



Smart solutions.  
Strong relationships.

# Emotron Modular Converter Solutions for Green Energy

Air cooled/Liquid cooled “Slim-LC” 19-4000 kW, 380-690V

- Low harmonic & regenerative converters – FDUL/VFXR/AFR
- Grid code regenerative converters – FDUG/VFXG/AFG
- VSI Motor inverters – FDU/VFX
- DC/DC Converter units – DCU

Technical catalogue

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## AFE (Active Front End) drives FDUL/VFXR/AFR - Page 6-14

General Active Front End (AFE) drives. Includes FDUL Low harmonic drives, VFXR Regenerative drives and AFR DC-bus supply unit. Available in both IP54 cabinet version and in IP20 module kit version. 55-4000 kW / 380-690 Vac range, Air-cooled and Liquid cooled (Slim-LC) versions offered.

## AFG Grid code regenerative converters FDUG/VFXG/AFG - Page 15-19

Grid code converters AFG. Bidirectional grid code compliant unit for grid generating applications. For connecting AC energy sources (generators) using FDUG/VFXG drives, as well as DC sources (batteries/fuel cells) with AFG unit to the grid. Power range 19-4000 kW / 380-690 Vac. Air-cooled and liquid cooled (Slim-LC) versions of IP20 module kits offered.

## VSI Motor inverters FDU/VFX - Page 21-22

Motor inverter VSI units for connection to DC-source, for example to AFR unit. Motor inverter types VFX and FDU. PEBB based IP20 VSI units in power range 55-4000 kW /380-690 Vac. Air-cooled and liquid cooled (Slim-LC) versions offered. Also available for Micro-grid functionality, using Sinusfilter.

## DC/DC Converter units DCU - Page 23-25

For DC voltage level conversions together with DC-sources such as e.g. batteries and fuel cells. For maximum 1120 Vdc voltage level. Low voltage side within 15-85% of high voltage side. Power range 23-1312 kW. Air-cooled and liquid cooled (Slim-LC) versions of IP20 module kits offered.



Emotron FDU 2.1/VFX 2.1	FDUL/VFXR/AFR Liquid cooled	FDUL/VFXR/AFR Air cooled	FDUG/VFXG/AFG Liquid cooled	FDUG/VFXG/AFG Air cooled
<b>Power range</b>	132 - 4000 kW	55 - 2200 kW	68-4000 kW	19-4000 kW
<b>Voltage range</b>	46: 230-460 Vac, 3ph 69: 400-690 Vac, 3ph		46: 230-460 Vac, 3ph 69: 400-690 Vac, 3ph	
<b>IP class, cabinet</b>	IP20 (inv) / IP00 (filter), IP54 (Cabinets)		IP20 (inv) / IP00 (filter), IP54 (Cabinets)	
<b>Control mode</b>	VFXR : Direct torque control or V/Hz, FDUL: V/Hz		VFXG : Direct torque control or V/Hz, FDUG: V/Hz	
<b>Filter</b>	LCL Standard		LCL Standard/LC option	
<b>EMC filter</b>	C3 is standard, C2 is optional		C3 standard, C2 is optional	
<b>Communication</b>	RS-485 (Modbus RTU) is standard		RS-485 (Modbus RTU) is standard	
<b>Coated boards</b>	Standard		Standard	
<b>Detachable control panel - multilanguage</b>	Standard (optional with Bluetooth or WiFi wireless comm)		Standard (optional with Bluetooth or WiFi wireless comm)	
<b>Options</b>	Encoder PTC/PT100 Extended IO Safe Torque Off (STO) CRIO (only VFXR) Wireless communication, (WiFi or Bluetooth)		Encoder PTC/PT100 Extended IO Safe Torque Off (STO) CRIO (only VFXR) Wireless communication, (WiFi or Bluetooth)	
<b>Serial communication option</b>	RS-232/485 (Modbus RTU)		RS-232/485 (Modbus RTU)	
<b>Communication options</b>	Profibus, DeviceNet, CANopen, Modbus/TCP, Profinet IO, EtherCAT, EtherNet IP		Profibus, DeviceNet, CANopen, Modbus/TCP, Profinet IO, EtherCAT, EtherNet IP	
<b>Liquid cooling</b>	Standard (heat exchanger optional)		Standard (heat exchanger optional)	

CE certification	All sizes		All sizes	
Marine certification	DNV		DNV	





	VSI Liquid cooled	VSI Air cooled	DCU Units Liquid cooled	DCU Units Air cooled
	142-4000 kW	55-3000 kW	82-1312 kW	23-1095 kW
	48: 230-460 Vac, 3ph 69: 400-690 Vac, 3ph		48: HV = 450-760 Vdc / LV =15-85% x HV 69: HV=600-1120 Vdc / LV =15-85% x HV	
	IP20 (inv), IP54 (Cabinets - option)		IP20 (inv) / IP00 (filter), IP54 (Cabinets - option)	
	VFX : Direct torque control or V/Hz, FDU: V/Hz			
	N/A		L (DC-filter) Standard/LC option	
	N/A		N/A	
	RS-485 (Modbus RTU) is standard		RS-485 (Modbus RTU) is standard	
	Standard		Standard	
	Standard (optional with Bluetooth or WiFi wireless comm)		Standard (optional with Bluetooth or WiFi wireless comm)	
	Encoder PTC/PT100 Extended IO Safe Torque Off (STO) CRIO (only VFXR) Wireless communication, (WiFi or Bluetooth)		PTC/PT100 Extended I/O Wireless communication, (WiFi or Bluetooth)	
	RS-232/485 (Modbus RTU)		RS-232/485 (Modbus RTU)	
	Profibus, DeviceNet, CANopen, Modbus/TCP, Profinet IO, EtherCAT, EtherNet IP		Profibus, DeviceNet, CANopen, Modbus/TCP, Profinet IO, EtherCAT, EtherNet IP	
	Standard (heat exchanger optional)		Standard (heat exchanger optional)	

	All sizes		All sizes	
	DNV		DNV	

# Energy saving operations with Emotron Green Energy Solutions

Emotron Green Energy Solutions will save costs and improve reliability in your energy conversion process. All Green Energy Products are based on standard Emotron drives, providing the same benefits in reliability, easy handling and advanced functionality. Setup is easy thanks to plug-and-play functionality to the mains supply.

## Trouble-free operation

State-of-the-art technology makes Emotron drives produce extremely low harmonic distortions, thereby reducing power losses in supply equipment. They provide genuine unity power factor, which allows for optimized sizing of the distribution transformer and can lower the electricity transfer tariff. They also offer the possibility of reactive power compensation. Emotron drives are nonsensitive to voltage dips or harmonics from other equipment, which could otherwise cause it to trip or break down. Voltage boosting assures full motor power in case of mains voltage fluctuations.

## The Emotron PEBB modular system

A flexible modular PEBB (power electronic building block) construction forms the basis of the Emotron Green Energy Product. Each PEBB is a line or motor inverter in itself with only the control board missing. Multiple PEBBs are connected to a common control board and function as a single unit.

The PEBB construction is excellent for redundancy, scalability and ease of service. The electrical and mechanically robust construction of Emotron drives is very easy to install and use.

## Complete cabinet drive or modular IP20 units

All Emotron Green Energy Solutions can be delivered either as an IP20 modular version for your own cabinet installation or as a complete IP54 cabinet drive.

## Complete certified solutions

The full series of Emotron's liquid cooled Green Energy Products have marine DNV approval.



Complete 1.1MW cabinet with water-to-water cooling. Cabinet sections from left to right : 1) Cooling 2) Main switch 3) and 4) LCL filter 5) AFR with 4 PEBBs 6) VSI with 5 PEBBs 7) Aux section.



