

Low Voltage Regulation System LVRSys™ - PM (Pole-Mount)

- ▶ Power range (single-phase): 7.5 kVA – 35 kVA
- ▶ Power range (three-phase): 22 kVA – 70 kVA
- ▶ Regulation range: $\pm 6\%$ / $\pm 8\%$ / $\pm 10\%$
- ▶ Step size: 1.5% / 2% / 2,5%
- ▶ Overall efficiency: 99.5%
- ▶ Regulation in all four quadrants
- ▶ Programmable voltage tolerance band
- ▶ Clean output - No interference generated

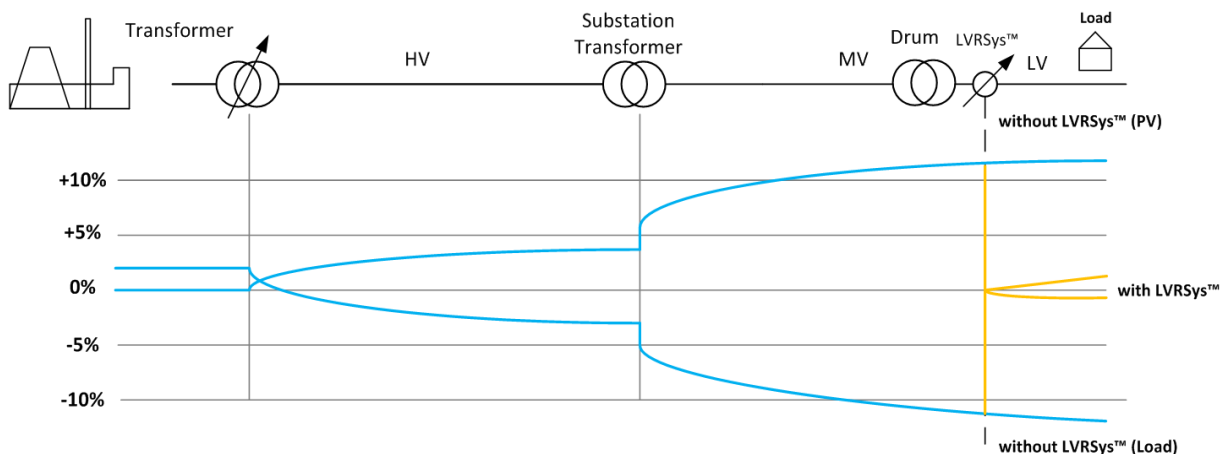


Application

LVRSys™ - PM is a low voltage regulation system that provides a cost-effective alternative to re-conductoring or installing additional line capacity to deal with voltage issues. It can be used on all low voltage Distribution Networks where voltage problems exist.

Voltage problems can occur locally (on single lines) or at the level of an entire low voltage Distribution Network. LVRSys™ - PM can be used with flexibility as a line regulator or as a regulator at a local LV Substation.

Power Generation



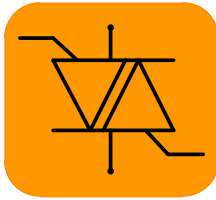
Voltage profile, with and without LVRSys™ - PM

Regulation of the line voltage

If single lines are affected by voltage issues, it is cost effective to use LVRSys™ - PM as a line regulator. The power levels to be regulated are low and therefore the use of the system is cost-effective.

A classic application for example is a circuit with multiple roof top (PV) photovoltaic installations or loads connected.

LVRSys™ - PM flexible and robust for every application



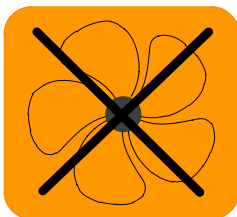
Robust

- ▶ Twenty billions switch operations
- ▶ Short circuit proof, up to 20 kA
- ▶ High resistance to over voltages, direct and indirect lightning strikes
- ▶ Overloading (as NH-Fuse)



Grid compatibility

- ▶ No grid interference, does not cause flicker or generate harmonics
- ▶ Balancing of the voltage via phase-independent regulation
- ▶ Existing fuse concept can be maintained
- ▶ Interruption-free power supply guaranteed (*Automatic Bypass*)



Reliable and economical

- ▶ High efficiency
- ▶ No air exchange with the environment even in direct sunlight
- ▶ 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



Easy

- ▶ Data export via USB-Stick in 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

