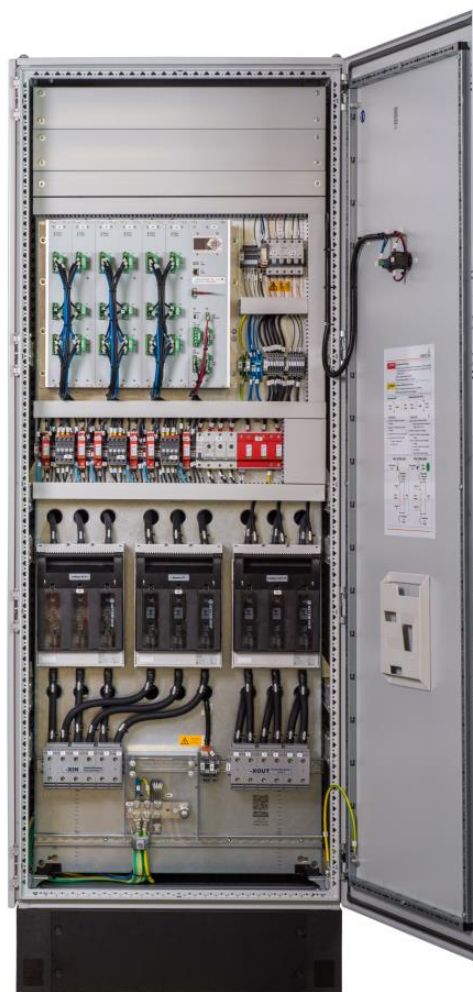


Low Voltage Regulation System

LVRSys™

- Power range: 22 kVA up to 2500 kVA
- Regulation ranges: $\pm 6\% \dots \pm 16\%$
- Number of steps: 9
- Efficiency: 99,4 % up to 99,8 %
- Phase independent regulation
- No grid interference



Voltage stabilization for industrial networks

EN 50160 describes, among other things, the voltage range in which the mains voltage must move. The tolerance limits are $\pm 10\%$, based on the nominal voltage U_N (400 V L-L). This corresponds to a permissible voltage band around U_N of 80 V. Machines, drives and lighting equipment are operated most efficiently when the applied voltage is at the operating point.

As a rule, the optimum operating point is the nominal voltage of the network. Outside the operating point, the efficiency and service life of the drive equipment decreases. Lighting devices such as LEDs in particular rapidly lose operating life as the voltage rises. Especially for industrial applications, the controller can be parameterized with response times of less than 30 ms.

Efficiency increase of 3-phase consumers

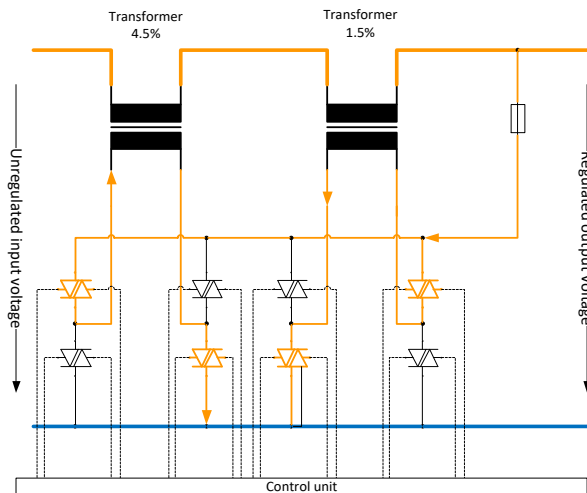
In industrial applications, mostly systems or machines are used which are supplied by a 3-phase / three-phase connection. These systems work most efficiently at nominal voltage U_N e.g. 230 V L-N, thus energy costs can be saved.

Especially three-phase motors have a big problem with unbalanced phase voltages. This asymmetry of L1/L2/L3 is significantly reduced by the control, which means increased efficiency and service life (e.g. alternating cycles of the motor carbons).

We take care of it.

Operation

The principle of the LVRsys™ control is similar to a linear regulator. By coupling and uncoupling two transformers with selected transfer ratios, it is possible to regulate the output voltage in 9 steps. The thyristors switch intelligently and avoid any current surges, voltage dips and harmonics.