# Compact liquid cooled drives for optimal power density

A state of the art cooling system and the flexible modular PEBBs form the basis of a compact drive. In the Emotron liquid cooled IP54 drive, the PEBB is mounted without frames directly into the cabinet, making the construction both space and cost efficient.

For example, with the unique PEBB structure and state of the art cooling, a 2MW liquid cooled AFE drive fits in a 2,4m wide cabinet.

## Hassle-free cooling

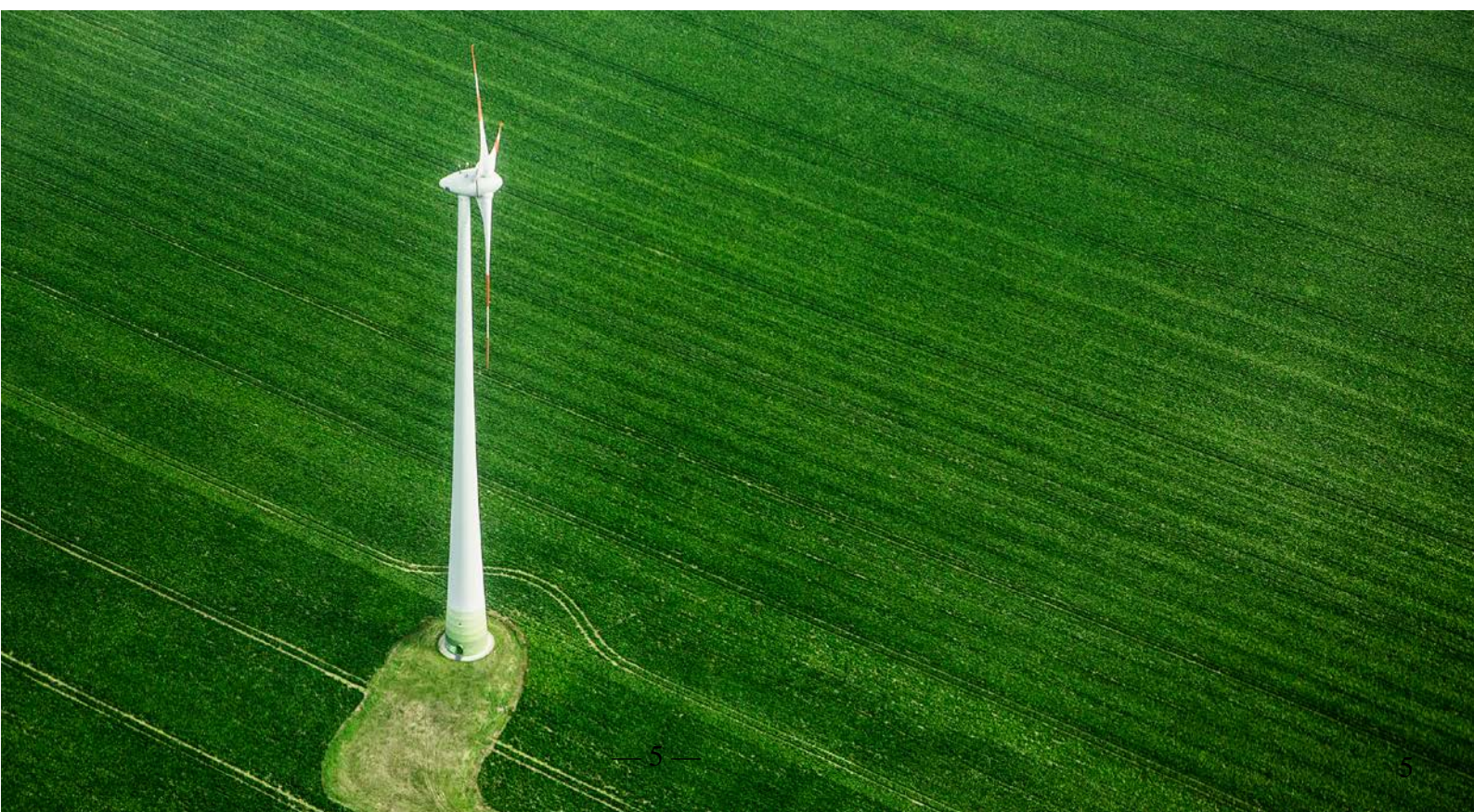
The new cooling system is easy to feed with industrial water from your own water cooling system or through an optional water-to-water heat exchanger section delivered as part of your complete drive solution cabinet. The water-to-water heat exchanger is also available in a seawater variant option.

The Emotron Green Energy Product has very low requirements on your water pressure, flow and temperature – the incoming cooling water is allowed to have a maximum temperature of 35°C. With the optional water/water heat exchanger and pump system, the water-cooling is fed directly from an adjacent part of the cabinet to the bottom of the drive for maximum electrical protection.

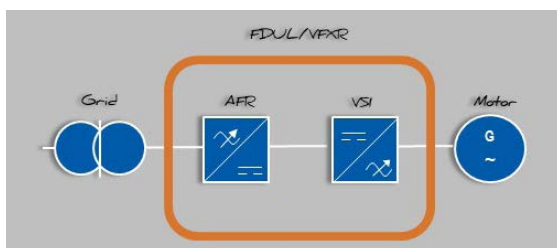
The cooling section is also available as a water to air heat exchanger type.

## No need for air conditioning

With liquid cooling there is no need for expensive and high maintenance air-conditioning units in the electrical room. The water cooling system is cooling both the drive modules and the LCL-filters, eliminating the need for e-room air-conditioner. Without the need for additional fans and air conditioning, noise level is also reduced.



# Emotron AFE 2.1 Top end efficiency



Emotron AFE drives are delivered as complete solutions in IP54 classified cabinets or as IP20 modules with module kits complete with filters. The IP54 solution uses a robust IP54 classified cabinet with IGBT power modules, LCL filter, circuit breaker, main contactor, charging circuit, EMC filter and output choke.

## Ultra low harmonic drives or regenerative drives

The Emotron AFE are available in two versions: Low harmonic drives FDUL and Regenerative drives VFXR/AFR.

The demand for network friendly electronic equipment is continuously increasing. Low harmonic drives are the answer to this challenge, improving reliability and reducing investment costs in applications such as pumps and fans in the mining, marine and process industries.

Emotron Low harmonic drives produce less than THDI 5% compared to 30-50% in conventional drives, thereby fulfilling the IEEE-519 standard. Reduced power losses eliminate the need to over dimension cables and transformers. Lower distortions also cause fewer malfunctions in other electronic equipment.

## Genuine unity power factor

The AC drive is rated for 100% power in both directions. It provides genuine unity power factor, which allows for optimized sizing of the distribution transformer and can lower the electricity transfer tariff. It also provides the possibility of reactive power compensation.

## Top rated efficiency

The Emotron AFE 2.1 with top rated efficiency and low harmonic distortion is available in a large power range. It is non-sensitive to voltage dips or harmonics, provides a unity power factor and has a wide power margin. Every aspect of its construction is made to secure a reliable operation at all times.

## Smart Power Electronic Building Blocks with air or liquid cooling

The AFE2.1 is made up of compact PEBB (Power Electronic Building Block) modules with a variety of cooling options. To avoid downtime, the modules are self-monitored and interchangeable. Communication options are plenty and extensive service options include remote access.

