Hybrid Power

AEP Smart Grid Cabinet

Bidirectional (dis)charging system

- Innovative in energy storage & Power Electronics
- Custom-made solutions
- Complete solution: storage & Power Electronics
- Design and system integration

Features

- Input and output are galvanically isolated over a 50Hz transformer
- Communication via CAN-interface and digital signals
- Three individual bidirectional systems in one

Applications

- Many variations on the load-side possible, according to customers' requirements:
  - Example: Electric vehicle charging, Ultracapacitors, batteries and fuel cells.

Mechanical Data

Length x Depth x Height
810 x 608 x 2208 mm
Approx. 1000 kg

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Hybrid Power

Technical Characteristics

Symbol	Parameter	Description	Value	Unit
	General			
U_{IN}	Input voltage	Phase – Phase ± 10%	400	VAC
I_{IN}	Input current		40 (Charging) – 217 (Discharging)	A
U_{OUT}	Output voltage		120 (Charging/SOFC) – 420 (Discharging/SOEC)	VDC
	Voltage accuracy		< ± 1,5	%
I_{OUT}	Output current	Per stack	40 (Charging) – 103 (Discharging)	A
	Current accuracy		< ± 1,5	%
	Power (Charging)	Per Stack (40 kW optional)	7	kW
	Power (Discharging)	Per Stack	41	kW
	Max. AC Power		135	kVA
	Net Frequency		50 ± 1%	Hz
	Environment			
	Operating temperature		0 to 40	°C
	Storage temperature		-20 till +50	°C
	Humidity	< 95 % non-condensing		
	Environmental conditions	EN 50178		
	EMC	EN 61000-6-4, EN 61000-6-2, EN 61000-3 (C2)		
	Panel sheet coating	Pre-galvanized steel		

