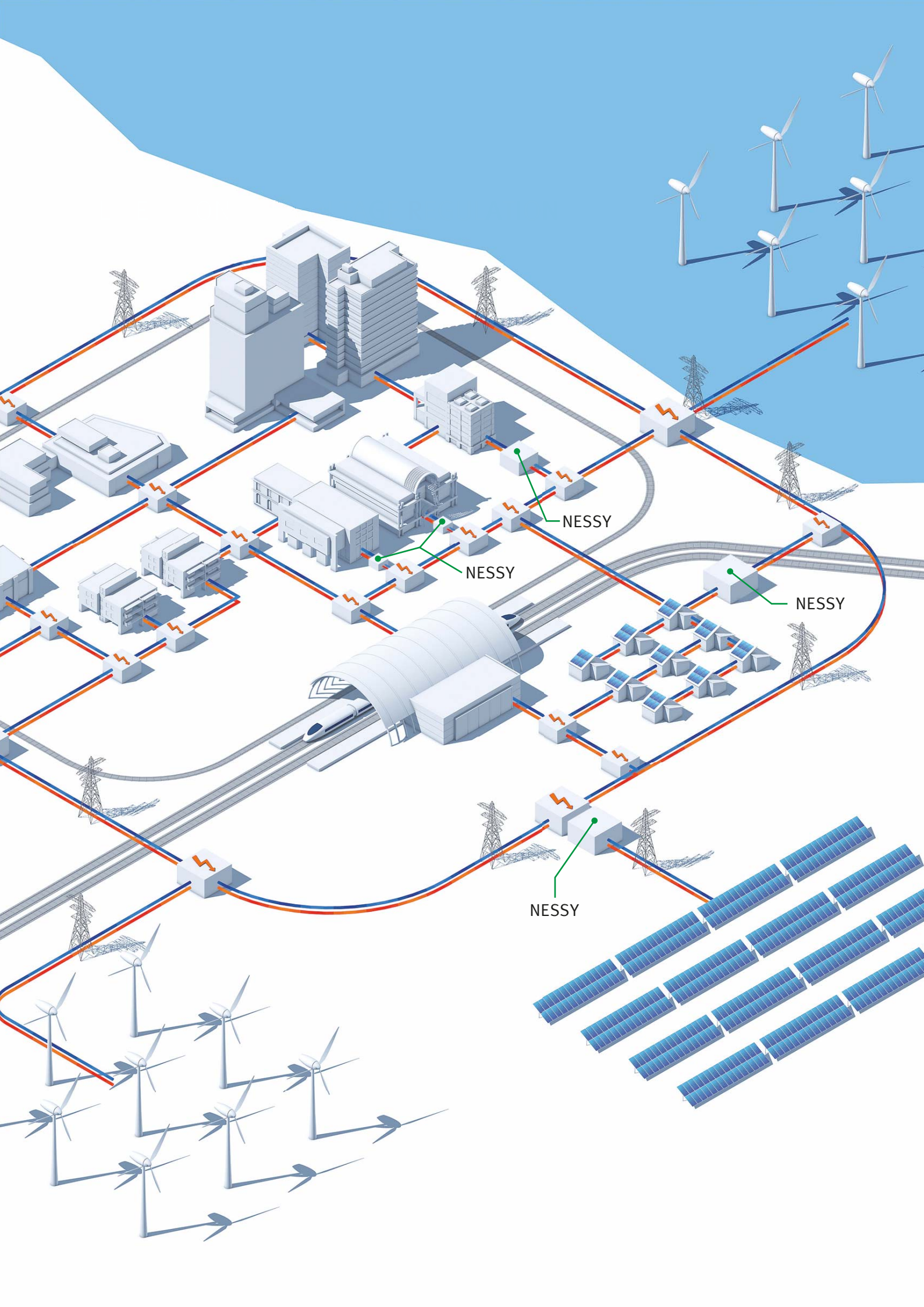
NESSY – NETWORK VOLTAGE STABILISATION SYSTEM