### MAIN FEATURES

- Top end efficiency - FDUL/VFXR at 97% and AFR at 98%
- Low harmonic distortion to supply, THDi < 5%
- Power range up to 4MW, 380-690V supply
- IP54 cabinet solution or IP20 modular version
- 100% interchangeable and uniquely self-monitored PEBB power modules
- Air cooling or liquid cooling
- Regenerative DC-bus supply unit (AFR) for common DC-bus application
- Project specific adaptation possible
- FDU/VFX options available including WiFi and Bluetooth wireless communication
- Very compact liquid cooled version with state of the art liquid cooling
- Liquid cooling options include water-to-water and water-to-air heat exchanger
- DNV Marine approval (liquid cooled)



# Network friendly low harmonic drives

The demand for network friendly electronic equipment is continuously increasing. Low harmonic drives are the answer to this challenge, improving reliability and reducing investment costs in applications such as pumps and fans in the mining, marine and process industries.

## Extremely low harmonic distortions

Emotron Low harmonic drives produce typically less than THDI 5% compared to 30-50% in conventional drives, thereby fulfilling the IEEE-519 standard. Reduced power losses eliminate the need to overdimension cables and transformers. Lower distortions also cause fewer malfunctions in other electronic equipment.

## Reactive power compensation

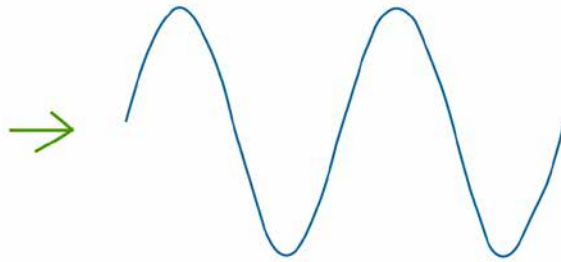
The AC drive is rated for 100% power in both directions. It provides genuine unity power factor, which allows for optimized sizing of the distribution transformer and can lower the electricity transfer tariff. It also provides the possibility of reactive power compensation.

*Standard 6-Pulse AC Drive*



**High current distortions THDI 30-50%**

*Emotron AFE Drive*



**Low current distortions THDI <5%**

Low harmonic drives are the answer for applications demanding extremely low harmonic distortions. The results are improved reliability and reduced investment costs.



# Energy saving regenerative drives

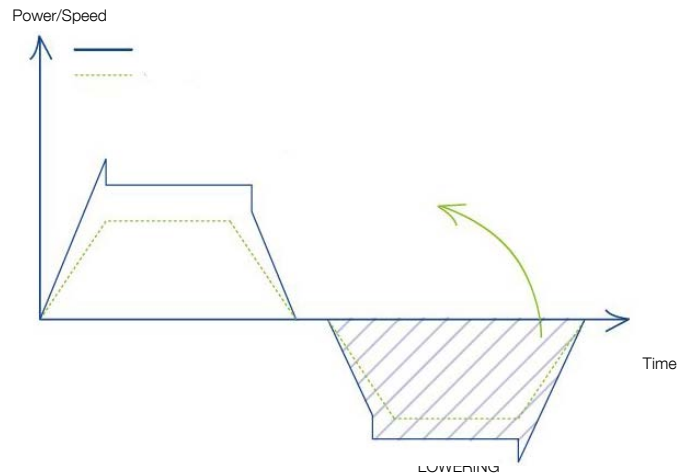
Emotron Regenerative drives, in addition to low harmonics, offer energy savings in applications with frequent braking, such as cranes, centrifuges, test benches, winders and ski lifts. They provide robust yet fast and smooth control, and allow uninterrupted power flow to and from the mains supply. Regenerative units can also be supplied as DC-bus feeder units. For info on VSI motor inverter units, see separate VSI chapter.

## Regenerative braking

Emotron Regenerative drives offer the option of feeding braking energy back to the mains instead of dissipating it via brake resistors. This will save considerable energy costs as well as the cost of investing in brake resistors, equipment that has limited lifetime and require cooling or external installation. The regenerative drives are rated for four quadrant operation with 100% power in both directions, ensuring continuous full braking power.

## Trouble-free operation

The regenerative drive is nonsensitive to voltage drops or harmonics from other equipment which otherwise could cause it to trip or break down. Voltage boosting also assures full motor power in case of mains voltage fluctuations.



Regenerative drives save energy in, for example, crane operation, by feeding the braking energy back to the mains instead of dissipating it via brake resistors.





# Technical data AFE

## Slim-LC – Liquid cooled version

Emotron VFXR – regenerative drives & Emotron FDUL – low harmonic drives

### 1. Emotron VFXR/FDUL typical motor power at mains voltage 400V

FDUL/ VFXR model	Max <sup>1</sup> output current I <sub>max</sub> [A]	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		Frame	Width IP20 H=1120 D=503 W (mm)	LCL-filter	Filter dimension HxWxD (mm)	Filter weight (kg)	Width IP54 cabinet <sup>4</sup> H=2200 D=600 W1/W2 (mm)
		Rated current I <sub>nom</sub> [A]	Power [kW]	Rated current I <sub>nom</sub> [A]	Power [kW]						
46-250-CL-XX	300	250	132	200	110	F+F (1+1)	170+170	LCL50-250R-AN	540x420x260 <sup>T</sup>	150	600/1000
46-295-CL-XX	354	295	160	236	132	F+G1 (1+1)	170+170	LCL50-250R-AN	540x420x260 <sup>T</sup>	150	600/1000
46-365-CL-XX	438	365	200	292	160	H1+H1 (1+1)	170+170	LCL50-365R-AN	580x420x300 <sup>T</sup>	210	800/1200
46-590-CL-XX	708	590	315	472	250	H+G2 (2+2)	314+314	LCL50-500R-WF	510x409x290 <sup>D</sup>	121	1400/1800
46-730-CL-XX	876	730	400	584	315	H2+H2 (2+2)	314+314	LCL50-700R-WF	465x575x469 <sup>S</sup>	191	1600/2000
46-810-CL-XX	972	810	450	648	355	H2+G3 (2+3)	314+457	LCL50-700R-WF	465x575x469 <sup>S</sup>	191	1800/2200
46-1010-CL-XX	1212	1010	560	808	450	G3+H3	457+457	LCL50-885R-WF	525x600x469 <sup>S</sup>	225	1800/2200
46-1100-CL-XX	1320	1100	630	880	500	H3+H3	457+457	LCL50-1050R-WF	525x600x469 <sup>S</sup>	285	2000/2400
46-1250-CL-XX	1500	1250	710	1000	560	G4+H4	601+601	LCL50-1050R-WF	525x600x469 <sup>S</sup>	285	2000/2400
46-1460-CL-XX	1752	1460	800	1168	630	H4+H4	601+601	2xLCL50-700R-WF	2x(465x575x469) <sup>S</sup>	2x191	3000/3600
46-1710-CL-XX	2052	1710	900	1368	710	H4+H5	601+314 +457	2xLCL50-700R-WF	2x(465x575x469) <sup>S</sup>	2x191	3200/3800
46-2200-CL-XX	2640	2200	1250	1760	1000	H6+H6	457+457+ 457+457	2 x LCL50-1050R- WF	2x (525x600x469) <sup>S</sup>	2x285	3600/4200
46-2500-CL-XX	3000	2500	1350	2000	1120	H6+H7	457+457+ 601+457	2xLCL50-1050R- WF	2x (525x600x469) <sup>S</sup>	2x285	3600/4200