Energy flow:
Grid to load → Charging
Load to grid → Discharging

System Overview

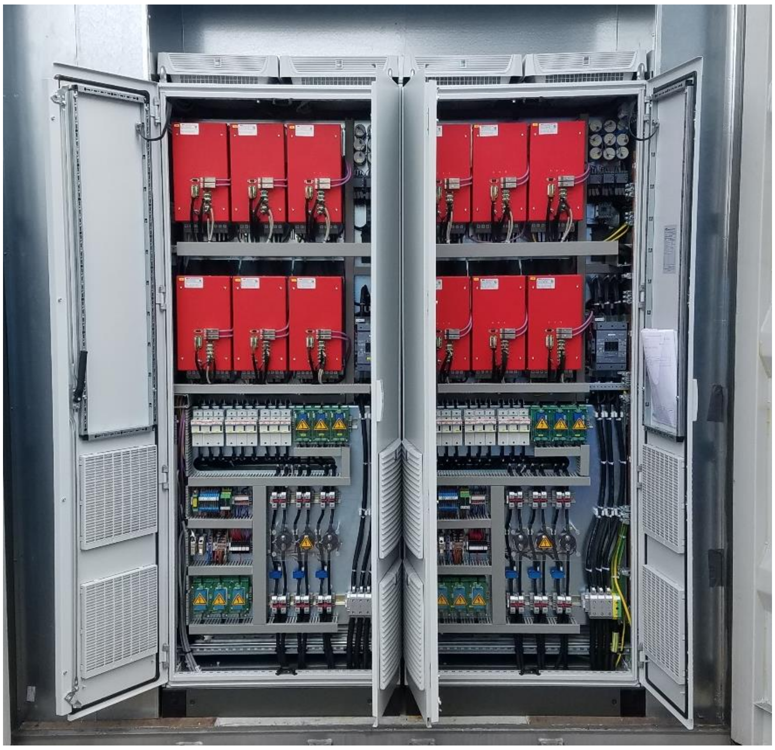


Figure 1: Example of two cabinets installed in a container

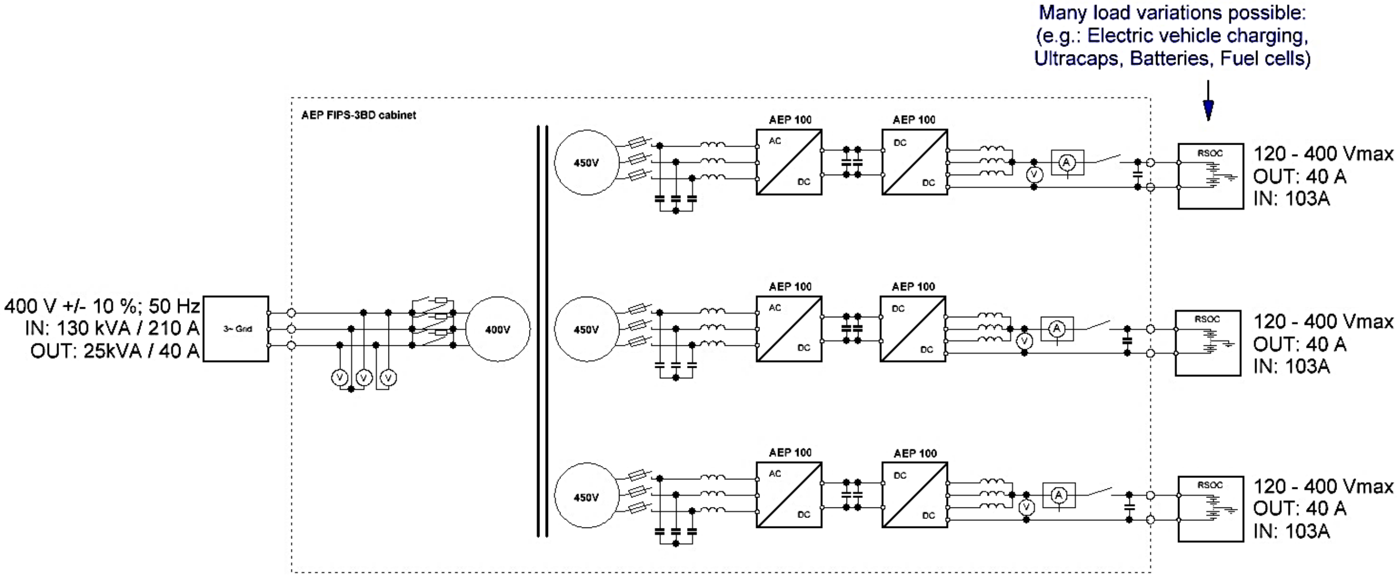


Figure 2: Example; block diagram of one cabinet with fuel cells

Mechanical Data

Length x Depth x Height: 178 x 359 x 238 mm
Weight: Approx. 9,8 kg

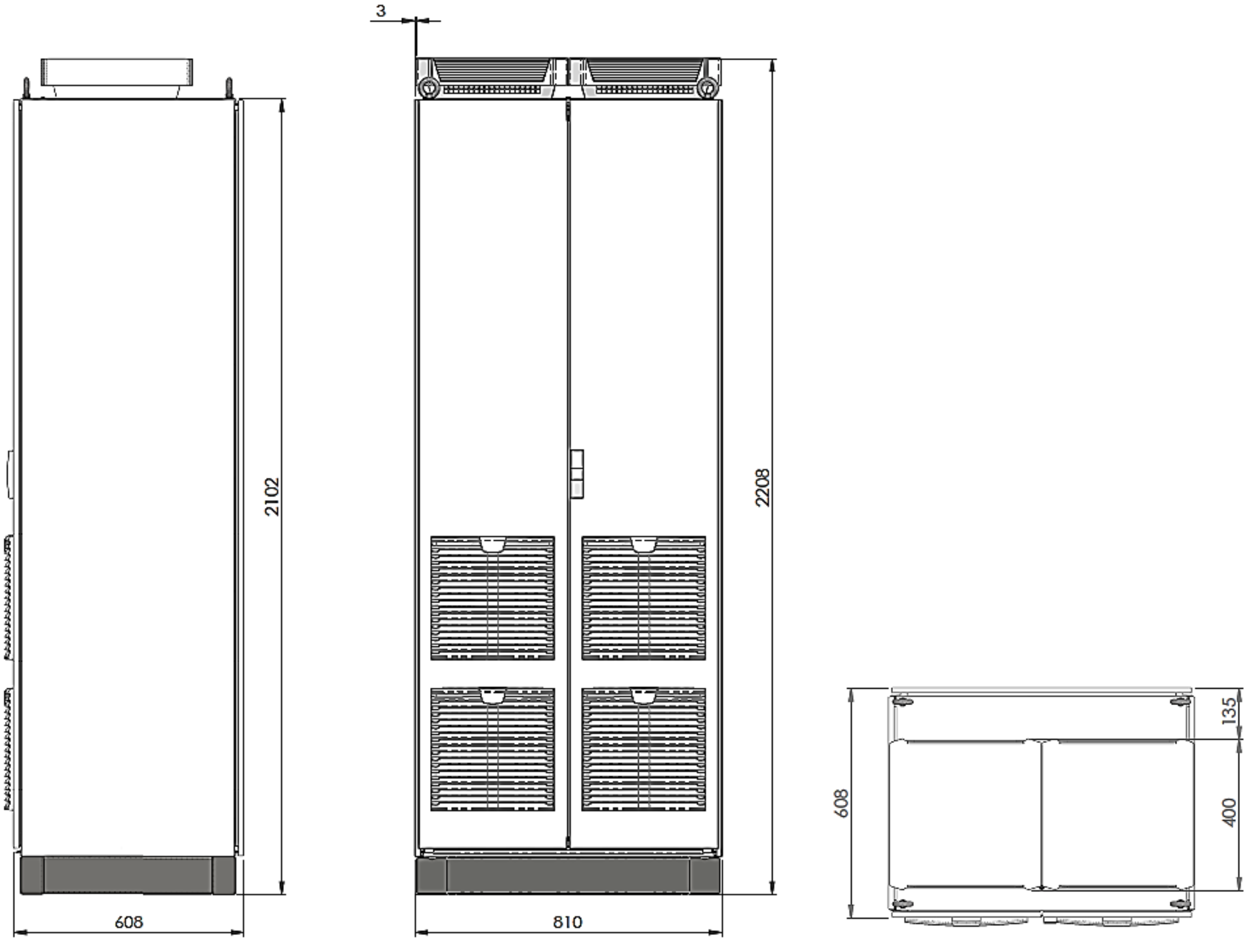


Figure 3: dimensions of the cabinet

Parameter	Description	Value	Unit