Permanent protection against voltage fluctuations in the low-voltage network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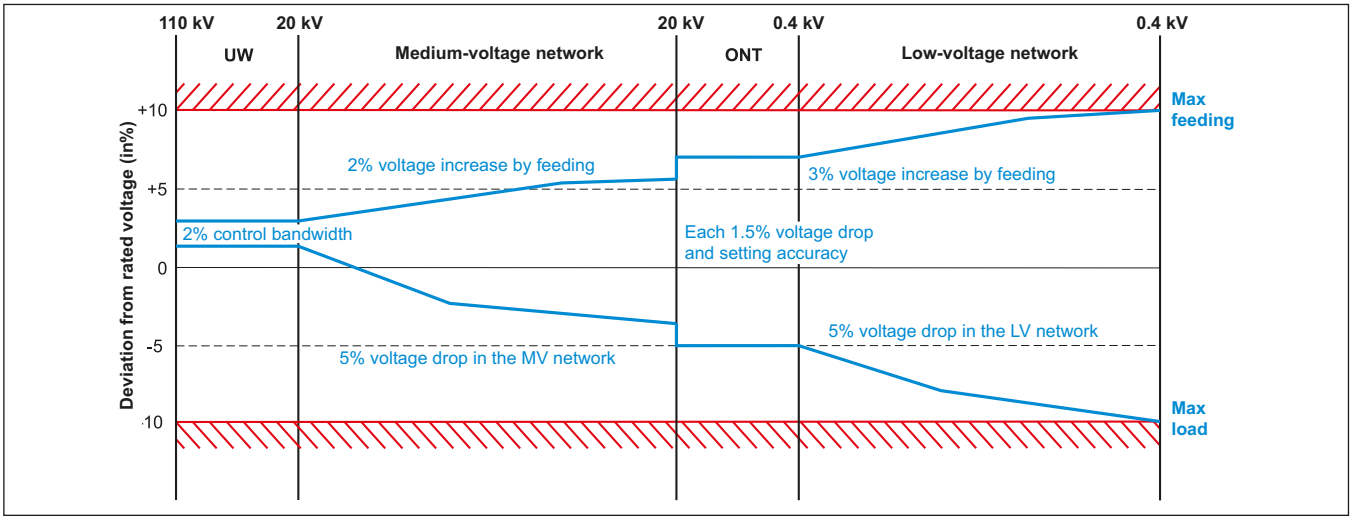
According to the Distribution Network Study of 2014, the installed wind power and photovoltaic output is set to double or even treble by the year 2032. The volatile EE supply means that significantly more than 25% of rural networks will have problems with voltage band violations.

The network voltage stabilisation system (NESSY) is an effective protection and economic alternative to controllable local network transformers (rONT).

VOLTAGE BAND VIOLATIONS PUT NETWORK STABILITY AT RISK

In low-voltage networks, the voltage band may not deviate from the rated voltage by more than ± 10% maximum (EN 50160). At the same time, decentralised energy producers (EE) may only increase the voltage by 3% during the energy feeding process (BDEW). Compliance with both standards and regulations leads to major problems when it comes to complying with the voltage band in distribution networks, as voltage fluctuations increase considerably due to the rising share of renewable energies.

Depending on the EE scenario, the installed wind power and photovoltaic output is set to double or even treble by the year 2032 (BMWi Distribution Network Study 2014). The volatile EE supply will rise significantly and the distribution networks will become distributing and receiving networks. This results in increasingly frequent local voltage surges, frequency deviations and numerous dynamic processes with negative consequences on the network stability.