### 2. Emotron VFXR/FDUL typical motor power at mains voltage 690V

FDUL/ VFXR model	Max <sup>1</sup> output current I <sub>max</sub> [A]	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		Frame	Width IP20 H=1120 D=503 W (mm)	LCL-filter	Filter HxWxD (mm)	Filter weight (kg)	Width IP54 cabinet <sup>4</sup> H=2200 D=600 W1/W2 (mm)
		Rated current I <sub>nom</sub> [A]	Power [kW]	Rated current I <sub>nom</sub> [A]	Power [kW]						
69-109-CL-XX	131	109	110	87	90	F69+F69 (1+1)	170+170	LCL69-109R-AN	450x360x250 <sup>T</sup>	106	
69-200-CL-XX	240	200	200	160	160	F69+F69 (1+1)	170+170	LCL69-175R-AN	540x420x300 <sup>T</sup>	195	600/1000
69-250-CL-XX	300	250	250	200	200	F69+F69 (1+1)	170+170	LCL69-233R-AN	420x420x500 <sup>S</sup>	210	800/1200
69-500-CL-XX	600	500	500	400	400	H69+H69 (2+2)	314+314	LCL69-466R-WF	770x460x300 <sup>T</sup>	191	1200/1600
69-750-CL-XX	900	750	710	600	600	I69+I69 (3+3)	457+457	LCL69-700R-WF	525x600x469 <sup>S</sup>	263	1800/2200
69-1000-CL-XX	1200	1000	1000	800	800	J69+J69 (4+4)	601+601	LCL69-900R-WF	525x625x469 <sup>S</sup>	296	1800/2200
69-1250-CL-XX	1500	1250	1250	1000	1000	K69+KA69 (6+5)	457+457+ 457+314	2xLCL69-700R- WF	2x(525x600x469) <sup>S</sup>	2x263	3000/3400
69-1500-CL-XX	1800	1500	1500	1200	1200	K69+K69 (6+6)	2x457+2x 457	2xLCL69-700R- WF	2x(525x600x469) <sup>S</sup>	2x263	3400/4000
69-2000-CL-XX	2400	2000	2000	1600	1600	M69+M69 (8+8)	(2x601+2x 601	2xLCL69-900R- WF	2x(525x625x469) <sup>S</sup>	2x296	3600/4200
69-3000-CL-XX	3600	3000	3000	2400	2400	Q69+Q69 (12+12)	3x601+3x 601	3xLCL69-900R- WF	3x(525x625x469) <sup>S</sup>	3x296	5200/6000
69-4000-CL-XX	4800	4000	4000	3200	3200	U69+U69 (16+16)	4x601+4x 601	4xLCL69-900R- WF	4x(525x625x469) <sup>S</sup>	4x296	7200/8800

Cabinets complete with incoming breaker/contactors, LCL-filter, EMC-filter, inverters & output chokes.

<sup>1</sup> Available for a limited time and as long as drive temperature permits

<sup>2</sup> Normal duty, 1 min every 10th minute

<sup>3</sup> Heavy duty, 1 min every 10th minute

<sup>4</sup> Width cabinet without/with cooling section water/water

<sup>S</sup> Side-by-side <sup>T</sup> Tower <sup>D</sup> Double deck



## Slim-LC - Liquid cooled AFR Regenerative DC-bus supply unit

### 3. Emotron AFR46 output DC power at mains voltage 400V

AFR model	Max <sup>1</sup> input current I <sub>max</sub> [A]	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		Frame	Width IP20 H=1120 D=503 W (mm)	LCL-filter	Filter HxWxD (mm)	Filter weight (kg)	Width IP54 cabinet <sup>4</sup> H=2200 D=600 W1/W2 (mm)
		Rated input current [A]	DC output power [kW]	Rated input current [A]	DC output power [kW]						
46-109-CL-XX	131	109	72	87	57	F (1)	170	LCL50-109R-AN	410x300x240 <sup>†</sup>	75	
46-146-CL-XX	175	146	96	117	77	F (1)	170	LCL50-175R-AN	510x360x250 <sup>†</sup>	110	
46-175-CL-XX	210	175	120	140	96	F (1)	170	LCL50-175R-AN	510x360x250 <sup>†</sup>	110	
46-210-CL-XX	252	210	138	168	110	F (1)	170	LCL50-175R-AN	510x360x250 <sup>†</sup>	110	
46-250-CL-XX	300	250	170	200	136	F (1)	170	LCL50-250R-AN	540x420x260 <sup>†</sup>	150	600/1000
46-295-CL-XX	354	295	200	236	160	G1 (1)	170	LCL50-295R-AN	540x420x300 <sup>†</sup>	190	
46-365-CL-XX	438	365	248	292	198	H1 (1)	170	LCL50-365R-AN	580x420x300 <sup>†</sup>	210	600/1000
46-500-CL-XX	600	500	340	400	272	H (2)	314	LCL50-500R-WF	510x409x290 <sup>‡</sup>	121	1000/1400
46-590-CL-XX	708	590	400	472	311	G2 (2)	314	LCL50-590R-WF	370x550x469 <sup>§</sup>	171	
46-700-CL-XX	840	700	475	560	380	H2 (2)	314	LCL50-700R-WF	465x575x469 <sup>§</sup>	191	1000/1400
46-885-CL-XX	1062	885	600	708	480	G3 (3)	457	LCL50-885R-WF	525x600x469 <sup>§</sup>	225	1000/1400
46-1050-CL-XX	1260	1050	713	840	570	H3 (3)	457	LCL50-1050R-WF	525x600x469 <sup>§</sup>	285	1400/1800
46-1400-CL-XX	1680	1400	950	1120	760	H4 (4)	601	2xLCL50-700R-WF	2x (465x575x469) <sup>§</sup>	2x191	2400/2800
46-1770-CL-XX	2124	1770	1200	1416	960	G6 (6)	457+457	2xLCL50-885R-WF	2x (525x600x469) <sup>§</sup>	2x225	2400/3000
46-2100-CL-XX	2520	2100	1425	1680	1140	H6 (6)	457+457	2xLCL50-1050R-WF	2x (525x600x469) <sup>§</sup>	2x285	2400/3000

### 4. Emotron AFR69 output DC power at mains voltage 690V

AFR model	Max <sup>1</sup> input current I <sub>max</sub> [A]	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		Frame	IP20 HxWxD (mm)	LCL-filter	Filter HxWxD (mm)	Filter weight (kg)	Width IP54 cabinet <sup>4</sup> H=2200 D=600 W1/W2 (mm)
		Rated input current [A]	DC output power [kW]	Rated input current [A]	DC output power [kW]						
69-109-CL-XX	131	109	124	87	99	F69 (1)	1120x170x503	LCL69-109R-AN	450x360x250 <sup>†</sup>	106	
69-175-CL-XX	210	175	205	140	164	F69 (1)	1120x170x503	LCL69-175R-AN	540x420x300 <sup>†</sup>	195	600/1000
69-233-CL-XX	280	233	275	186	220	F69 (1)	1120x170x503	LCL69-233R-AN	420x420x500 <sup>§</sup>	210	800/1200
69-466-CL-XX	559	466	545	373	436	H69 (2)	1120x314x503	LCL69-466R-WF	770x460x300 <sup>†</sup>	191	1000/1400
69-700-CL-XX	840	700	820	560	656	I69 (3)	1120x457x503	LCL69-700R-WF	525x600x469 <sup>§</sup>	263	1200/1600
69-900-CL-XX	1080	900	1050	720	840	J69 (4)	1120x601x503	LCL69-900R-WF	525x625x469 <sup>§</sup>	296	1200/1600
69-1400-CL-XX	1680	1400	1640	1120	1312	K69 (6)	2x (1120x457x503)	2xLCL69-700R-WF	2x(525x600x469) <sup>§</sup>	2x263	2200/2600
69-1800-CL-XX	2160	1800	2100	1440	1680	M69 (8)	2x (1120x601x503)	2xLCL69-900R-WF	2x(525x625x469) <sup>§</sup>	2x296	2400/2800
69-2100-CL-XX	2520	2100	2460	1680	1968	N69 (9)	3x (1120x457x503)	3xLCL69-700R-WF	3x(525x600x469) <sup>§</sup>	3x263	3400/4000
69-2700-CL-XX	3240	2700	3150	2160	2520	Q69 (12)	3x (1120x601x503)	3xLCL69-900R-WF	3x(525x625x469) <sup>§</sup>	3x296	3400/4000
69-3600-CL-XX	4320	3600	4200	2880	3360	U69 (16)	4x (1120x601x503)	4xLCL69-900R-WF	4x(525x625x469) <sup>§</sup>	4x296	4800/5600

Cabinets complete with incoming breaker/contactors, LCL-filter, EMC-filter, inverters & output chokes.