Mechanical Data			
Weight		1000	kg
Dimensions (W x D x H)		810 x 608 x 2208	mm
Enclosure type	Rittal TS 8		
Cooling	Forced air cooling: 2 roof-fans		
Socket	100 mm (Rittal standard), RAL		
International Protection degree (IP)	IP 20 (Exceptions cutouts on door and roof)		

Example of use

Figure 3: Top view

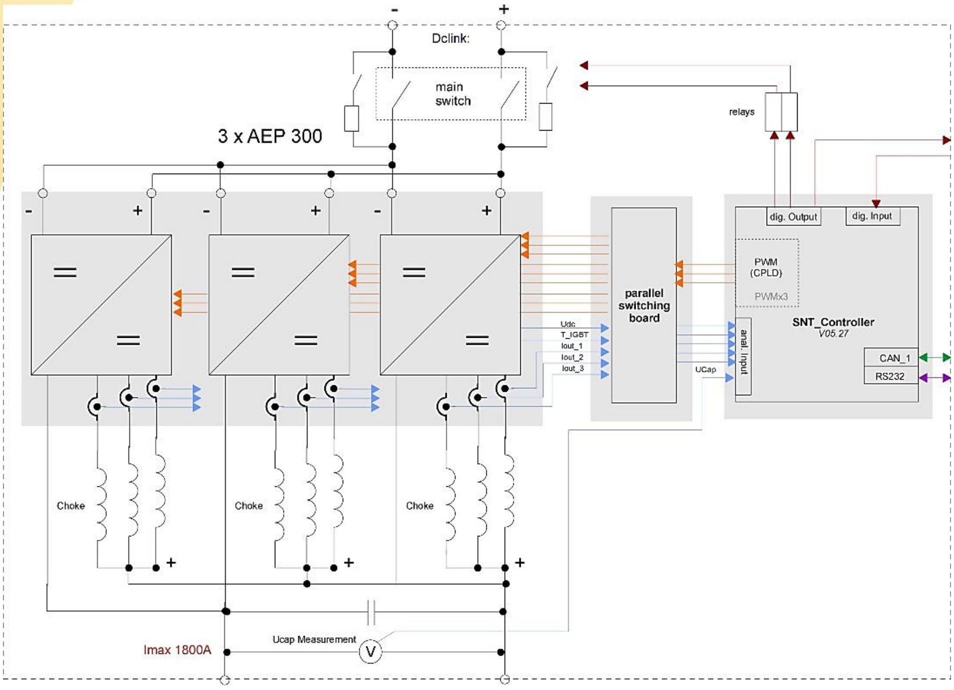


Figure 4: Typical example of use

<u>Note:</u> Individual Converter stack does not include controller and parallel switching board.