Technical data

Rated data		
Rated voltage U_N	400 V / 230 V $\pm 20\%$ (L-L/LE)	
Rated current I_N	Single – Phase Systems	Three – Phase Systems
	32 A (7.5 kVA System)	32 A (22 kVA System)
	63 A (15 kVA System)	63 A (44 kVA System)
	160 A (35 kVA System)	100 A (70 kVA System)
Rated frequency f_N	50 Hz / 60 Hz	
Efficiency	99.5 %	
Maximum switching duration	30 ms	
Regulation ranges	$\pm 6\%$ from U_N in 9 steps \acute{a} 1.5 % $\pm 8\%$ from U_N in 9 steps \acute{a} 2.0 % $\pm 10\%$ from U_N in 9 steps \acute{a} 2.5 % up to $\pm 24\%$ from U_N (Special design)	
Operating temperature	- 40 °C up to + 50 °C Ambient	
Maximum permitted air temperature in the switch cabinet	70 °C	
Altitude of the installation (NN)	< 2000 m	
Safety class	IP55	
Max. power consumption of secondary electronics	200 mA (230 V)	
Short-circuit impedance u_k	ca. 0.3 %	
Cooling	Passive, no direct air exchange with environment	

Limits	
Rated impulse voltage U_{Imp}	6 kV
Short time current resistance I_{cw} (1 s)	5 kA (up to 100 A phase current)
	15 kA (up to 200 A phase current)
Rated conditional short-circuit current I_{cc}	20 kA (up to 100 A phase current)
	50 kA (up to 200 A phase current)
Rated conditional short-circuit current I_{cf} protected with fuses	3 kA (7,5 kVA)
	5 kA (15 kVA)
	10 kA (35 kVA)
High rated peak withstand currents I_{pk}	20 kA (up to 100 A phase current)
	50 kA (up to 200 A phase current)

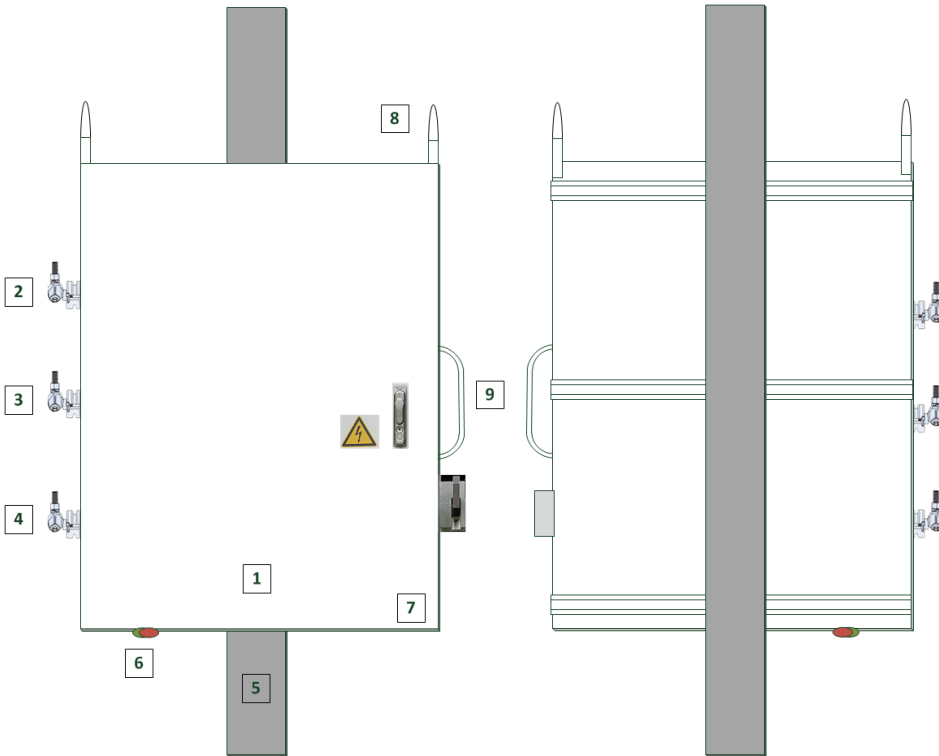
We take care of it.

Dimensions and weight		
Switch cabinet dimensions W/D/H	Single – Phase Systems	Three – Phase Systems
	550 mm/270 mm/700 mm	800 mm/300 mm/1200 mm
Weight switch cabinet	Single – Phase Systems	Three – Phase Systems
	45 kg (7.5 kVA System)	100 kg (22 kVA System)
	50 kg (15 kVA System)	120 kg (44 kVA System)
	65 kg (35 kVA System)	150 kg (70 kVA System)

