

Voltage Regulated Distribution Transformer



**J. Schneider
Elektrotechnik**



■ **SmartActiveTransformer**

The economical alternative

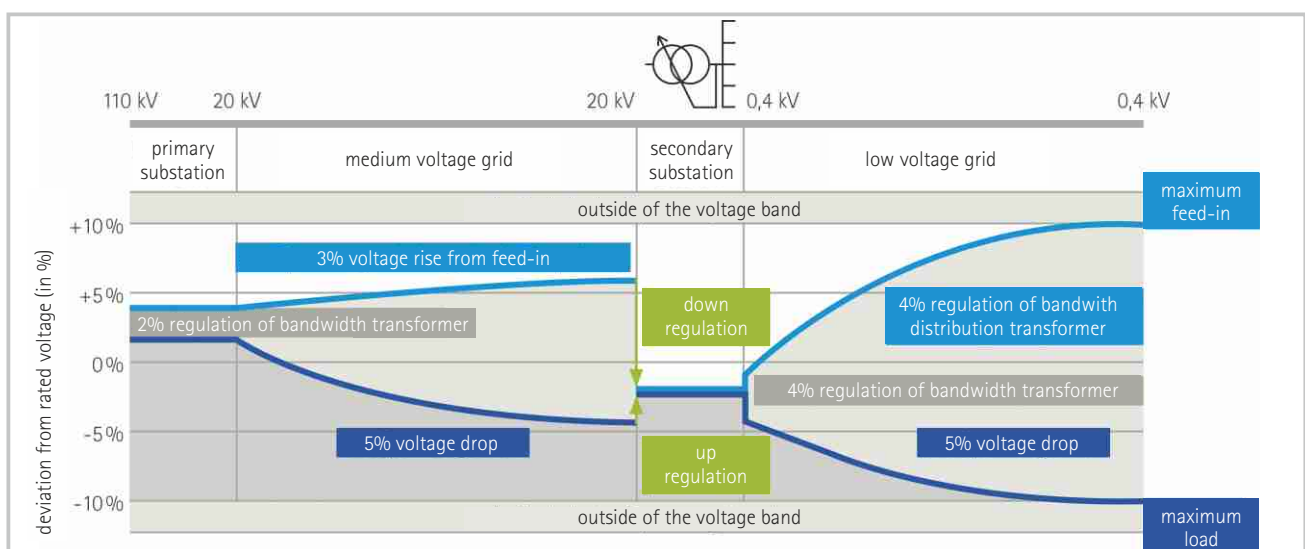
The economical alternative to grid expansion – optimal grid capacity utilisation: the integration of increasingly decentralised energy sources feeding renewable energy into low-voltage systems presents energy providers with increasingly greater challenges.

The specified nominal voltage range of +/- 10% according to DIN 50160 only allows a maximum voltage rise of 3% for decentralised energy sources. The remaining bandwidth must be available for medium voltage, voltage drops, and setting accuracy.

In this context, more and more network operators are being forced to undertake expensive expansion activities in their grids, even though the available power capacity in the affected low-voltage distribution network is still far from being reached.

This is precisely where the core problem of adherence to the voltage range becomes the focus of a variable local network transformer, which adjusts the voltage dynamically. By decoupling the voltages in the medium and low-voltage networks, 11 percent, rather than 3 percent, are now available for voltage spikes that occur while feeding into the low-voltage network. In many cases, use of this type of controllable local network transformer enables network expansion to be omitted completely or at least significantly reduced in the few remaining cases.

In each case, the already available operating equipment can be utilised to a high degree by the network operator resulting in more economical operation.





■ The ideal solution for power distribution network operators

Maintenance-free, long-lasting

- no lifetime-limited electronics in the circuit breaker
- maintenance-free for its entire lifespan thanks to vacuum technology
- lifetime analogy to conventional local network transformers

Maximum operating reliability

- critical operating conditions are excluded by the reactor principle
- a communication interface enables integration with the control room as required
- the SmartActiveTransformer features the entire know-how of more than 35,000 vacuum switches and over 10,000 reactor switches developed by Maschinenfabrik Reinhausen, which are used around the world

Low lifecycle costs

- 700,000 reliable circuits make maintenance unnecessary
- the on-load tap changer operates reliably throughout the entire lifetime of the transformer
- motor and controller may be easily replaced as required