<sup>1</sup> Available for a limited time and as long as drive temperature permits

<sup>2</sup> Normal duty, 1 min every 10th minute

<sup>3</sup> Heavy duty, 1 min every 10th minute

<sup>4</sup> Width cabinet without/with cooling section water/water

<sup>§</sup> Side-by-side <sup>†</sup> Tower <sup>‡</sup> Double deck

# Cooling sections for Slim-LC AFE Drives

Option Water/ Water and Water/ Air- cooling sections including IP54 cabinet

## 5. Emotron liquid cooling section - water to water

Cooling section	Max power losses in kW (to water)	Water flow in l/min	Cabinet dimensions HxWxD (mm)	Cab. dim with redundant pumps HxWxD (mm)
Cooling section <14kW	14	27	2200x400x600	2200x400x600
Cooling section <46kW	46	70	2200x400x600	2200x600x600
Cooling section <70kW	70	106	2200x800x600	2200x800x600

Cooling section includes: Heat exchanger, pump, pump inverter, expansion tank, valves & cabinet

Max water pressure in 4 bar  
 Max water inlet temperature 35°C  
 Pipe couplings for in- and out-water G1"

## 6. Emotron liquid cooling section - water to air

Cooling section	Max power losses in kW (to water)	Weight (filled)	Unit dimensions HxWxD (mm)
Cooling unit 12 kW	12	95	813x570x486
Cooling unit 24 kW	24	230	1079x1465x731

Rated voltage (pump+ventilator) 380-415 V / 50 Hz // 380-440 V / 60 Hz  
 Anti-freeze (glycol) mix 30% glycol, 70% water  
 Ambient temperature 0-45°C  
 Water quality (industrial water) See manual



Cooling unit water to air heat exchanger



Cooling section water to water heat exchanger.



# Air cooled version

## Emotron VFXR - Regenerative drives & Emotron FDUL - Low harmonic drives

### 7. Emotron VFXR/FDUL typical motor power at mains voltage 400 V

VFXR/ FDUL model	Max <sup>1</sup> output current I <sub>max</sub> [A]	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		Frame	IP20 HxWxD (mm)	LCL-filter	Filter HxWxD (mm)	Filter weight (kg)	IP54 cabinet Width [mm] H=2200 D=600
		Rated current [A]	Power [kW]	Rated current [A]	Power [kW]						
46-109	131	109	55	87	45	E+E (2)	1036x500x450	LCL50-109R-AN	410x300x240 <sup>T</sup>	75	800
46-146	175	146	75	117	55	E+E (2)	1036x500x450	LCL50-175R-AN	510x360x250 <sup>T</sup>	110	800
46-175	210	175	90	140	75	E+E (2)	1036x500x450	LCL50-175R-AN	510x360x250 <sup>T</sup>	110	1000
46-210	252	210	110	168	90	E+F (2)	1036x500x450	LCL50-175R-AN	510x360x250 <sup>T</sup>	110	1000
46-250	300	250	132	200	110	F+F (2)	1036x500x450	LCL50-250R-AN	540x420x260 <sup>T</sup>	150	1000
46-295	354	295	160	236	132	F+G1 (2)	1036x500x450	LCL50-250R-AN	540x420x260 <sup>T</sup>	150	1200
46-365	438	365	200	292	160	H1+H1 (2)	1176x500x450	LCL50-365R-AN	580x420x300 <sup>T</sup>	210	1200
46-500	600	500	250	400	220	H+H (2+2)	2x (1036x500x450)	LCL50-500R-AN	500x448x550 <sup>S</sup>	240	1600
46-590	708	590	315	472	250	H+G2 (2+2)	2x (1036x500x450)	LCL50-500R-AN	500x448x550 <sup>S</sup>	240	1600
46-730	876	730	400	584	315	H2+H2 (2+2)	2x (1176x500x450)	LCL50-700R-AF	1400x510x350	200	2000
46-810	972	810	450	648	355	H2+G3 (2+3)	1176x500x450 + 1036x730x450	LCL50-700R-AF	1400x510x350	200	2400
46-1010	1212	1010	560	808	450	G3+H3 (3+3)	1036x730x450 + 1176x730x450	LCL50-885R-AF	1400x510x350	226	2800
46-1100	1320	1100	630	880	500	H3+H3 (3+3)	2x (1176x730x450)	LCL50-1050R-AF	1400x510x350	275	2800
46-1300	1560	1300	710	1040	560	G4+H4 (4+4)	2x (1036x500x450) + 2x (1176x500x450)	2xLCL50-590R-AN	2x (440x448x550 <sup>S</sup> )	2x260	3000
46-1460	1752	1460	800	1168	630	H4+H4	4x (1176x500x450)	2xLCL50-700R-AF	2x (1400x510x350)	2x200	3600
46-1710	2052	1710	900	1368	710	H4+H5	3x (1176x500x450) + 1176x730x450	2xLCL50-700R-AF	2x (1400x510x350)	2x200	4400
46-2200	2628	2190	1200	1752	1000	H6+H6	4x (1176x730x450)	2xLCL50-1050R-AF	2x (1400x510x350)	2x275	5400

### 8. Emotron VFXR/FDUL typical motor power at mains voltage 690 V

VFXR/ FDUL modell	Max <sup>1</sup> output current I <sub>max</sub> [A]	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		Frame	IP20 HxWxD (mm)	LCL-filter	Filter HxWxD (mm)	Filter weight (kg)	IP54 cabinet Mått Höjd = 2250 mm Djup = 600 mm Bredd [mm]
		Rated current [A]	Power [kW]	Rated current [A]	Power [kW]						
69-109	131	109	110	87	90	F69+F69 (2)	1176x500x450	LCL69-109R-AN	450x360x250 <sup>T</sup>	106	800
69-146	175	146	132	117	110	F69+F69 (2)	1176x500x450	LCL69-175R-AN	540x420x300 <sup>T</sup>	195	800
69-185	222	185	160	148	132	F69+F69 (2)	1176x500x450	LCL69-175R-AN	540x420x300 <sup>T</sup>	195	900
69-250	300	250	250	200	200	H69+H69 (2+2)	2x(1176x500x450)	LCL69-350R-AN	550x420x500 <sup>S</sup>	270	1800
69-300	360	300	315	240	250	H69+H69 (2+2)	2x(1176x500x450)	LCL69-350R-AN	550x420x500 <sup>S</sup>	270	1800
69-375	450	375	355	300	315	H69+H69 (2+2)	2x(1176x500x450)	LCL69-350R-AN	550x420x500 <sup>S</sup>	270	1800
69-430	516	430	450	344	355	I69+I69 (3+3)	2x(1176x730x450)	LCL69-525R-AF	1400x510x350	211	2800
69-560	672	560	560	448	450	I69+I69 (3+3)	2x(1176x730x450)	LCL69-525R-AF	1400x510x350	211	2800
69-749	900	750	710	600	600	J69+J69 (4+4)	4x(1176x500x450)	2xLCL69-350R-AN	2x (550x420x500) <sup>S</sup>	2x270	On request
69-995	1200	1000	1000	800	800	K69+KA69 (6+5)	3x(1176x730x453) + (1176x500x450)	2xLCL69-525R-AF	2x (1400x510x350)	2x211	On request
69-1K12	1344	1120	1100	896	900	K69+K69 (6+6)	4x(1176x730x450)	2xLCL69-525R-AF	2x (1400x510x350)	2x211	On request
69-1K68	2016	1680	1650	1344	1300	N69+N69 (9+9)	6x(1176x730x450)	3xLCL69-525R-AF	3x (1400x510x350)	3x211	On request
69-2K24	2688	2240	2200	1792	1750	Q69+Q69 (12+12)	8x(1176x730x450)	4xLCL69-525R-AF	4x (1400x510x350)	4x211	On request