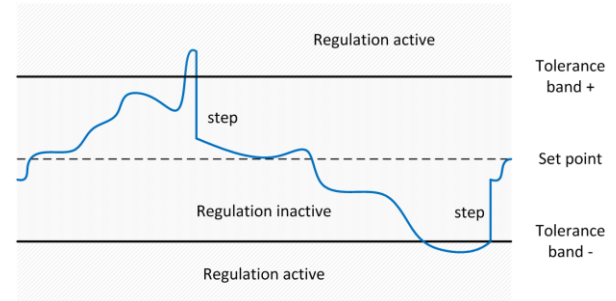
Example for 3 % voltage reduction

Step	Transformer 1,5%	Transformer 4,5%
+6 %	+1,5 %	+4,5 %
+4,5 %	0 %	+4,5 %
+3 %	-1,5 %	+4,5 %
+1,5 %	+1,5 %	0 %
0 %	0 %	0 %
-1,5 %	-1,5 %	0 %
-3 %	+1,5 %	-4,5 %
-4,5 %/	0 %	-4,5 %
-6 %	-1,5 %	-4,5 %

Generation of voltage levels; E.g. system ±6 %

Regulation parameters

- Set point (voltage value, 3-phase)
- Tolerance band +
(Upper limit value of the tolerance area)
- Tolerance band -
(Lower limit value of the tolerance area)
- Reaction time
- Balancing of the 3-phase voltages within the tolerance area



Regulation range

Balancing of the three-phase voltage

The phase-independent regulation enables the *balancing* of the three-phase voltages and thus improves the power quality of the grid. Three-phase

loads, such as motors, operate with a symmetrical voltage more efficiently and have in consequence a longer product life cycle.

Perfect scaling for all industrial power supply grids

Power classes from 22 kVA to 2500 kVA are available specifically for low-voltage networks in industrial plants.

LVRsys™ flexible and robust for any application



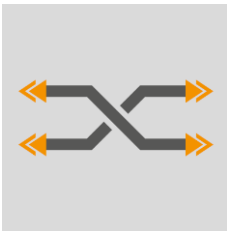
Robust

- Twenty billions of switches
- Short circuit proofed up to 50 kA
- High resistance to over voltages, direct and indirect lightning strikes
- Overloading (as NH-Fuse)



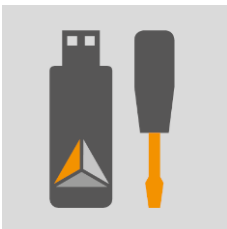
Reliable and economical

- High efficiency
- Passive cooling
- Operation temperature -40 °C up to +50 °C ambient temperature



Flexible and fast

- Adjustable response time of the controller < 30 ms up to 100 s
- Adaption of the control algorithms to different applications
- Line drop compensation, without additional communication
- Independent tolerance bands



Easy

- Data export via USB-Stick into e. g. MS Excel
- Firmware update via USB-Stick or SCADA Systems
- Common communication interfaces *Modbus TCP, IEC 60870-5-104*
- Drag indicator in the Display

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Design and installation

Depending on the power requirements, the control cabinets are designed in different sizes.



Various housings sorted by power

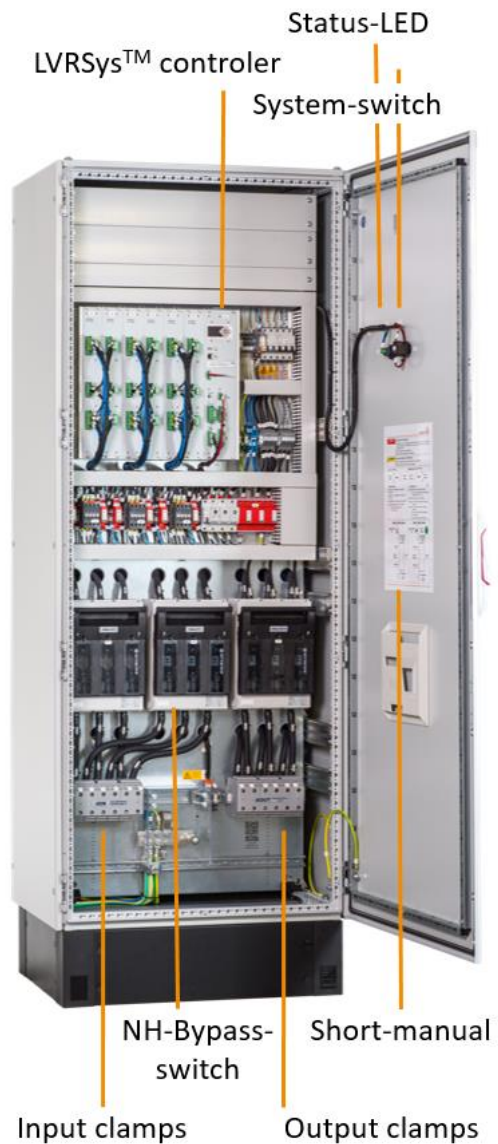
Transportation of the systems

The cabinets can be transported on pallets.