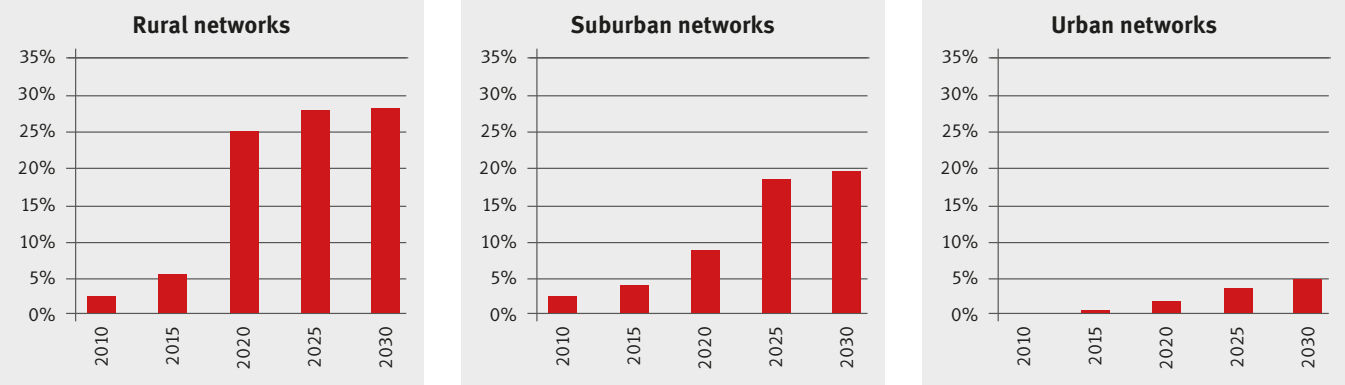


A voltage increase by 3% is already attained at supply ratings that can be significantly below the transmission capacity of the medium-voltage and low-voltage lines (cf. Distribution Network Study)

EVERY FOURTH RURAL NETWORK WITH VOLTAGE FLUCTUATIONS

Depending on the local network structure, the effects on the voltage quality are nevertheless very different. Rural and suburban networks – with large decentralised feeders such as solar farms, wind farms and biogas plants and, at the same time, few consumers – are affected much more by voltage fluctuations.

The RWTH Aachen already came to the conclusion in 2012 that by 2020 approx. 25% of rural networks will have problems with voltage band violations. As a result of the more rapid EE annex, these problems will presumably occur even earlier and to a greater extent.



Share of low-voltage networks with voltage band violations (based on data of the RWTH Aachen, 2012)

VOLTAGE FLUCTUATIONS PUT IT SYSTEMS, MACHINES AND PLANTS AT RISK

Voltage deviations can cause IT systems, industrial controls, machines or hospital installations to fail or damage these considerably, or outputs of drives and process engineering systems can be changed. The extent of voltage fluctuations in low-voltage networks is often not even known owing to the lack of measuring equipment.

“The demands by electricity consumers for the quality of the voltage have risen significantly due, in particular, to the high sensitivity of IT devices. Thus electronic controls respond most sensitively to voltage fluctuations, even if these only occur within a fraction of a second.” (Network Technology / Network Operation Forum in the VDE)

This also has legal consequences for network operators: according to the Federal Court of Justice, network operators are liable according to the Product Liability Act for damage due to surge voltage (Federal Court of Justice, 25.02.2014 - VI ZR 144/13).

INTELLIGENT TECHNOLOGIES FOR VOLTAGE STABILISATION

The ZZ annex leads to a fundamental conversion of the distribution networks. The use of intelligent technologies means that the network development in the low voltage can be almost completely avoided (BMWi Distribution Network Study). Controllable local network transformers (rONT) and low-voltage control systems / voltage linear controllers are the most suitable system for this. The technologies are tested and sophisticated.

In these systems, the voltage is measured locally, processed there and a control performed independently. A connection to an external control or a control system is possible but not necessary. According to the Distribution Network Study, such an 'autonomous' function is perfectly adequate for the application in 95% of cases.

NESSY MAKES EXISTING LOCAL NETWORK TRANSFORMERS “CONTROLLABLE”

The network voltage stabilisation system (NESSY) or the controllable local network transformer (rONT) are equally effective, but have different strengths and application fields.