<sup>1</sup> Available for a limited time and as long as drive temperature permits

<sup>2</sup> Normal duty, 1 min every 10th minute

<sup>3</sup> Heavy duty, 1 min every 10th minute

<sup>S</sup> Side-by-side <sup>T</sup> Tower

# Emotron AFR - Regenerative DC-bus supply unit

## 9. Emotron AFR46 output DC power at mains voltage 400 V

AFR Model	Max <sup>1</sup> input current I <sub>max</sub> [A]	ND 120 %		HD 150 % <sup>3</sup>		Frame	IP20 HxWxD (mm)	LCL-filter	Filter dimensions (HxWxD mm)	Filter weight (kg)	IP54 cabinet Dimensions H = 2250 D = 600 Width [mm]
		Rated input current [A]	DC output power [kW]	Rated input current [A]	DC output power [kW]						
AFR46-175	210	175	115	140	92	E (1)	1036x270x450	LCL50-175R-AN	510x360x250 <sup>†</sup>	110	600
AFR46-250	300	250	165	200	132	F (1)	1036x270x450	LCL50-250R-AN	540x420x260 <sup>†</sup>	150	600
AFR46-365	438	365	148	292	198	H1 (1)	1176x270x450	LCL50-365R-AN	580x420x300 <sup>†</sup>	210	600
AFR46-500	600	500	330	400	264	H (2)	1036x500x451	LCL50-500R-AF	1200x510x350	156	1000
AFR46-700	840	700	475	560	380	H2 (2)	1176x500x450	LCL50-700R-AF	1400x510x350	200	1400
AFR46-885	1062	885	600	708	480	G3 (3)	1036x730x451	LCL50-885R-AF	1400x510x350	226	1800
AFR46-1050	1260	1050	713	840	570	H3 (3)	1176x730x450	LCL50-1050R-AF	1400x510x350	275	1800
AFR46-1400	1680	1400	950	1120	760	H4 (4)	2x(1176x500x450)	2xLCL50-700R-AF	2x(1400x510x350)	2x200	On request
AFR46-1770	2124	1770	1200	1416	960	G6 (6)	2x(1036x730x450)	2xLCL50-885R-AF	2x(1400x510x350)	2x226	On request
AFR46-2100	2520	2100	1425	1680	1140	H6 (6)	2x(1176x730x450)	2xLCL50-1050R-AF	2x(1400x510x350)	2x275	On request

## 10. Emotron AFR69 output DC power at mains voltage 690 V

AFR Model	Max <sup>1</sup> input current I <sub>max</sub> [A]	ND 120 %		HD 150 % <sup>3</sup>		Frame	IP20 HxWxD (mm)	LCL-filter	Filter dimensions (HxWxD mm)	Filter weight (kg)	IP54 cabinet Dimensions H = 2200 D = 600 Width [mm]
		Rated input current [A]	DC output power [kW]	Rated input current [A]	DC output power [kW]						
AFR69-109	131	109	124	87	99	F69 (1)	1176x270x450	LCL69-109R-AN	450x360x250 <sup>†</sup>	106	800
AFR69-175	210	175	200	140	164	F69 (1)	1176x270x450	LCL69-175R-AN	540x420x300 <sup>†</sup>	195	800
AFR69-350	420	350	400	280	328	H69 (2)	1176x500x450	LCL69-350R-AN	550x420x500 <sup>§</sup>	270	1200
AFR69-525	630	525	600	420	492	I69 (3)	1176x730x450	LCL69-525R-AF	1400x510x350	211	1700
AFR69-700	840	700	800	560	656	J69 (4)	2x(1176x500x450)	2xLCL69-350R-AN	2x(550x420x500) <sup>§</sup>	2x270	On request
AFR69-1050	1260	1050	1200	840	984	K69 (6)	2x(1176x730x450)	2xLCL69-525R-AF	2x(1400x510x350)	2x211	On request
AFR69-1575	1890	1575	1800	1260	1476	N69 (9)	3x(1176x730x450)	3xLCL69-525R-AF	3x(1400x510x350)	3x211	On request
AFR69-2100	2520	2100	2400	1680	1968	Q69 (12)	4x(1176x730x450)	4xLCL69-525R-AF	4x(1400x510x350)	4x211	On request

<sup>1</sup> Available for a limited time and as long as drive temperature permits

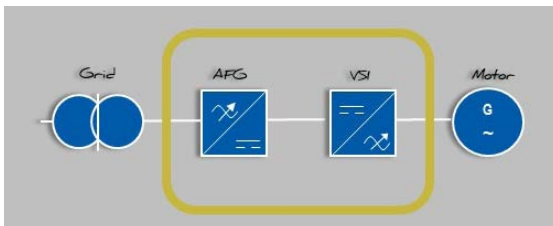
<sup>2</sup> Normal duty, 1 min every 10th minute

<sup>3</sup> Heavy duty, 1 min every 10th minute

<sup>§</sup> Side-by-side <sup>†</sup> Tower



# Emotron AFG is your grid ready AFE



Emotron AFG drives have all the benefits of the AFE units but comes with a special advantage – it has grid code compliant software. They are delivered as IP20 modules with module kits complete with LCL line filters, EMC-filter, precharging and voltage measurement unit. As option available in IP54 cabinet including also breaker/contactor.

## Energy to grid

Emotron AFG grid code drives are often used with renewable energy applications where an energy source such as a wind mill, hydro power turbine, thermal power turbine and wave power plant are producing electrical power to a power grid via its electrical generator. Marine shaft generator for PTI/PTO control is another application suitable for the AFG drive.

The AFG can connect to a public grid, be part of a micro grid as well as forming an island grid. When connecting to a public grid the AFG has the necessary functions to fulfill the required grid codes.

## Energy to batteries, fuel cells and super capacitors

The AFG unit can also be used to produce 3-phase AC power to a grid from DC energy sources such as batteries, fuel cells and super capacitors. Power direction can also be the opposite for e.g. charging batteries. The very flexible AFG unit can momentarily change between the different control modes.

For battery operation the AFG can be equipped with a special LCL line-filter to filter also the Common mode disturbances without the need for an isolation transformer on the supply side.

The AFG drive is using as active igbt type rectifier and an AFG-type LCL line-filter together with a control including all necessary grid code functionality as well as voltage/current/power control modes.

VFXG is the bidirectional power, complete drive unit including an AFG supply unit and VSI unit for connection to the generator/motor. The AFG supply unit is for connection to DC grids or single DC-sources such as batteries.