Installation & commissioning (systems up to 400 kVA)

The installation and commissioning of the system follows simple steps:

1. Disconnect mains power
2. Insert cable
3. Connect desired cables to the clamps
4. Reconnect mains power
5. Switch to control mode via bypass switch
6. Set system switch to ON (system controls with factory-set parameters, sufficient in 90% of cases)



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Technical data

Rated data	
Rated voltage U_N	400 V / 230 V ± 30 % (L-L/LE)
Rated current I_N 3-phase/1-phase	32 A (22 kVA system) 63 A (44 kVA system) 100 A (70 kVA system) 160 A (110 kVA system) 200 A (144 kVA system) 250 A (175 kVA system) 300 A (200 kVA system) 355 A (250 kVA system) 580 A (400 kVA system) 1450 A (1000 kVA system) 2300 A (1600 kVA system) 2900 A (2000 kVA system) 3600 A (2500 kVA system)
Rated frequency f_N	50 Hz / 60 Hz
Efficiency	99,4 % – 99,8 %
Maximum switching duration	30 ms
Regulation ranges	± 6 % of U_N in 9 steps á 1,5 % ± 8 % of U_N in 9 steps á 2,0 % ± 10 % of U_N in 9 steps á 2,5 % ± 12 % of U_N in 9 steps á 3,0 % ± 14 % of U_N in 9 steps á 3,5 % ± 16 % of U_N in 9 steps á 4,0 %
Operating temperature	- 25 °C up to + 50 °C
Altitude of the installation (NN)	< 2000 m
Safety class	IP21
Max. power consumption of secondary electronics	200 mA (230 V)
Short-circuit impedance u_k	ca. 0,2 - 0,3 %
Cooling	passive (convection via control cabinet housing)

Limits	
Rated impulse voltage U_{Imp}	6 kV
Short time current resistance I_{cw} (1 s)	5 kA (up to 110 kVA) 15 kA (144 kVA to 630 kVA) 40 kA (1000 kVA to 2500 kVA)
Rated conditional short-circuit current I_{cc}	20 kA (up to 110 kVA) 50 kA (144 kVA to 2500 kVA)
Rated conditional short-circuit current I_{cf} protected with fuses	3 kA (22 kVA) 20 kA (175 kVA) 5 kA (44 kVA) 25 kA (200 kVA) 10 kA (70 kVA) 30 kA (250 kVA) 14 kA (110 kVA) 50 kA (400 kVA)

	16 kA (144 kVA)	50 kA (630 -2500 kVA)
High rated peak withstand currents I_{pk}	20 kA (up to 110 kVA)	
	50 kA (144 to 630 kVA)	
	80 kA (1000 kVA to 2500 kVA)	

	Dimensions B/T/H	Weight	Power
Cabinet	60 cm/60 cm/180 cm	300 kg	up to110 kVA
	90 cm/60 cm/200 cm	600 kg	up to175 kVA
	120 cm/80 cm/200 cm	800 kg	up to630 kVA
	2 x 120 cm/80 cm/200 cm	2 x 700 kg	up to1000 kVA
	3 x 120 cm/80 cm/200 cm	3 x 1200 kg	up to1600 kVA
	4 x 120 cm/80 cm/200 cm	4 x 1400 kg	up to2500 kVA
Base	60 cm/60 cm/20 cm	20 kg	up to110 kVA
	80 cm/60 cm/20 cm	30 kg	up to175 kVA
	120 cm/80 cm/20 cm	40 kg	up to630 kVA
	2 x 120 cm/80 cm/200 cm	2 x 40 kg	up to1000 kVA
	3 x 120 cm/80 cm/200 cm	3 x 40 kg	up to1600 kVA
	4 x 120 cm/80 cm/200 cm	4 x 40 kg	up to2500 kVA

Directives	
EMC stability	DIN EN 61000-6-1
EMC interference emission	DIN EN 61000-6-3
Assembly instructions	DIN EN 61439-1/5
Low voltage directive	2014/35/EU
Noise emissions	< 50 dB(A)

We take care of it.

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Subject to change.