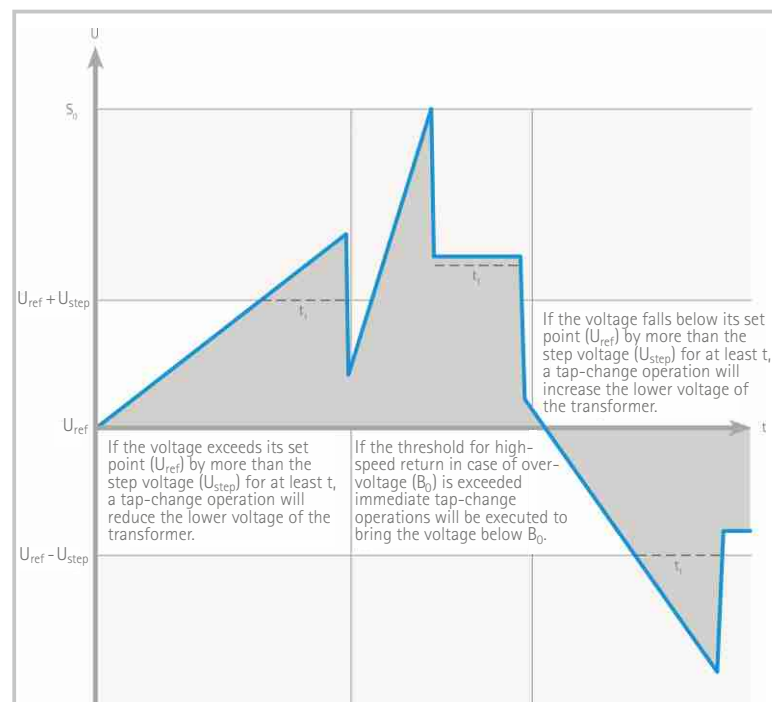
Fit for the future

- a maximum of 9 operating positions and step spacing of up to 3% enable a control range up to 24%
- the on-load tap changer is also configurable asymmetrically for situations primarily featuring loads or primarily featuring feeds
- The voltage range of +/- 10% as per DIN 50160 can be fully utilised

■ Control algorithm

The integrated voltage regulator enables completely autonomous operation, whereby the SmartActiveTransformer independently adapts to the current network conditions. For this purpose, the voltage carried by the low-voltage bus bar includes all 3 phases, and the control parameters react accordingly. Threshold hunting also prevents build up in the switch due to phase asymmetry.

The definable parameters for the control algorithm include the target voltage (U_{sol}), the step voltage (U_{step}), the dead time (t_1), and the threshold for the high-speed transfer switch (S_0). In addition to parameterisable standard algorithm, individual alternative algorithms may also be implemented as required. Standard protocols also make communicative connection with cross-systems possible.



SmartActiveTransformer

■ The SmartActiveTransformer suits any compact station

The on-load tap changer was specially developed and optimally integrated with the transformer tank in which the switches operate in special vacuum cells to exclude the possibility of oil contamination, thus no second oil vessel is required for the circuit.

The innovative design enables the SmartActiveTransformer to correspond with the dimensions of local network transformers, and it is easily integrated with conventional compact stations. In connection with the control cabinets, it also includes all of the functions that are required for self-sufficient voltage regulation.





