PowerLogic DVR

Catalog 2023

Dynamic Voltage Restorer for steady supply of voltage for continuity in production process

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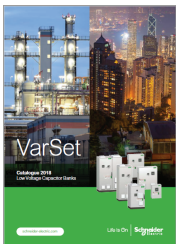

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Power Quality - Voltage Disturbances



It is well-documented that power quality issues are one of the most significant and costly impacts on electrical systems. Studies have shown poor power quality costs the European economy up to €150 billion annually and the U.S. economy up to $188 billion annually, according to two independent studies by the Leonardo Power Quality Initiative and the Electric Power Research Institute (EPRI), respectively.

One economic model summarizes the total cost associated with power quality events as follows:

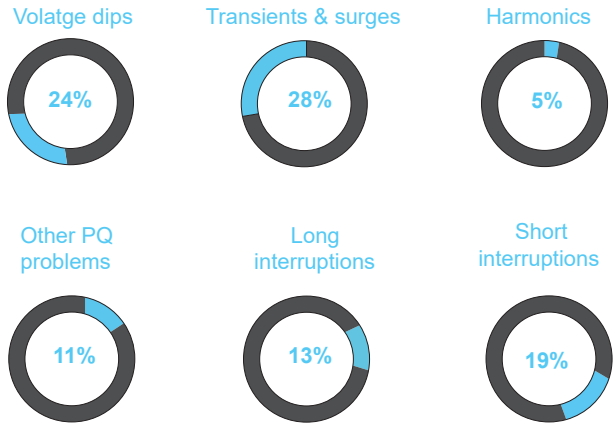
Total losses = production losses + restart losses + product/material losses + equipment losses + third-party costs + other miscellaneous costs

Other miscellaneous costs may include intangible losses such as a damaged reputation with customers and suppliers or more direct losses such as the devaluation of credit ratings and stock prices.

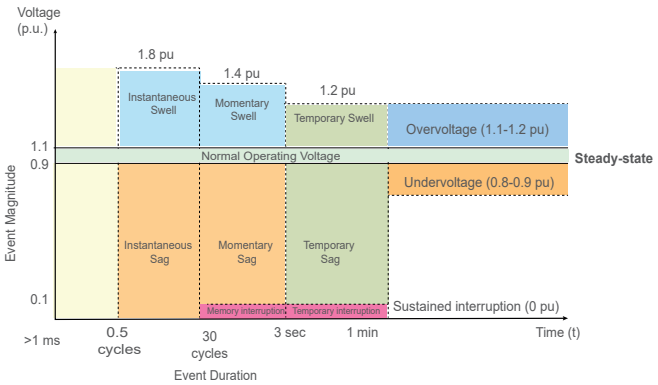
The seven power quality categories defined by IEEE 1159-2019, short-duration rms variations are the most disruptive and have the largest universal economic impact on energy consumers. Short-duration rms variations include voltage sags/dips, swells, instantaneous interruptions, momentary interruptions and temporary interruptions. One study by EPRI estimates an average of 66 voltage sags are experienced by industrial customers each year. As the trend of industries becoming more dependent on sag-sensitive equipment has increased, so has the impact of these events.

In Summary, more than 50% of the Power Quality issues comes from voltage disturbances and Dynamic Voltage Restorer (DVR) is the solution to address the Voltage Sag, Voltage unbalance problems.

Classification of Power Quality Events



Classification of Voltage Disturbances



PowerLogic DVR

The PowerLogic™ Dynamic Voltage Restorer (DVR) is an inventive system designed to mitigate and eliminate the effect of electrical disturbances that can impact critical processes and/or services.

DVR is cost-effective and efficiently protects sensitive loads in power distribution and transmission systems against voltage distortions. It is primarily designed to reduce voltage sags on power lines that cater to sensitive commercial and industrial equipments.

The DVR system consists of a transformer, a reversible rectifier, and an inverter with three modes of operation (Normal Mode, Static Bypass Mode, and Manual Bypass Mode) to meet the requirements of industrial production processes, maintain a stable and constant output voltage regardless of changes in input voltage as defined in the operation limits.