NESSY is based on a microcontroller-based control and is a further development of the established section controller/voltage linear controller technology. With NESSY existing local network transformers can be retrofitted. This makes the ONT “controllable”. NESSY has a cost advantage here, because the existing transformers do not have to be replaced.

NESSY can be used for both oil and cast resin transformers. This is, above all, relevant for industrial networks or shopping centres with their own medium-voltage supply. These frequently utilise cast resin transformers that cannot be replaced by rONT.

NESSY 150 kVA

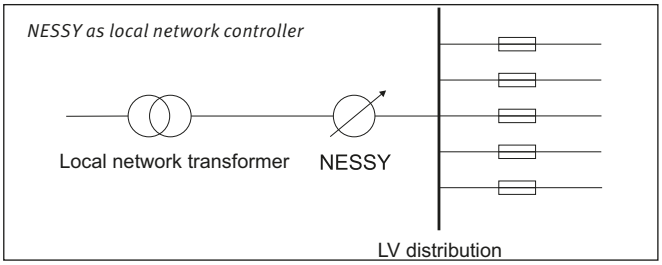
ADVANTAGE IN RURAL AND SUBURBAN NETWORKS

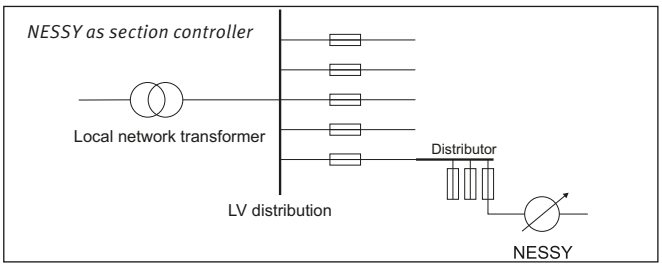
NESSY can also be used as a section controller / voltage linear controller to correct asymmetries. These strengths are above all required in rural and suburban networks, where larger feeders put loads on individual network sections. Here, targeted regulation of the relevant section is more effective and cheaper.

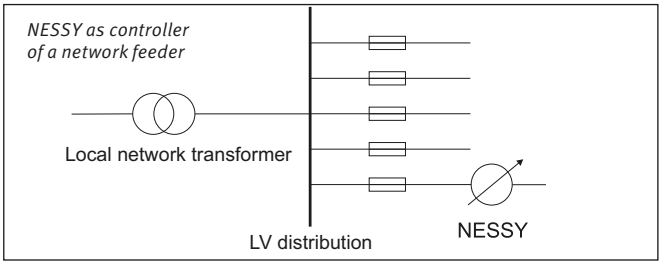
“The use of a voltage linear controller is above all advantageous where the installed output of EE systems distributes very unevenly to the feeders of a low-voltage network.

Regulation of the busbar voltage and hence even voltage regulation of all feeders by a controllable local network transformer might not be adequate for this.” (BMWi Distribution Network Study)

In comparison to urban networks, the cable sections are also longer and the voltage drop greater at the line between the controller and consumer. This is, for example, relevant for areas where 630 kVA transformers cover individual networks for the voltage supply, such as supplying local networks, department stores, commercial or industrial enterprises. Here too the use of NESSY is more effective and economical.