Regulator function

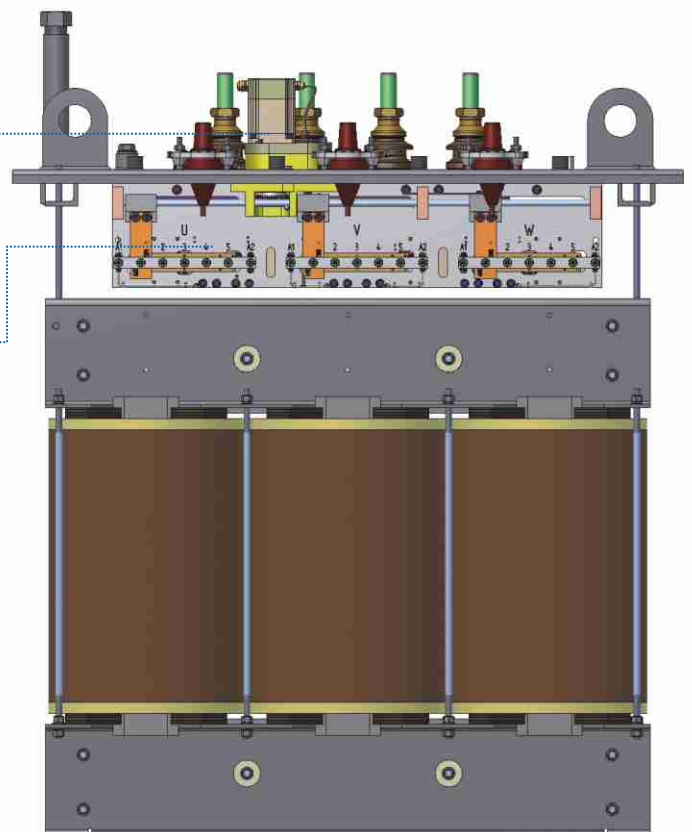
- configuration of the voltage regulation according to the following methods:
 - static nominal value with measurement at the bus bar
 - static nominal value and measurement with remote sensors
 - current dependent nominal value adaption
 - rating dependent nominal value adaption
 - multi sensor evaluation
- voltage regulation on the low-voltage bus bar
- three-phase voltage measurement
- automatic, remote and manual modes
- higher/lower operation
- ethernet and RS232 interfaces
- IEC 60870-5-101, IEC 60780-5-104 and IEC 61850 control system protocols
- MODBUS TCP
- powder-coated sheet metal housing
- IP54 degree of protection

Drive function

- step motor
- duration less than 2 seconds per cycle
- IP65 degree of protection

Load switching function

- on-load tap changer based on the reactor principle
- electric arcs are quenched in specially developed vacuum switch tubes
- space-saving integration
- maintenance-free for the lifetime of the transformer (up to 700,000 cycles)
- regulation on the upper voltage side



TYPE	max. rated through current [A]
iTAPIII30A	30
iTAPIII85A	85

Technical data

Technical data	SmartActiveTransformer	Options
winding material	copper / alu at $B_0 - C_K$	
high voltage	selectable, max. 24 kV voltage class	
steps	up to max 9 steps, configuration selectable e.g. +/- 4 x „X%“; +4/-3 x „X%“; +6/-2 x „X%“	
step voltages	selectable, max. 600V, common 1,5%, 2%, 2,5%	
frequency	50 Hz	
low voltage	selectable	
vector group	Dyn 5	more on request
cooling	ONAN	more on request
max. installation altitude	1000 m over NN	more on request
HV bushings	12 - 24 kV / 250 A plug-bushing DIN 50190	12 - 24 kV / 250 A ceramic-bushing DIN 50386
LV-bushings	flange connection DIN 43675	conductor terminal IEC 61238
tank type	hermetic-corrugated tank	
protective device	non	transformer protection DGPT 2
thermometer pocket	thermometer pocket according to DIN 42554 on LV side	dial thermometer
driving rolls	lengthwise and crosswise DIN EN 50216-4, material: steel	
coating	RAL 7033, total coating thickness $\geq 140 \mu\text{m}$	more on request

Power loss according to ecodesign regulation No 548/2014 (EU)

S_N [kVA]	u_k [%]	P_0 $A_0 + 20\%$ [W]	P_K $B_K + 5\%$ [W]
250	4	360	2880
400	4	516	4040
630	4/6	720	5670
800	6	780	7350