It is designed not only to eliminate voltage sags and it also helps in mitigating other energy quality problems at the same time, such as: fluctuations, flicker effects, overvoltage, and voltage unbalance.

A touchscreen control panel is provided on the front panel of the PowerLogic DVR system to monitor and control the status of the equipment quickly, which allows to view the information on the current operating status, instantaneous and historical sag events details that are corrected by DVR or which is passed to bypass.

The Challenge

Due to natural phenomena, the energy generation systems, transportation systems, and distribution systems have certain limitations. These systems can cause electrical disturbances due to factors such as consequences of manoeuvres, breakdowns, atmospheric phenomena, or disturbances introduced by receivers. These disturbances can affect the processes and/or services and can have significant economic consequences for companies.

Unfortunately, the electrical grids are not always between the two lines. The disturbances in the electrical grids are represented by dark grey areas and it depends on the magnitude and duration of the disturbance. These disturbances cannot be eliminated completely, so it is necessary to adapt the customer facilities in order to be protected from disturbances that can impact the normal operation and to minimize the disturbing emissions that can be generated and introduced in the electricity grid.

The typical range of the disturbances that usually causes problem is with a time duration of 0-500 milliseconds and voltage drop of -10 to -40%. Although, the most serious disturbances can reach -60%, when suffering greater lapses of time. The failure in the mains could produce a series of disturbances due to automatic reconnections while trying to correct these detected faults. This series of disturbances often requires that the voltage compensation equipment operates for several seconds.

Utility Supply Problem	Input	Output	Correction Time
Three-phase utility sags correction from	60% remaining supply voltage	100%	30 seconds
	50% remaining supply voltage	90%	10 seconds
	40% remaining supply voltage	70%	600 milliseconds
Single-phase utility sags correction from	40% remaining voltage	100%	30 seconds
	0% remaining voltage	57%	600 milliseconds
Single-phase utility swells correction from 115% voltage		100%	Continuous
Three-phase utility undervoltage to 90% of the nominal supply voltage		100%	Continuous
Three-phase utility overvoltage up to 110% of the nominal supply voltage		100%	Continuous
Correction of phase angle errors created by faults in the supply system		Yes	
Correction of voltage imbalance from utility supply		Yes	
Attenuation of flicker voltages in the utility supply		Yes	

Technical Specification

Utility - Input	
Power range	150 – 1800 kVA (220 V model) 150 – 3600 kVA (400 and 480 V model)
Rated voltage (model specific)	220 V – application range 208 – 220 V 400 V – application range 380 – 415 V 480 V – application range 440 – 480 V
Maximum supply voltage	110%
Nominal supply frequency	50 or 60 Hz
Frequency tolerance	± 5 Hz
Power system	3 phase + Neutral (4-Wire)[1] Center ground referenced (TN-S)
Overvoltage category	III
Fault capacity	Refer to the model tables shown in this document
Outage – control ride through	600 ms
Harmonics[2]	IEC 61000-2-4 Class 2 (THDv < 8%)

Load - Output	
Voltage	To match nominal input voltage[3]
Equivalent series impedance	< 4% (model specific)
Displacement power factor	0 lagging to 0.9 leading[4]
Crest factor	3.0
Overload capability from 100% supply voltage	150% for 30 s, once every 500 s

Performance	
Efficiency	Typically > 98%
Sag correction response	Initial < 250 µs Complete < ½ cycle
Voltage regulation accuracy	±1% typical, ±2% max.
Sag correction accuracy	±4%
Continuous regulation range	±10%
Sag correction performance[5] Three phase sags Single phase	 60% to 100% for 30 s, 50% to 90% for 10 s 40% to 100% for 30 s
Partial correction derating conditions[6]	1.0 PF at 80% load 0.8 PF at 100% load

Internal Bypass	
Capacity	100% of model rating (kVA)
Maximum overload capacity (in bypass)	125% for 10 minutes 150% for 1 minute 500% for 1 s 2000% for 200 ms
Transfer time	To Bypass < 0.5 ms To Inverter < 250 ms
Equivalent series impedance	bypass < 2.5% typical