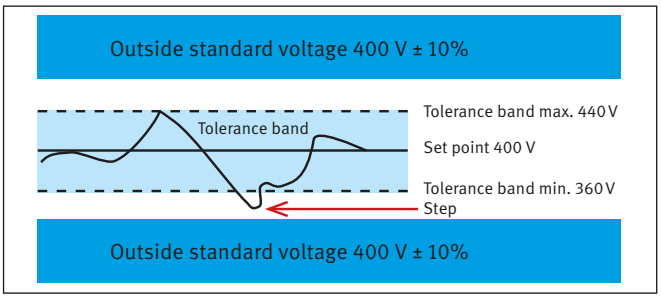






NESSY PROTECTS EFFECTIVELY AGAINST VOLTAGE FLUCTUATIONS

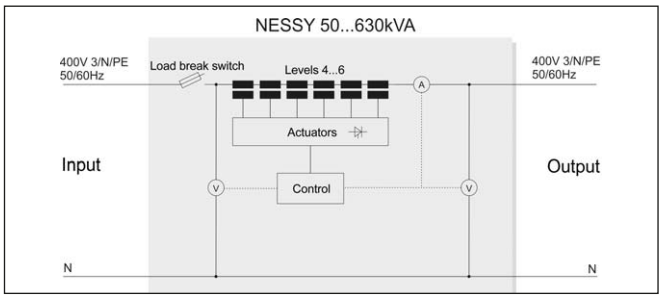
Using the electronic network voltage stabilisation system (NESSY) systems for existing local network transformers enables the network voltage to be kept permanently within the tolerance band of ± 10 %.



Robust, maintenance-free control
The measurement values (voltage and current) are measured on the consumer side and logged by a PLC. Via a microcontroller-based control, semiconductor components (Triacs) are triggered as activators. Depending on the voltage deviation, 1 to 6 transformers are either switched in (voltage increase if voltage too low) or switched in the opposite direction (voltage reduction if voltage too high).

In contrast to other electromechanical solutions with switches, extremely robust and maintenance-free Triacs are used as actuators with NESSY.

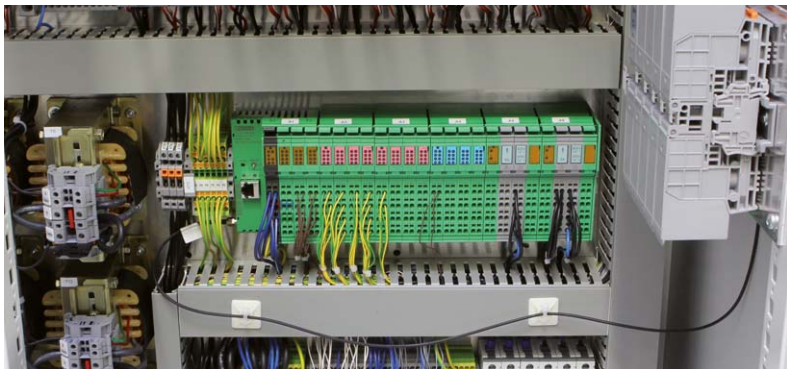
Voltage steps available for selection
Transformers adjust the output voltage can be adjusted "up" or "down" in voltage steps. The adjustment range is e.g. ±10% in ±4 x 2.5% steps. The voltage steps can be selected. The controller



draws voltage values from the busbar, based on which the steps are determined.

Rapid control, high efficiency
The control is fast responsive and attains a regulation speed of 150 ms per step. The efficiency is › 99%.

Operation is safeguarded against faults
In the event of a fault or during maintenance of the power electronics, a contactor becomes active, which puts the step transformers out of operation (Save mode). The network thus continues to be fully ready and operational without control device.