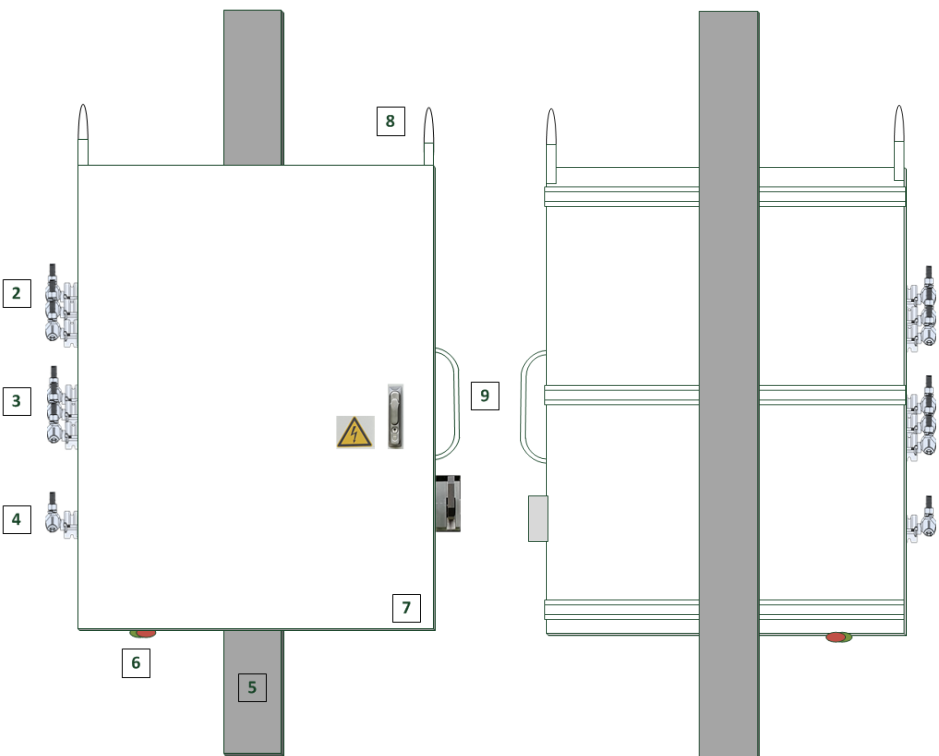
Directives	
EMC stability	DIN EN 61000-6-1
EMC interference emission	DIN EN 61000-6-3
Assembly instructions	DIN EN 61439-1/5
Low voltage directive	2014/35/EU
Noise emissions	< 37 dB(A)

Mounting & Installation

LVRSys™ - PM is suitable for mounting outdoors on a pole.



Mounting and Installation scheme LVRSys™ - PM 1-phase 7.5 kVA to 35 kVA ratings



Mounting and Installation scheme LVRSys™ - PM 3-phase 22 kVA to 70 kVA ratings

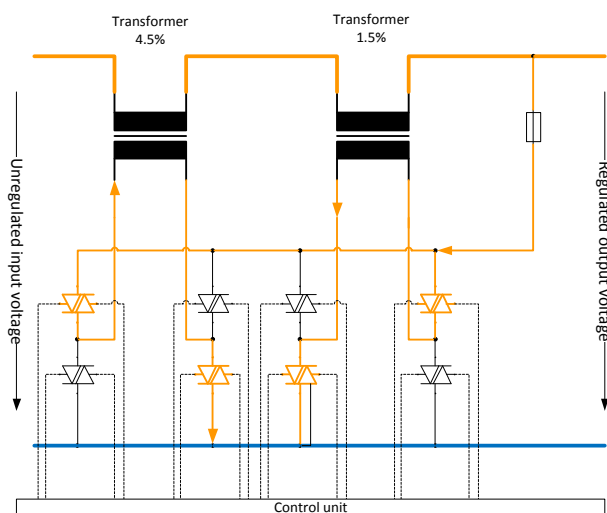
No.	Description
1	Switch cabinet LVRSys™ - PM
2	External insulators for termination input
3	External insulators for termination output
4	External insulators for termination PEN
5	Pole
6	Operation light
7	System switch (Hot stick)
8	Crane lugs
9	Handle
10	Uni-strut type - Profile rail with slot nuts

A *Hot stick System switch – ON/OFF* is provided on the side of the connection box. The *System switch* in *OFF* position sets the LVRSys™ - PM in *BYPASS – mode*, over the contactors. In *ON* position is the LVRSys™ - PM in *CONTROL - mode* and regulates the voltage. It provides easy service accessibility.

The Operation light is clearly visible from the ground beneath the LVRSys™ - PM and indicates that the system is in operation (healthy state).

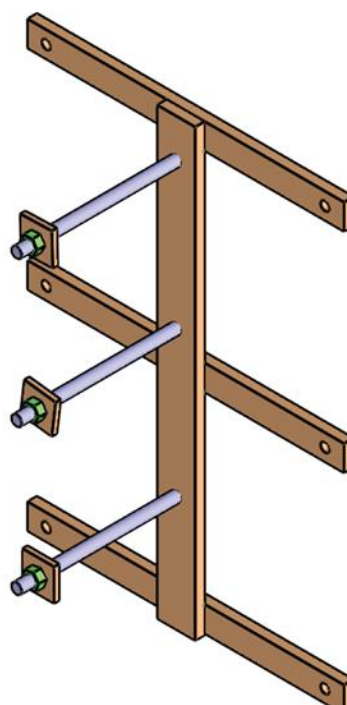
Operation

The principle of the LVRSys™ - PM control is of 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



Example of 3 % voltage reduction

Mounting frame is available as an option.