Injection Transformer	
Transformer type	Dry
Insulation	IEC 60085 Thermal class 200
Frequency	50 Hz and 60 Hz
Vector group	Diii (delta + 3 independent windings)

[1] Neutral provided by supply transformer if required by the load
[2] For THDv > 8%, please refer to factory. For applications where THDv is above 10% lifetime of components may be significantly affected, please refer to factory.
[3] Output voltage can be adjusted by ±10% with 0.1% steps
[4] Consult the factory if there is a power factor correction unit downstream
[5] Refer to performance curves in this document for more details

Environmental	
Operating temperature range	0° C to 50° C (32° F to 122° F)
Temperature derating	Above 40° C, derate at 2% load per °C to a maximum of 50° C
Operating altitude	< 1000 m without derating
Capacity derating with altitude	1% every 100 m above 1000 m 2000 m maximum
Inverter cooling	Forced ventilation
Transformer cooling	Natural convection
Humidity	< 95%, non-condensing
Pollution degree rating	2
Noise	< 75dBA @ 2 m

Enclosure	
Enclosure rating	IP20
Material	Electro-galvanized steel
Panel thickness Side and rear Door	 1.5 mm 2 mm
Finish	Standard epoxy-polyester powder coating textured finish
Color	RAL7035
Enclosure access	Hinged doors with key lock

Service	
MTTR	30 min typical by module exchange
Diagnostics	Non-volatile event & service log
Remote monitoring	E-mail

User Interface	
User interface	10.1” color touch panel, multilingual
Touch panel	Full parameter control, system event log, voltage event log
Control inputs	Start / Stop / Reset digital inputs
Control outputs	Run, warning and fault relays
Communication	Ethernet Modbus TCP E-mail

Power Quality Event Monitor	
Events recorded	Voltage Sag (RMS) Voltage Surge (RMS)
Measurement type	Half-cycle RMS according to IEC 61000-4-30
Event detection	Input Voltage
Sag threshold	90% of Utility voltage default setting (user adjustable)
Surge threshold	110% of Utility voltage default setting (user adjustable)
Accuracy	Voltage: ±2% Duration: 10 ms
Remote monitoring	E-mail notification

Standards and Certifications	
Quality	ISO 9001
Environmental	ISO 14001
Marking	CE, C-Tick
Safety	IEC 62103
Electromagnetic compatibility	Emissions: CISPR 11 Class A Group 1 Immunity: IEC 61000-6-2
Performance	IEC 61000-4-34