Connections

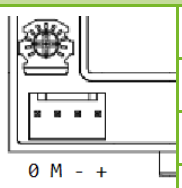
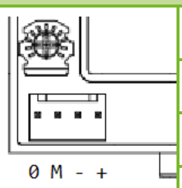
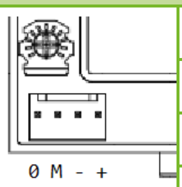
Power connection

Pin	Signal	Connection cross-section	Connector	Description
	L1	25 … 50 mm²	Copper bar with hole M8	Fastening torque: 25 Nm
	L2	25 … 50 mm²	Copper bar with hole M8	Fastening torque: 25 Nm
	L3	25 … 50 mm²	Copper bar with hole M8	Fastening torque: 25 Nm
	DC-link +	25 … 2 x 50 mm²	Copper bar with hole M8	Fastening torque: 25 Nm
	DC-link -	25 … 2 x 50 mm²	Copper bar with hole M8	Fastening torque: 25 Nm

FAN terminal

Connector	Pin	Signal	Description
X1 → Fan control			
	1	FAN_RELAYS_24V	+24V for fan relays
	2	FAN_PWM	2kHz PWM signal for fan control
	3	FAN_RELAYS_ON	Fan relays on (control signal switched to GN
	4	FAN_24V	+24V supply for fan (I_{max} :7,5A)
	5	FAN_GND	Ground for fan supply

Current sensors LEM HAS 200

Connector	Pin	Signal	Description
Phase 1	**T1**		
	1	0	Ground
	2	M	Current measure signal phase 1
	3	-	-15V supply sensor
	4	+	+15V supply sensor
Phase 2	**T2**		
	1	0	Ground
	2	M	Current measure signal phase 2
	3	-	-15V supply sensor
	4	+	+15V supply sensor
Phase 3	**T3**	**Analog input ANA8**	
	1	0	Ground
	2	M	Current measure signal phase 3
	3	-	-15V supply sensor
	4	+	+15V supply sensor

IGBT connectors

Connector	Pin	Signal	Description
Phase 1	**PL401**		
	1	PE	Connected to chassis
	2	SK1_PH_BOT	PWM signal - BOT IGBT
	3	SK1_ERR	Error signal – IGBT
	4	SK1_PH_TOP	PWM signal - TOP IGBT
	5	SK1_OT	Error signal - over temperature
	6	+24V	24V driver supply
	7	+24V	24V driver supply
	8	+15V	15V driver supply
	9	NC	Not used
	10	GND	Ground
	11	GND	Ground
	12	SK1_T	Measure signal – Dc-link voltage
	13	SK1_GNDA	Analogue ground
	14	SK1_I	Not used

Phase 2	PL402		
	1	PE	Connected to chassis
	2	SK2_PH_BOT	PWM signal - BOT IGBT
	3	SK2_ERR	Error signal – IGBT
	4	SK2_PH_TOP	PWM signal - TOP IGBT
	5	SK2_OT	Error signal – over temperature
	6	+24V	24V driver supply
	7	+24V	24V driver supply
	8	+15V	15V driver supply
	9	NC	Not used
	10	GND	Ground
	11	GND	Ground
	12	SK2_T	Not used
	13	SK2_GNDA	Analogue ground
	14	SK2_I	Not used
Phase 3	PL403	Analog input ANA8	
	1	PE	Connected to chassis
	2	SK3_PH_BOT	PWM signal - BOT IGBT
	3	SK3_ERR	Error signal – IGBT
	4	SK3_PH_TOP	PWM signal - TOP IGBT
	5	SK3_OT	Error signal – over temperature
	6	+24V	24V driver supply
	7	+24V	24V driver supply
	8	+15V	15V driver supply
	9	NC	Not used
	10	GND	Ground
	11	GND	Ground
	12	SK3_T	Measure signal – IGBT temperature
	13	SK3_GNDA	Analogue ground
	14	SK3_I	Not used

Accessories

Figure 5: Pre-charge

Figure 6: EMC filter

Figure 7: Voltage measurement

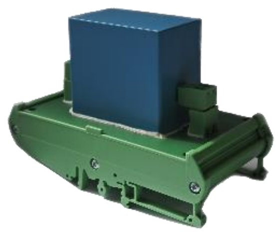


Figure 8: Output cap