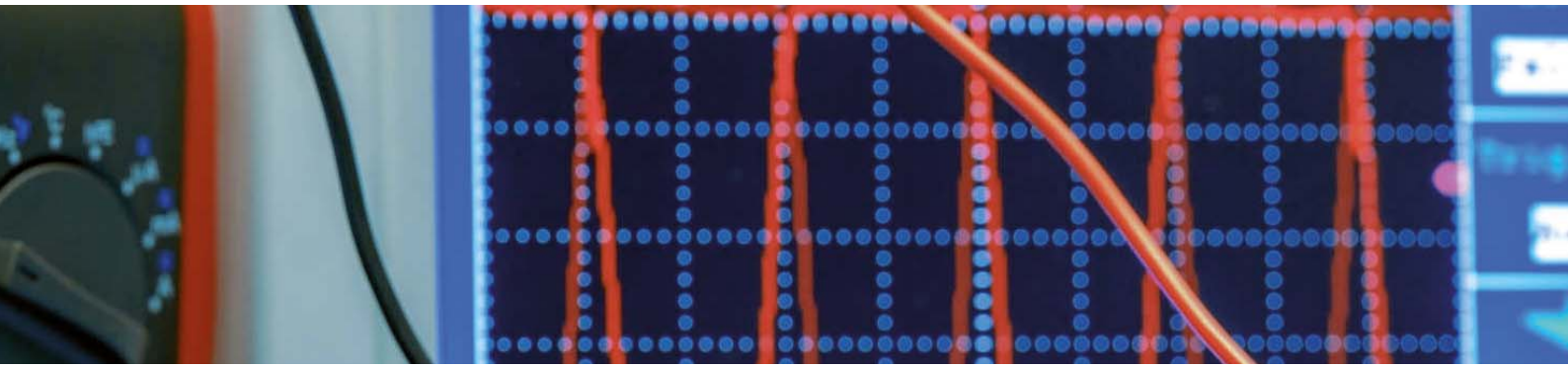
QUICKLY INSTALLED, FLEXIBLE AND COST EFFECTIVE

NESSY does not require any network conversion, is easy to install and available immediately. The capacity of the distribution network for EEE feeding therefore also increases without cost-intensive network development measures.

Control for individual network sections or phases
In the case of a large number of local networks, a complete renewal of the local network transformer is uneconomical. Small decentralised voltage controllers are often more advisable in order to stabilise only individual network sections, for example. While local network transformers always control all three phases, it can be advisable in an industrial network with very different load distribution to control individual phases specifically. Such a voltage optimisation is more economical and, as an "electrotechnical firewall", increases the operational safety and system availability. A controlled voltage also stabilises sensitive drives and processes.

Flexible and individually controllable
With NESSY, both the voltage band and the voltage steps can be selected. If the voltage is inside the specified range, the controller is thus in automatic wait mode. If the voltage is outside the specified range, the automatic control is thus active.

If the tolerance band setting is, say, ±5%, the control range extends with ±10% to ±15% of the rated voltage U_N. The freely adjustable tolerance band and a reduced supply voltage allow energy and cost optimisations to be achieved in an industrial enterprise.