Mounting frame for poles

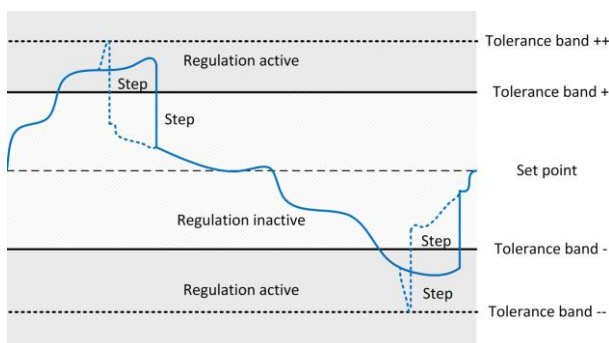
switch intelligently and avoid any current surges, voltage dips and harmonics.

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 the voltage levels in 9 steps

Regulation parameters

- ▶ Set point (voltage value)
- ▶ Tolerance band +
(Upper limit value of the tolerance area)
- ▶ Tolerance band -
(Lower limit value of the tolerance area)
- ▶ Reaction time
- ▶ Line drop compensation
Current values are included in regulation
- ▶ Remote measurement



Regulation range

Communication

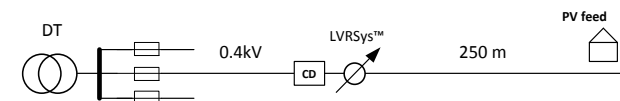
Within the LVRsyst™ - PM the controller has a Modbus TCP/IP Interface and an IEC 60870-5-104 Interface which can be used for the communication to SCADA or for remote access purposes.

Line drop compensation

The reference voltage value is calculated from the current measurement and the grid impedance. The regulation can thereby be optimized without additional communication devices.

If load is applied, the calculated voltage value is reduced, if feed in is applied, the calculated voltage value is increased.

Example for grid impedance regulation:



Example: Line with 250 m cable between LVRsyst™ and PV feed

In this line a PV system feeds current into the grid. The grid impedance regulation calculates the voltage drop of the cable in addition.

The LVRsyst™ - PM regulates the voltage at the end of the cable into the tolerance bands. The regulation area is widened and the voltage at the end of the line is regulated.

All set up parameters of the regulator can be changed and all measurements read via Modbus. It is also possible to operate the system remotely (Hand mode/Automatic mode/Step change).

Time synchronisation is via NTP-Server.

We take care of it.

Ordering Details

For determining ordering details:

Only one code with the same capital letter is possible.

Characteristics	Code	
Low Voltage Regulation – Pole mount System 1-phase		
Low Voltage Regulation System 35 kVA 1-phase	LVRSys-PM 35-1/230	<input type="checkbox"/>
Low Voltage Regulation System 15 kVA 1-phase	LVRSys-PM 15-1/230	<input type="checkbox"/>
Low Voltage Regulation System 7.5 kVA 1-phase	LVRSys-PM 7,5-1/230	<input type="checkbox"/>
Low Voltage Regulation – Pole mount System 3-phase		
Low Voltage Regulation System 70 kVA 3-phase	LVRSys-PM 70-3/230	<input type="checkbox"/>
Low Voltage Regulation System 44 kVA 3-phase	LVRSys-PM 44-3/230	<input type="checkbox"/>
Low Voltage Regulation System 22 kVA 3-phase	LVRSys-PM 22-3/230	<input type="checkbox"/>
Regulation range/step size 1-phase or 3-phase		
± 6% in 1,5% steps	S1	<input type="checkbox"/>
± 8% in 2% steps	S21	<input type="checkbox"/>
± 10% in 2,5% steps	S31	<input type="checkbox"/>
Control /switching speed		
< 1 s (Standard)	E1	<input type="checkbox"/>
< 30 ms	E2	<input type="checkbox"/>
Communication		
Modbus TCP/IP	L1	<input type="checkbox"/>
IEC 60870-104	L2	<input type="checkbox"/>
Other choices on request	L9	<input type="checkbox"/>
Mounting frame		
Mounting frame (1-phase)	MF1	<input type="checkbox"/>
Mounting frame (3-phase)	MF2	<input type="checkbox"/>

Higher Rated LVRSys are available - up to 630 kVA

This Datasheet details Single Phase Pole Mount LVRSys. A.Eberle also manufacture higher rated 3-Phase Systems designed for pad mount. These are described in a separate Datasheet.

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