Range

Rated power kVA		Rated Input Current A[9]	Rated Output Current A	Fault Capacity kA	Losses kW[10]	Efficiency %[11]	Airflow m3/min	Frame Size	Type Code Place R for right termination side or L for left termination side instead of x
220 V Models Utility Voltages									
220 V	208 V								
150	142	459	394	31.5	5.0	96.7	18	1B	PwrLgc-DVR-150-220-0B5-40-x
225	213	686	591	31.5	6.5	97.2	18	1B	PwrLgc-DVR-225-220-0B75-40-x
300	284	905	788	31.5	7.1	97.7	18	1B	PwrLgc-DVR-300-220-01B-40-x
450	425	1350	1181	40	9.7	97.9	36	2B	PwrLgc-DVR-450-220-01B5-40-x
600	567	1791	1575	40	11.8	98.1	36	2B	PwrLgc-DVR-600-220-02B-40-x
750	709	2239	1969	50	14.5	98.1	54	3B	PwrLgc-DVR-750-220-02B5-40-x
900	851	2679	2362	50	16.4	98.2	54	3B	PwrLgc-DVR-900-220-03B-40-x
1200	1135	3567	3150	80	20.7	98.3	72	4B	PwrLgc-DVR-1200-220-04B-40-x
1500	1418	4450	3937	100	25.2	98.4	90	5B	PwrLgc-DVR-1500-220-05B-40-x
1800	1702	5331	4724	100	29.1	98.4	108	6B	PwrLgc-DVR-1800-220-06B-40-x
480 V Models Utility Voltages									
480 V	440 V								
150	138	211	180	20	4.7	96.9	18	1B	PwrLgc-DVR-150-480-0B5-40-x
225	206	315	271	20	6.1	97.3	18	1B	PwrLgc-DVR-225-480-0B75-40-x
300	275	415	361	20	6.6	97.8	18	1B	PwrLgc-DVR-300-480-01B-40-x
450	413	619	542	25	8.9	98.1	36	2B	PwrLgc-DVR-450-480-01B5-40-x
600	550	821	722	25	10.8	98.2	36	2B	PwrLgc-DVR-600-480-02B-40-x
750	688	1026	903	25	13.5	98.2	54	3B	PwrLgc-DVR-750-480-02B5-40-x
900	825	1228	1083	25	15.2	98.4	54	3B	PwrLgc-DVR-900-480-03B-40-x
1200	1100	1635	1444	40	19.1	98.5	72	4B	PwrLgc-DVR-1200-480-04B-40-x
1500	1375	2040	1805	40	23.3	98.5	90	5B	PwrLgc-DVR-1500-480-05B-40-x
1800	1650	2444	2166	50	26.8	98.6	108	6B	PwrLgc-DVR-1800-480-06B-40-x
2400	2200	3290	2887	65	34.1	98.6	144	8B	PwrLgc-DVR-2400-480-08B-40-
3000	2750	4110	3609	65	44.3	98.5	180	10B	PwrLgc-DVR-3000-480-10B-40-x
3600	3300	4940	4331	65	55.4	98.5	216	12B	PwrLgc-DVR-3600-480-12B-40-x

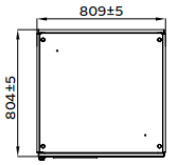
[9] At 90% utility voltage
[10] Typical value
[11] Typical value

Layout Plans and Dimensions

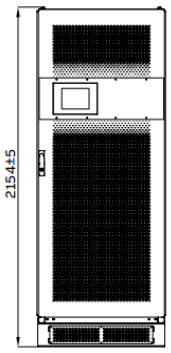
Side-by-side Layout Plans

The following plans relate to the standard Side-by-Side Layout of all frame sizes. Shown layouts are only for right (R) termination side. For left (L) termination side in Side-by-Side layout, the Transformer Enclosure is mounted on left side of Controller Enclosure.

1B frame size[12]

