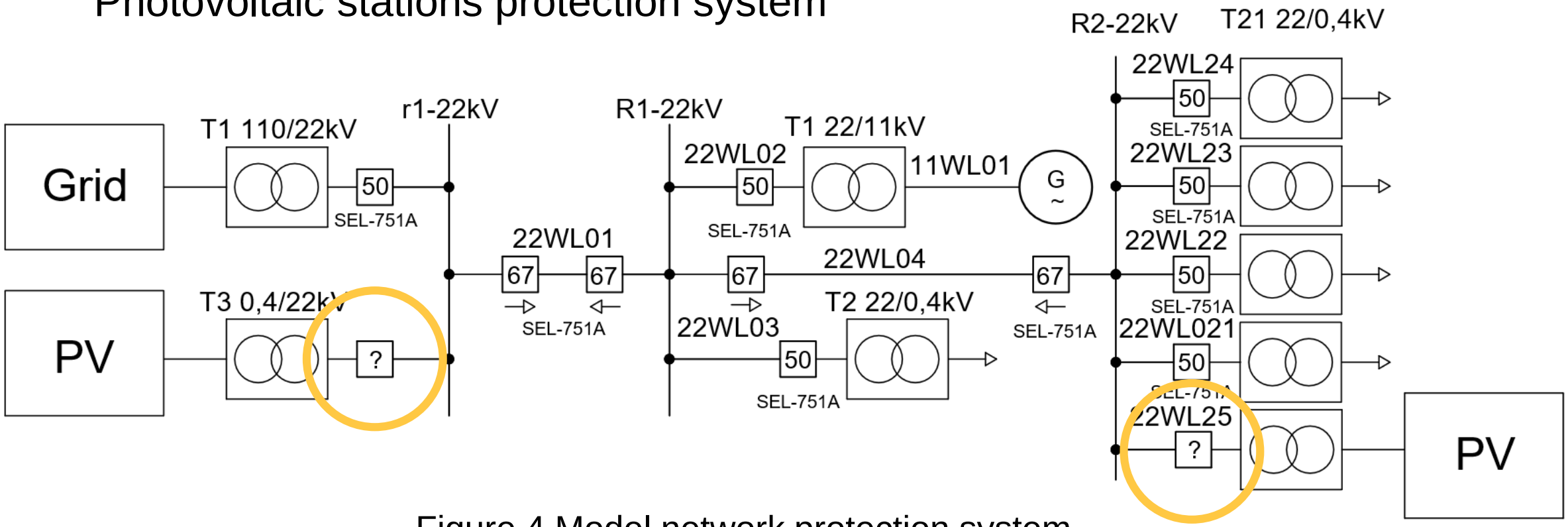



Figure 4 Model network protection system

# Photovoltaic stations protection system

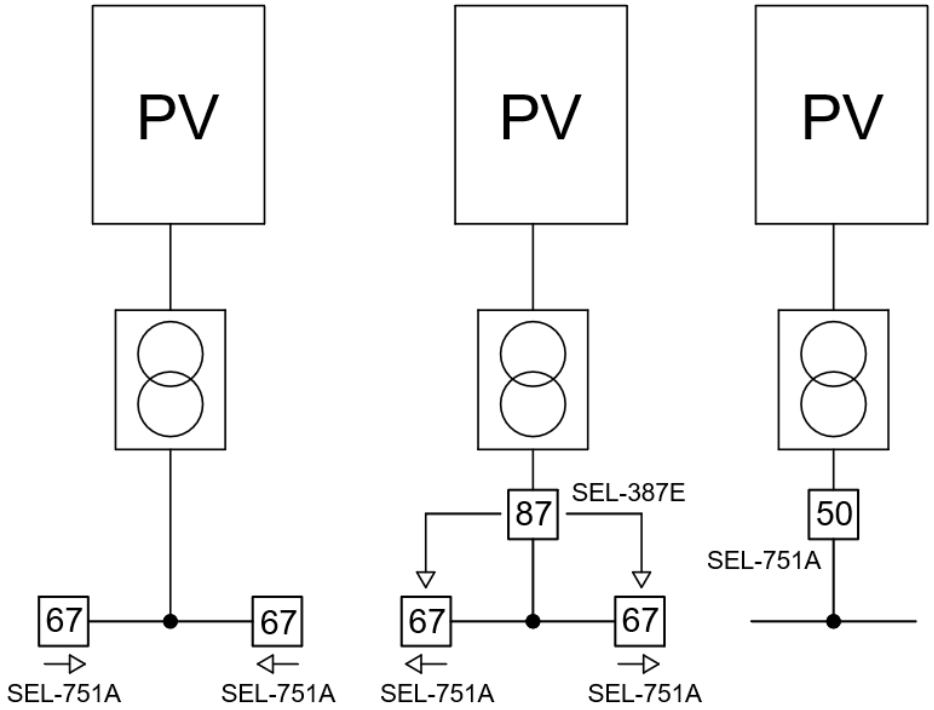



Figure 5 PV protection system

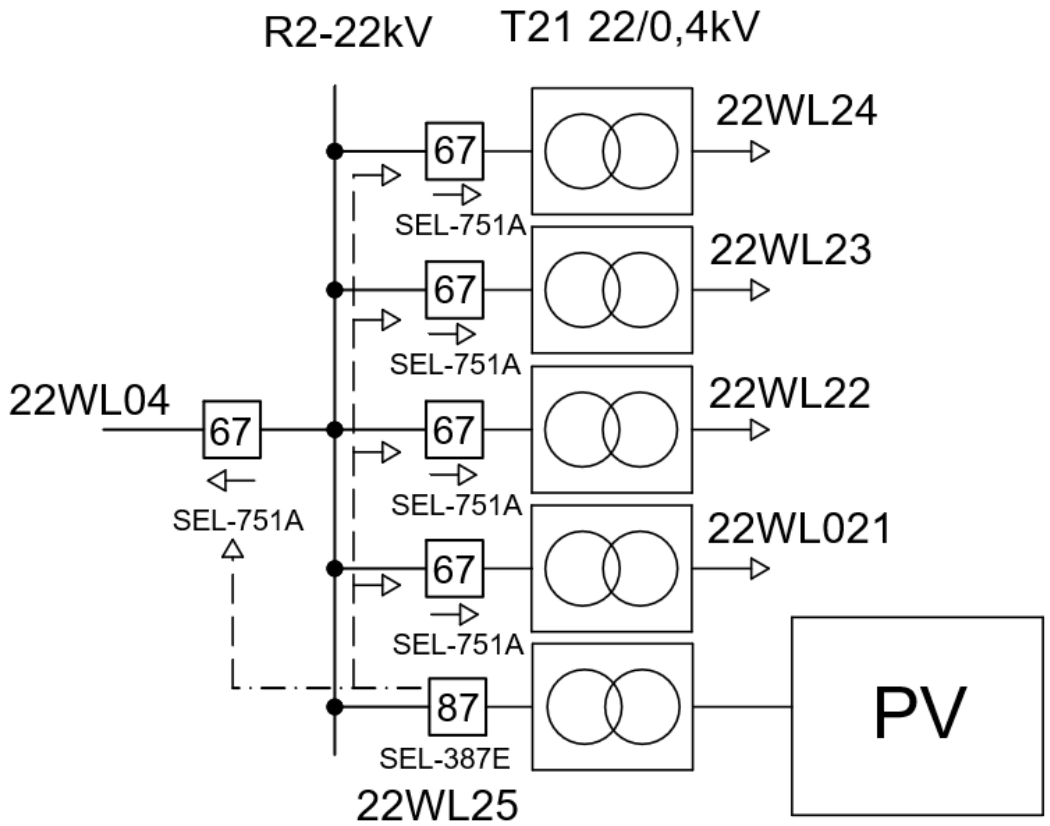



Figure 6 PV protection system for solved model

# Final evaluation

The issue of the correct design of a protection system with the integration of RES into distribution systems requires increased attention due to the large increase in photovoltaic stations and wind power plants.

This article had the main task to draw attention to the issue in the STN EN 60909 standard itself, which does not consider or neglect the contributions of short-circuit currents from photovoltaic stations, and in the future.

The aim of this article was to show the possibilities of adapting already deployed protections, if such adaptations allow such devices.

# Discussion on the problems of microgrid systems

The modelled scheme of the microgrid system offers the possibility of using the already existing topology in distribution networks.

How much can the existing distribution network be adapted to microgrid systems?

Why do we not find a chapter on RES for the calculation of short-circuit currents when comparing the standard STN EN 60909 in the English version with the Czech version?

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# Thanks for paying attention

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