## MAIN FEATURES

- Top end efficiency - FDUG/VFXG at 97% and AFG at 98%
- Low harmonic distortion to supply, THDi < 5%
- Power range up to 4MW, 380-690V supply
- IP54 cabinet solution or IP20 modular version
- 100% interchangeable and uniquely self-monitored PEBB power modules
- Air cooling or liquid cooling
- Regenerative DC-bus supply unit (AFG) for common DC-bus application
- Project specific adaptation possible
- FDU/VFX options available including WiFi and Bluetooth wireless communication
- Very compact liquid cooled version with state of the art liquid cooling
- Liquid cooling options include water-to-water and water-to-air heat exchanger
- DNV Marine approval (liquid cooled)
- Quiet rail filter option for common mode filtering with battery applications

## UNIQUE SOFTWARE FUNCTIONS

Software for grid code compliance

- Requirements for EN 50549-1 and IEEE 1547/UL 1741, certification ongoing
- Anti-islanding detection (IEC62116:2014 & IEEE1547.1)

Grid support functionality

- FFR, FCR frequency control
- Reactive power support, fault ride through, intended islanding
- Black start

Grid protection functions for voltage and frequency deviations

# Technical data AFG Grid Code Drives

## Slim-LC – Liquid cooled version

Emotron VFXG – regenerative drives & Emotron FDUG – low harmonic drives

1. Emotron VFXG/FDUG typical motor/generator power at mains voltage 400 V

FDUG/VFXG Model	Max <sup>1</sup> output current I <sub>max</sub>	ND 120 % <sup>2</sup>		Frame	IP20 module HxWxD (mm)	LCL-filter	Filter HxWxD (mm)	Filter weight (kg)
		Rated AC current [A]	Gen Power [kW]					
46-250-CL	300	250	132	F+F (1+1)	1120x(170+170)x503	LCL50-210G-AN	540x420x260 <sup>T</sup>	155
46-295-CL	354	295	160	G1+G1 (1+1)	1120x(170+170)x503	LCL50-259G-AN	570x420x300 <sup>T</sup>	205
46-365-CL	438	365	200	H1+H1 (1+1)	1120x(170+170)x503	LCL50-321G-AN	600x420x300 <sup>S</sup>	210
46-590-CL	708	590	315	G2+G2 (2+2)	1120x(314+314)x503	LCL50-518G-WF	430x510x469 <sup>S</sup>	164
46-730-CL	876	730	400	H2+H2 (2+2)	1120x(314+314)x503	LCL50-642G-WF	465x600x469 <sup>S</sup>	230
46-810-CL	972	810	450	G3+G3	1120x(457+457)x503	LCL50-777G-WF	525x600x469 <sup>S</sup>	270
46-1010-CL	1212	1010	560	H3+H3	1120x(457+457)x503	LCL50-963G-WF	525x625x469 <sup>S</sup>	315
46-1100-CL	1320	1100	630	G4+H3	1120x(601+457)x503	2x LCL50-518G-WF	2x (430x510x469) <sup>S</sup>	2x164
46-1460-CL	1752	1460	800	H4+H4	1120x(601+601)x503	2x LCL50-642G-WF	2x (465x600x469) <sup>S</sup>	2x230
46-1710-CL	2052	1710	900	G6+H5	1120x(457+457+457+314)x503	2x LCL50-777G-WF	2x (525x600x469) <sup>S</sup>	2x270
46-2200-CL	2628	2190	1200	H6+H6	1120x(457+457+457+457)x503	2x LCL50-963G-WF	2x (525x625x469) <sup>S</sup>	2x315

2. Emotron VFXG/FDUG typical motor/generator power at mains voltage 690 V

FDUG/VFXG Model	Max <sup>1</sup> output current I <sub>max</sub>	ND 120 % <sup>2</sup>		Frame	IP20 module HxWxD (mm)	LCL-filter	Filter HxWxD (mm)	Filter weight (kg)
		Rated AC current [A]	Gen Power [kW]					
69-109-CL	131	109	110	F69+F69 (1+1)	1120x(170+170)x503	LCL69-109G-AN	505x420x260 <sup>T</sup>	150
69-200-CL	240	200	200	F69+F69 (1+1)	1120x(170+170)x503	LCL69-200G-AN	570x420x300 <sup>T</sup>	210
69-300-CL	360	300	300	H69+H69 (2+2)	1120x(314+314)x503	LCL69-298G-AN	500x420x500 <sup>S</sup>	270
69-400-CL	480	400	400	H69+H69 (2+2)	1120x(314+314)x503	LCL69-400G-WF	470x575x469 <sup>S</sup>	230
69-500-CL	600	500	500	I69+H69 (3+2)	1120x(457+314)x503	LCL69-600G-WF	530x600x469 <sup>S</sup>	320
69-750-CL	900	750	710	J69+I69 (4+3)	1120x(601+457)x503	LCL69-800G-WF	530x600x469 <sup>S</sup>	410
69-1000-CL	1200	1000	1000	K69+J69 (6+4)	1120x(2x457+601)x503	2x LCL69-600G-WF	2x (530x600x469)	2x320
69-1250-CL	1500	1250	1250	K69+KA69 (6+5)	1120x(3x457+314)x503	2x LCL69-600G-WF	2x (530x600x469)	2x320
69-1500-CL	1800	1500	1500	M69+K69 (8+6)	1120x(2x601+2x457)x503	2x LCL69-800G-WF	2x (530x600x469)	2x410
69-2000-CL	2400	2000	2000	Q69+M69 (12+8)	1120x(5x601)x503	3x LCL69-800G-WF	3x (530x600x469)	3x410
69-2500-CL	3000	2500	2500	Q69+O69 (12+10)	1120x(3x601+2x457+2x314)x503	3x LCL69-800G-WF	3x (530x600x469)	3x410
69-3250-CL	3900	3250	3250	U69+R69 (16+13)	1120x(4x601+3x457+2x314)x503	4x LCL69-800G-WF	4x (530x600x469)	4x410

<sup>1</sup> Available for a limited time and as long as drive temperature permits

<sup>2</sup> Normal duty, 1 min every 10th minute, 150% 10 sec

<sup>S</sup> Side-by-side <sup>T</sup> Tower <sup>D</sup> Double deck



# Slim-LC – Liquid cooled version

## Emotron AFG - Liquid cooled AFG Regenerative DC-bus supply unit

### 3. Emotron AFG46 AC power at mains voltage 400 V

AFG Model	Max <sup>1</sup> Input current I <sub>max</sub> [A]	ND 120 % <sup>2</sup>			Frame	IP20 module HxWxD (mm)	LCL-filter	Filter HxWxD (mm)	Filter weight (kg)
		Rated AC current [A]	AC Power [kW]	Apparent Power [kVA]					
46-109-CL	164	109	68	76	F (1)	1120x170x503	LCL50-109G-AN	450x360x250 <sup>T</sup>	100
46-146-CL	219	146	91	101	F (1)	1120x170x503	LCL50-146G-AN	480x360x250 <sup>T</sup>	105
46-175-CL	263	175	110	122	F (1)	1120x170x503	LCL50-175G-AN	510x420x260 <sup>T</sup>	145
46-210-CL	315	210	132	146	F (1)	1120x170x503	LCL50-210G-AN	540x420x260 <sup>T</sup>	155
46-259-CL	389	259	161	179	G1 (1)	1120x170x503	LCL50-259G-AN	570x420x300 <sup>T</sup>	205
46-321-CL	482	321	200	222	H1 (1)	1120x170x503	LCL50-321G-AN	600x420x300 <sup>T</sup>	210
46-420-CL	630	420	264	291	H (2)	1120x314x503	LCL50-420G-WF	608x495x302 <sup>D</sup>	185
46-518-CL	777	518	322	359	G2 (2)	1120x314x503	LCL50-518G-WF	430x510x469 <sup>S</sup>	164
46-642-CL	963	642	400	445	H2 (2)	1120x314x503	LCL50-642G-WF	465x600x469 <sup>S</sup>	230
46-777-CL	1166	777	483	540	G3 (3)	1120x457x503	LCL50-777G-WF	525x600x469 <sup>S</sup>	270
46-963-CL	1445	963	600	667	H3 (3)	1120x457x503	LCL50-963G-WF	525x625x469 <sup>S</sup>	315
46-1036-CL	1554	1036	644	718	G4 (4)	1120x601x503	2x LCL50-518G-WF	2x(430x510x469) <sup>S</sup>	2x164
46-1284-CL	1926	1284	800	890	H4 (4)	1120x601x503	2xLCL50-642G-WF	2x(465x600x469) <sup>S</sup>	2x230
46-1554-CL	2331	1554	966	1077	G6 (6)	1120x(2x457)x503	2xLCL50-777G-WF	2x(525x600x469) <sup>S</sup>	2x270
46-1926-CL	2889	1926	1200	1334	H6 (6)	1120x(2x457)x503	2xLCL50-963G-WF	2x(525x625x469) <sup>S</sup>	2x315
46-2331-CL	3497	2331	1453	1615	G9 (9)	1120x(3x457)x503	3xLCL50-777G-WF	3x(525x600x469) <sup>S</sup>	3x270
46-2889-CL	4334	2889	1800	2001	H9 (9)	1120x(3x457)x503	3xLCL50-963G-WF	3x(525x625x469) <sup>S</sup>	3x315