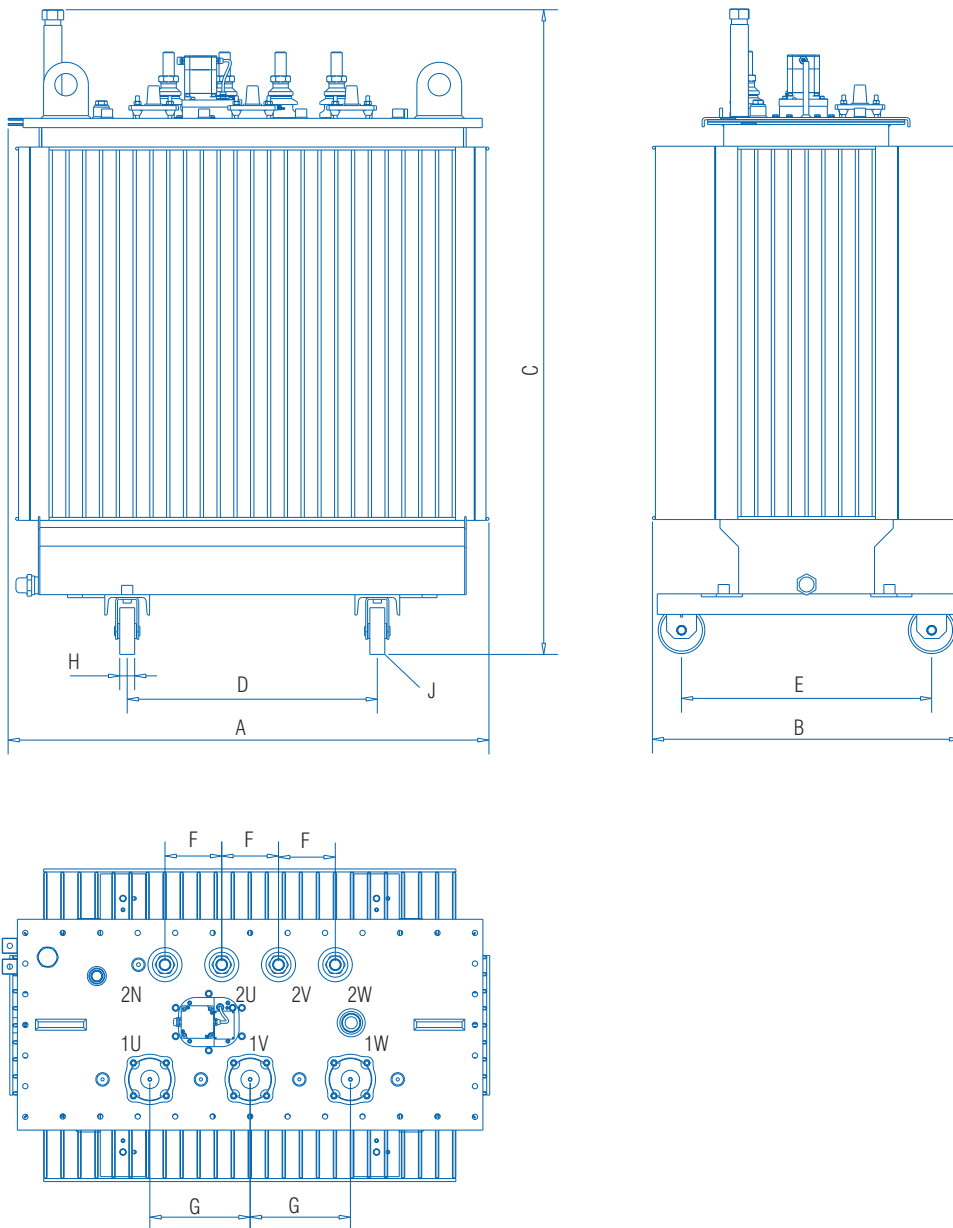
Technical data voltage regulator and control cabinet

permissible voltage range note: measuring voltage is supply voltage	180...264 V AC, 50 Hz U_N : 207...253 V
input current	max. 5,8 A
power consumption	max. 350 VA, typ. 50 VA
frequency	50 Hz
test voltage to ground	2 kV / 1 minute
duration of tap change operation	ca. 2 s
shortest gap between tap-change operation	2 s
interfaces	Ethernet, RS 232
protocols	IEC 60870-5-101, IEC 60870-5-104, IEC 61850
housing (W x H x D)	380 x 380 x 180 mm
weight	15 kg





**J. Schneider
Elektrotechnik**



Dimensions SmartActiveTransformer [mm]

	250 kVA 10/20 kV	400 kVA 10/20 kV	630 kVA 10/20 kV	630 kVA 10/20 kV	800 kVA 10/20 kV
uk	4 %	4 %	4 %	6 %	6 %
A	1080	1260	1410	1500	1550
B	810	900	900	920	1040
C	1650	1650	1750	1750	1800
D	520	670	670	670	670
E	520	670	670	670	670
F	150	150	150	150	150
G	265	265	265	265	265
H	40	40	40	40	40
J	Ø 125	Ø 125	Ø 125	Ø 125	Ø 125



J. Schneider Elektrotechnik GmbH

Helmholtzstrasse 13

D-77652 Offenburg

Germany

Phone +49 / 7 81 / 2 06 -0

Fax +49 / 7 81 / 2 53 18

www.j-schneider.de

info@j-schneider.de