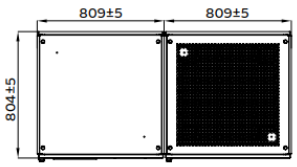


Top View

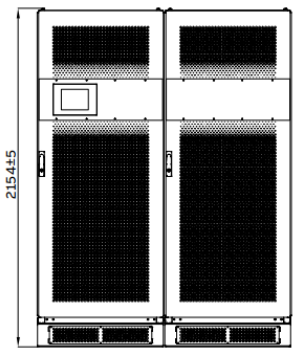


Front View

2B frame size[13]
Right termination side

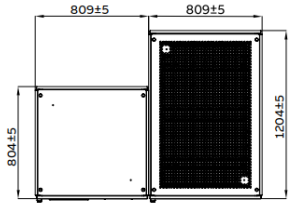


Top View

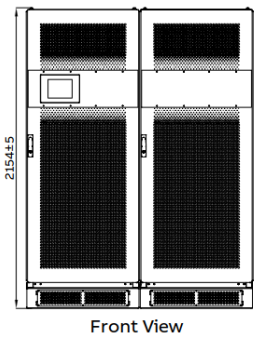


Front View

3B frame size[13]
Right termination side

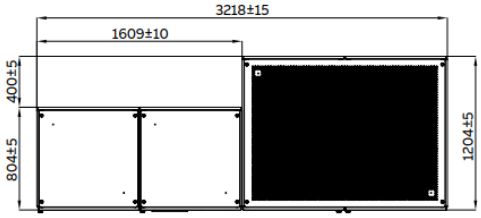


Top View

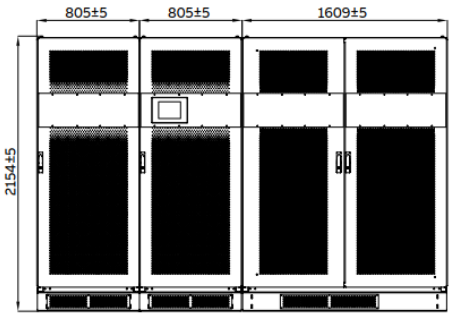


Front View

4B, 5B and 6B frame size
Right termination side



Top View



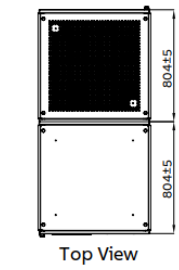
Front View

[12] In frame size 1B without optional Termination Enclosure, Cable Ducts or Side Aperture termination side can be from left, right or bottom as the Injection Transformer terminals (customer's connection terminals) are facing front.
[13] For frame sizes 2B and 3B, due to position of Injection Transformer terminals, optional Termination Enclosure or Side Aperture MUST be selected. Please see Options chapter of this document for option description.

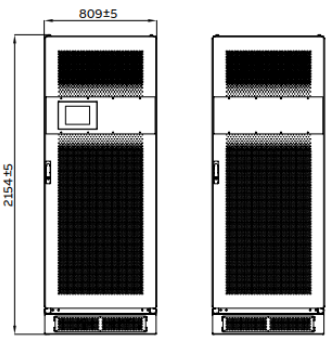
Back-to-back Layout Plans

The following plans relate to the optional Back-to-Back layout with left (L) or right (R) termination side options shown. Exact termination side needs to be defined with L or R in the product type code.

2B frame size[14]



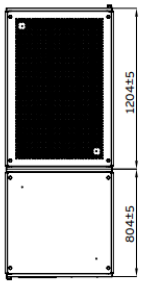
Top View



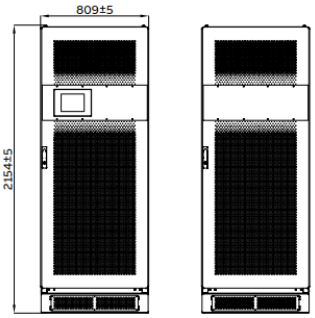
Front View

Rear View

3B frame size[14]