SYSTEM VARIANT NESSY

	NESSY 50	NESSY 75	NESSY 100	NESSY 125	NESSY 150	NESSY 200
Rated power	50 kVA	75 kVA	100 kVA	125 kVA	150 kVA	200 kVA
Rated voltage	3 × 400 V (3PH+N)	3 × 400 V (3PH+N)	3 × 400 V (3PH+N)	3 × 400 V (3PH+N)	3 × 400 V (3PH+N)	3 × 400 V (3PH+N)
Rated current	72 A	108 A	144 A	180 A	216 A	288 A
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz
Control range	± 6% … ± 15% of U_N	± 6% … ± 15% of U_N	± 6% … ± 15% of U_N	± 6% … ± 15% of U_N	± 6% … ± 15% of U_N	± 6% … ± 15% of U_N
Switching	Separate stabilisation of all 3 phases	Separate stabilisation of all 3 phases	Separate stabilisation of all 3 phases	Separate stabilisation of all 3 phases	Separate stabilisation of all 3 phases	Separate stabilisation of all 3 phases
Number of steps (per phase)	4, 5, 6	4, 5, 6	4, 5, 6	4, 5, 6	4, 5, 6	4, 5, 6
Step width	1.5%, 2%, 2.5%	1.5%, 2%, 2.5%	1.5%, 2%, 2.5%	1.5%, 2%, 2.5%	1.5%, 2%, 2.5%	1.5%, 2%, 2.5%
Dead band	Adjustable	Adjustable	Adjustable	Adjustable	Adjustable	Adjustable
Response time	150 … x ms (Programmable)"	150 … x ms (Programmable)"	150 … x ms (Programmable)"	150 … x ms (Programmable)"	150 … x ms (Programmable)"	150 … x ms (Programmable)"
Stabilisation time (Min. – Max.)	‹ 2 sec.	‹ 2 sec.	‹ 2 sec.	‹ 2 sec.	‹ 2 sec.	‹ 2 sec.
Efficiency	› 99%	› 99%	› 99%	› 99%	› 99%	› 99%
Operating time	S1 (Continuous operation)	S1 (Continuous operation)	S1 (Continuous operation)	S1 (Continuous operation)	S1 (Continuous operation)	S1 (Continuous operation)
Communication	GSM/Ethernet	GSM/Ethernet	GSM/Ethernet	GSM/Ethernet	GSM/Ethernet	GSM/Ethernet
Cooling type	AN (Air self-cooling)	AN (Air self-cooling)	AN (Air self-cooling)	AN (Air self-cooling)	AN (Air self-cooling)	AN (Air self-cooling)
Protection class (according to EN 60529)	IP21 / IP54	IP21 / IP54	IP21 / IP54	IP21 / IP54	IP21 / IP54	IP21 / IP54
Setup	Indoor / Outdoor	Indoor / Outdoor	Indoor / Outdoor	Indoor / Outdoor	Indoor / Outdoor	Indoor / Outdoor
Housing colour	RAL 7035	RAL 7035	RAL 7035	RAL 7035	RAL 7035	RAL 7035
Ambient conditions	max. 40°C 1000 m above sea level	max. 40°C 1000 m above sea level	max. 40°C 1000 m above sea level	max. 40°C 1000 m above sea level	max. 40°C 1000 m above sea level	max. 40°C 1000 m above sea level
Relative air humidity	85% (without dew)	85% (without dew)	85% (without dew)	85% (without dew)	85% (without dew)	85% (without dew)
Total weight	220 kg	approx. 450 kg	approx. 500 kg	approx. 500 kg	approx. 500 kg	approx. 650 kg
Dimensions (W × D × H mm)	approx. 800×500×1200	approx. 800×500×1200	approx. 800×500×1200	approx. 1400×500×1200	approx. 1400×500×1200	approx. 1400×500×1200

