

Smart-R-Trafo – voltage regulation solution for distribution transformers

The traditional power grid is based on centralized generation plants that supply end-users via long-established, unidirectional transmission and distribution systems. But times are changing. Future demands for increased power supplies with higher reliability from cleaner and preferably renewable energy sources, cannot be met with today's grid infrastructure. We need an intelligent system that can receive power of all qualities from all sources – both centralized and distributed – and deliver reliably on demand, to all consumers. We need a Smart-R-Trafo for the Smart Grid.

Smart-R-Trafo

ABB's Smart-R-Trafo is designed to meet these new challenging network conditions, meaning it can regulate the voltage automatically on-load. It is a standard distribution transformer equipped with on-load voltage tap changer, which detects voltage changes in the network and automatically adjust the voltage ratio. For utilities, ABB's Smart-R-Trafo is a cost effective alternative to the expensive option of strengthening the network to overcome the voltage fluctuation issues and increase the hosting capacity of distribution networks for renewable generation. It is worth noting that ABB distribution transformers equipped with automatic voltage regulation do not require any special adaptation to the network infrastructure. The tap changer itself uses vacuum technology, meaning that the switches are maintenance free, an important consideration for distribution system operators (DSO's). The Smart-R-Trafo footprint remains unchanged allowing transformers to be housed in existing secondary substation kiosks, which minimizes the total investment cost. Furthermore, it is equipped with a communication interface, which is fully compatible with network monitoring systems and can be integrated in the grid allowing monitoring and remote control.

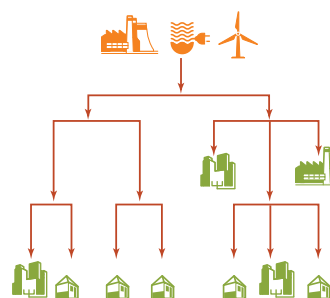


Distribution grid evolution

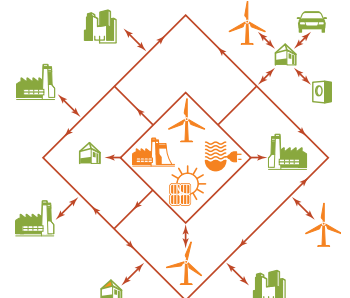
Dynamic changes in the distribution network infrastructure and the transition from traditional to smart grid configuration, make the topic of automatic voltage regulation an urgent and important issue for distribution system operators (DSO's). As power generation becomes more distributed and more power comes from renewable resources, the distribution grid will need to accommodate and absorb more fluctuations in power quality and two-way power flow, while becoming more responsive to changes in customer demand.

The power flow in modern networks is changing to become more complex

traditional grids



future grids



Technical challenge

One of the issues related to power quality is the voltage level, which must be kept within the bandwidth of ± 10 percent according to DIN EN 50160 across the MV/LV distribution system. In reality it means that in LV network, only a 3 percent voltage rise due to generation in-feed is permitted. Usually in traditional distribution networks, voltage regulation referred only to voltage drops and was managed by primary substation transformers equipped with on-load tap changers. This new situation requires a smart solution which will allow for automatic regulation of voltage in the low voltage network.

Technical parameters

- Power rating – 250 kVA to 800 kVA
- Tap changer – configurable for 5, 7 & 9 position (e.g. $\pm 4 \times 2.5$ percent)
- Vector Group – all Delta and Star configurations suitable
- Automatic tap changing, on-load
- No service required as switching contacts are maintenance free
- No change in transformer footprint – no change in secondary substation size
- Communication with external SCADA system (remote control operation if required)
- Automatic, remote and manual modes
- Ethernet and RS232 interfaces
- Control system protocols IEC 608705101, 608705104, 61850

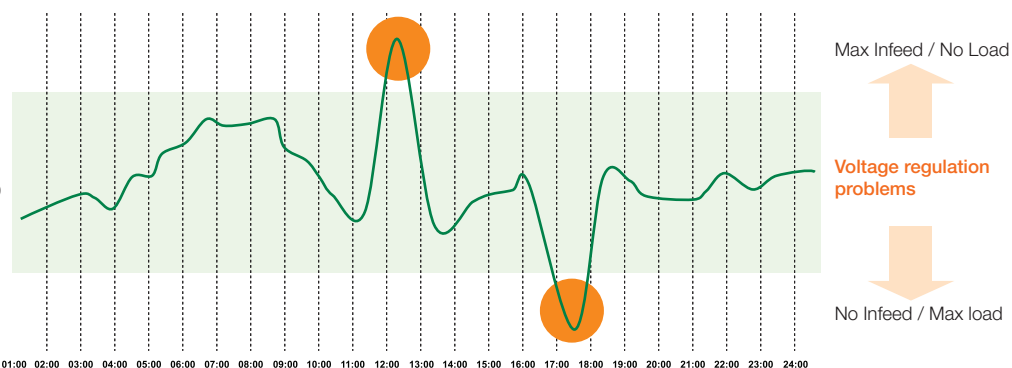
Voltage regulation – The technical solution

Standard distribution transformer



RMS Voltage

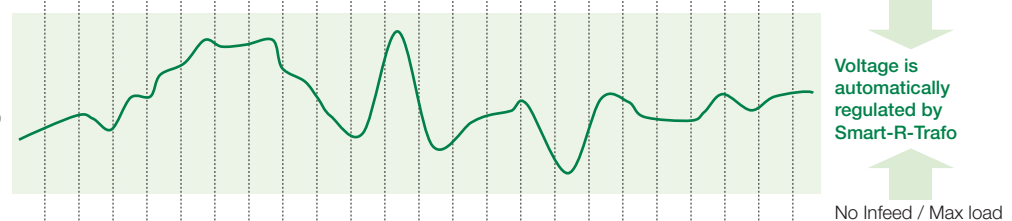
$\pm 10\%$ voltage bandwidth as per the DIN EN 50160 standard



Smart-R-Trafo



$\pm 10\%$ voltage bandwidth as per the DIN EN 50160 standard



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