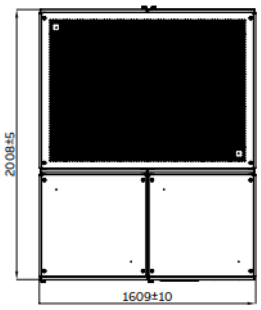
Top View



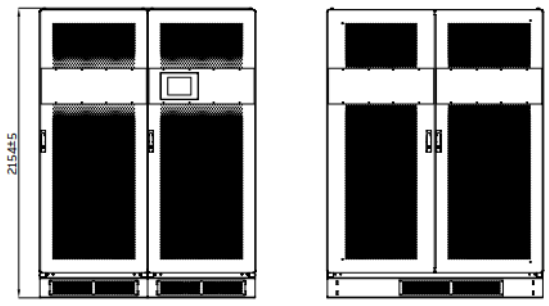
Front View

Rear View

4B, 5B and 6B frame size



Top View

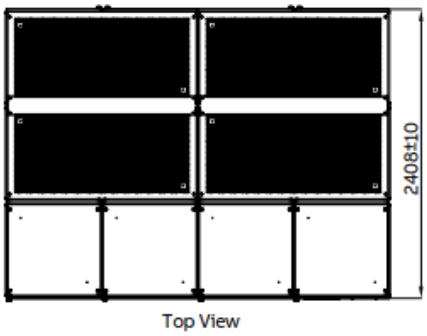


Front View

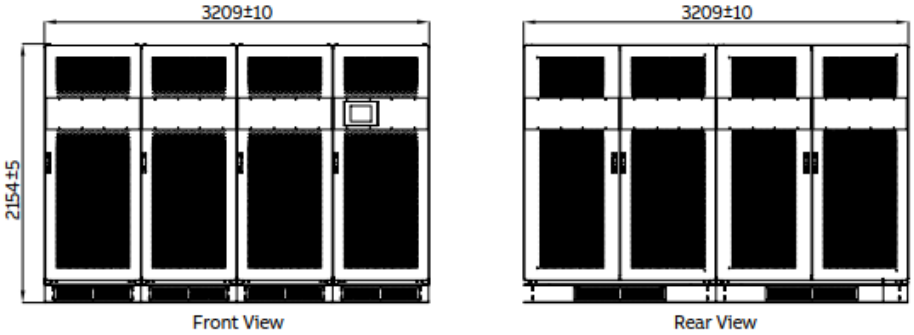
Rear View

[14] For frame sizes 2B and 3B, due to position of Injection Transformer terminals, optional Termination Enclosure or Side Aperture MUST be selected. Please see Options chapter of this document for option description.

8B, 10B and 12B frame size



Top View



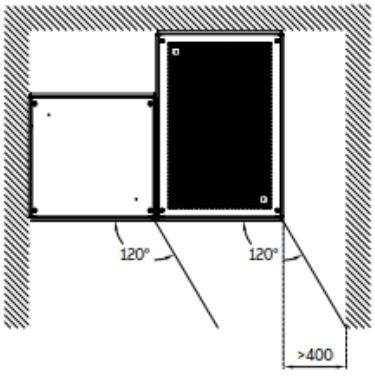
Front View

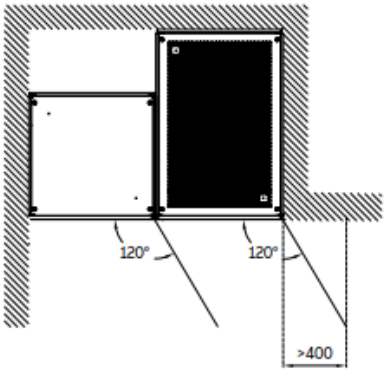
Rear View

Clearance

The following clearances are required for all enclosures:

- Allow 200 mm (minimum above)
- Allow 1500 mm (recommended) clearance in front
- Allow 200 mm (minimum) clearance at the rear of Controller Enclosure for air flow. (Exception: The Transformer Enclosure can be placed back to back without any clearance.)
- No side clearance required
- Side clearance to the wall at the side where the cabinet outmost hinges of minimum 400 mm is recommended to allow the doors to open sufficiently. The doors must open 120° to allow normal cabinet access the DVR module replacement.





Weights

The following tables show the dimensions and weights of Controller Enclosure and Injection Transformer Enclosure in different frame sizes[15].

Frame Sizes	Controller Enclosure Dimensions (HxWxD)	Transformer Enclosure Dimensions (HxWxD)[16]	Controller Enclosure Weight	Transformer Enclosure Weight	Controller Enclosure Weight	Transformer Enclosure Weight
	mm	mm	kg	kg	kg	kg
			220 V Models[17]		400 and 480 V Models	
1B	2154x809x804		1155		1010	
2B	2154x809x804	2154x809x804	581	1520	581	1235
3B	2154x809x804	2154x809x1204	714	2380	714	1760
4B	2154x1609x804	2154x1609x1204	1162	3880	1162	2885
5B	2154x1609x804	2154x1609x1204	1294	3880	1294	2885
6B	2154x1609x804	2154x1609x1204	1427	3880	1427	2885
8B	2154x3209x804	2154x3209x1604			2324	7300
10B	2154x3209x804	2154x3209x1604			2590	7300
12B	2154x3209x804	2154x3209x1604			2856	7300

[15] Allow ±10% tolerance for weights shown in the table

[16] 1B frame size enclosure houses both the controller and transformer subassemblies

[17] 220 V models do not have 8B, 10B and 12B frame sizes

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