	NESSY 250	NESSY 315	NESSY 400	NESSY 500	NESSY 630
Rated power	250 kVA	315 kVA	400 kVA	500 kVA	630 kVA
Rated voltage	3 × 400 V (3PH+N)	3 × 400 V (3PH+N)	3 × 400 V (3PH+N)	3 × 400 V (3PH+N)	3 × 400 V (3PH+N)
Rated current	360 A	455 A	578 A	721 A	910 A
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz
Control range	± 6% … ± 15% of U_N	± 6% … ± 15% of U_N	± 6% … ± 15% of U_N	± 6% … ± 15% of U_N	± 6% … ± 15% of U_N
Switching	Separate stabilisation of all 3 phases	Separate stabilisation of all 3 phases	Separate stabilisation of all 3 phases	Separate stabilisation of all 3 phases	Separate stabilisation of all 3 phases
Number of steps (per phase)	4, 5, 6	4, 5, 6	4, 5, 6	4, 5, 6	4, 5, 6
Step width	1.5%, 2%, 2.5%	1.5%, 2%, 2.5%	1.5%, 2%, 2.5%	1.5%, 2%, 2.5%	1.5%, 2%, 2.5%
Dead band	Adjustable	Adjustable	Adjustable	Adjustable	Adjustable
Response time	150 … x ms (Programmable)	150 … x ms (Programmable)	150 … x ms (Programmable)	150 … x ms (Programmable)	150 … x ms (Programmable)"
Stabilisation time (Min. – Max.)	‹ 2 sec.	‹ 2 sec.	‹ 2 sec.	‹ 2 sec.	‹ 2 sec.
Efficiency	› 99%	› 99%	› 99%	› 99%	› 99%
Operating time	S1 (Continuous operation)	S1 (Continuous operation)	S1 (Continuous operation)	S1 (Continuous operation)	S1 (Continuous operation)
Communication	GSM/Ethernet	GSM/Ethernet	GSM/Ethernet	GSM/Ethernet	GSM/Ethernet
Cooling type	AN (Air self-cooling)	AN (Air self-cooling)	AN (Air self-cooling)	AN (Air self-cooling)	AN (Air self-cooling)
Protection class (according to EN 60529)	IP21 / IP54	IP21 / IP54	IP21 / IP54	IP21 / IP54	IP21 / IP54
Setup	Indoor / Outdoor	Indoor / Outdoor	Indoor / Outdoor	Indoor / Outdoor	Indoor / Outdoor
Housing colour	RAL 7035	RAL 7035	RAL 7035	RAL 7035	RAL 7035
Ambient conditions	max. 40°C 1000 m above sea level	max. 40°C 1000 m above sea level	max. 40°C 1000 m above sea level	max. 40°C 1000 m above sea level	max. 40°C 1000 m above sea level
Relative air humidity	85% (without dew)	85% (without dew)	85% (without dew)	85% (without dew)	85% (without dew)
Total weight	approx. 700 kg	approx. 800 kg	approx. 1000 kg	approx. 1000 kg	approx. 1000 kg
Dimensions (W × D × H mm)	approx. 1600×500×1200	approx. 1600×800×2000	approx. 1600×800×2000	approx. 1600×800×2000	approx. 1600×800×2000

PERFORMANCE DATA NESSY

- Throughput capacity: 50 to 630 kVA
- Control range:* ± 6% / ± 15% von U_N
- Step width: * 1.5% / 2% / 2.5%
- Number of steps per phase: 4, 5, 6
- Control speed: 150 ms per step
- Efficiency: › 99%
- Control phase-independent
- Tolerance of the voltage band parameterisable
- 4 quadrant operation possible, i.e. as soon as the power flow is reversed,
  the voltage can be adjusted downward in the network section connected at the secondary end
- Installation in a standard switch cubicle with standardised dimensions.

** Further control ranges and steps on enquiry (e.g. 6 × 2.0 % steps, this resulting in a control range of ± 12 %)*

NESSY 630 kVA

NESSY 50 kVA

RUHSTRAT – OVER 80 YEARS OF EXPERIENCE IN VOLTAGE STABILISER TECHNOLOGY

When the brothers Adolf and Ernst Ruhstrat opened their small electrical shop in 1888 in Göttingen, our company's success story was still unwritten.

Today Ruhstrat Power Technology (RPT) designs and produces electrical testing solutions, voltage optimizers and transformers. In the electrical testing field, RPT specializes in testing facilities for temperature rise, motors and pumps as well as testing systems for high voltage cables (heat cycle tests).

In the area of voltage optimization, RPT relies on over 80 years of experience to offer modern equipment to protect against voltage dips and ensure voltage stabilization. RPT's transformer production for low and middle voltage with control cabinets guarantee a continuous high quality of all electrical elements.

The expert knowledge about the technology of electrical testing solutions, voltage optimizers, transformers and systems with control cabinets, control and PLC, makes us a strong and innovative partner to our customers,

Would you like more information on Ruhstrat and our products? Simply visit our website at: ***www.ruhstrat.com***

Do you have any questions about NESSY network voltage stabilisation systems and/or would you like a concrete offer? You can find various options for contacting us under the quick link ***http://tinyurl.com/nessy-kontakt***. It is even quicker if you scan the QR code displayed on the left with your smartphone/tablet.

Our sales team in office and field service will be pleased to advise you regarding all questions about the product areas listed below.

Electrical testing technology

Voltage optimisation

Transformers

AC/DC reactors

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