### 4. Emotron AFG69 AC power at mains voltage 690 V

AFG Model	Max <sup>1</sup> Input current I <sub>max</sub> [A]	ND 120 % <sup>2</sup>			Frame	Width IP20 module D=450 WxH (mm)	LCL-filter	Filter HxWxD (mm)	Filter weight (kg)
		Rated AC current [A]	AC Power [kW]	Apparent Power [kVA]					
69-109-CL	164	109	117	130	F69 (1)	1120x170x503	LCL69-109G-AN	505x420x260 <sup>T</sup>	150
69-109-CL	224	149	160	178	F69 (1)	1120x170x503	LCL69-149G-AN	540x420x260 <sup>T</sup>	160
69-109-CL	300	200	215	239	F69 (1)	1120x170x503	LCL69-200G-AN	570x420x300 <sup>T</sup>	210
69-298-CL	447	298	320	356	H69 (2)	1120x314x503	LCL69-298G-AN	500x420x500 <sup>S</sup>	270
69-400-CL	600	400	430	478	H69 (2)	1120x314x503	LCL69-400G-WF	470x575x469 <sup>S</sup>	230
69-600-CL	900	600	645	717	I69 (3)	1120x457x503	LCL69-600G-WF	530x600x469 <sup>S</sup>	320
69-800-CL	1200	800	860	956	J69 (4)	1120x601x503	LCL69-800G-WF	530x600x469 <sup>S</sup>	410
69-1200-CL	1800	1200	1290	1434	K69 (6)	1120x(2x457)x503	2xLCL69-600G-WF	2x(530x600x469)	2x320
69-1600-CL	2400	1600	1720	1912	M69 (8)	1120x(2x601)x503	2xLCL69-800G-WF	2x(530x600x469)	2x410
69-1800-CL	2700	1800	1935	2151	N69 (9)	1120x(3x457)x503	3xLCL69-600G-WF	3x(530x600x469)	3x320
69-2400-CL	3600	2400	2580	2868	Q69 (12)	1120x(3x601)x503	3xLCL69-800G-WF	3x(530x600x469)	3x410
69-3200-CL	4800	3200	3440	3824	U69 (16)	1120x(4x601)x503	4xLCL69-800G-WF	4x(530x600x469)	4x410

<sup>1</sup> Available for a limited time and as long as drive temperature permits <sup>S</sup> Side-by-side <sup>T</sup> Tower <sup>D</sup> Double deck

<sup>2</sup> Normal duty, 1 min every 10th minute, 150% 10 sec

## Air cooled version

### Emotron VFXG – regenerative drives & Emotron FDUG – low harmonic drives

#### 5. Emotron VFXG/FDUG typical motor/generator power at mains voltage 400 V

FDUG/ VFXG Model	Max <sup>1</sup> output current I <sub>max</sub>	ND 120 % <sup>2</sup>		Frame	IP20 module HxWxD (mm)	LCL-filter	Filter HxWxD (mm)	Filter weight (kg)
		Rated AC current [A]	Gen Power [kW]					
46-109	131	109	55	E+E (1+1)	1036x500x450	LCL50-109G-AN	450x360x250 <sup>T</sup>	100
46-146	175	146	75	E+E (1+1)	1036x500x450	LCL50-146G-AN	480x360x250 <sup>T</sup>	105
46-175	210	175	90	E+E (1+1)	1036x500x450	LCL50-146G-AN	480x360x250 <sup>T</sup>	105
46-210	252	210	110	F+F (1+1)	1036x500x450	LCL50-175G-AN	510x420x260 <sup>T</sup>	145
46-250	300	250	132	F+F (1+1)	1036x500x450	LCL50-210G-AN	540x420x260 <sup>T</sup>	155
46-295	354	295	160	G1+G1 (1+1)	1036x500x450	LCL50-259G-AN	570x420x300 <sup>T</sup>	205
46-365	438	365	200	H1+H1 (1+1)	1176x500x450	LCL50-321G-AN	600x420x300 <sup>T</sup>	210
46-500	600	500	250	H+H (2+2)	2x (1036x500x450)	LCL50-420G-AN	480x420x500 <sup>S</sup>	250
46-590	708	590	315	G2+G2 (2+2)	2x (1036x500x450)	LCL50-518G-AF	1200x510x350	199
46-730	876	730	400	H2+H2 (2+2)	2x (1176x500x450)	LCL50-642G-AF	1400x510x350	212
46-810	972	810	450	G3+G3 (3+3)	2x (1036x730x450)	LCL50-777G-AF	1400x510x350	243
46-1010	1212	1010	560	H3+H3 (3+3)	2x (1176x730x450)	LCL50-963G-AF	1850x510x350	291
46-1100	1320	1100	630	G4+H3 (4+3)	2x (1036x500x450) + (1176x730x450)	2x LCL50-518G-AF	2x (1200x510x350)	2x199
46-1460	1752	1460	800	H4+H4 (4+4)	4x (1176x500x450)	2x LCL50-642G-AF	2x (1400x510x350)	2x212
46-1710	2052	1710	900	G6+H5 (6+5)	2x (1036x730x450) + (1176x(730+500)x450)	2x LCL50-777G-AF	2x (1400x510x350)	2x243
46-2200	2628	2190	1200	H6+H6 (6+6)	4x (1176x730x450)	2x LCL50-963G-AF	2x (1850x510x350)	2x291

#### 6. Emotron VFXG/FDUG typical motor/generator power at mains voltage 690 V

FDUG/ VFXG Model	Max <sup>1</sup> output current I <sub>max</sub>	ND 120 % <sup>2</sup>		Frame	IP20 module HxWxD (mm)	LCL-filter	Filter HxWxD (mm)	Filter weight (kg)
		Rated AC current [A]	Gen Power [kW]					
69-109	131	109	110	F69+F69 (1+1)	1176x500x450	LCL69-109G-AN	505x420x260 <sup>T</sup>	150
69-146	175	146	132	F69+F69 (1+1)	1176x500x450	LCL69-149G-AN	540x420x260 <sup>T</sup>	160
69-175	210	175	160	F69+F69 (1+1)	1176x500x450	LCL69-149G-AN	540x420x260 <sup>T</sup>	160
69-300	360	300	315	H69+H69 (2+2)	2x (1176x500x450)	LCL69-298G-AN	500x420x500 <sup>T</sup>	270
69-430	516	430	450	I69+I69 (3+3)	2x (1176x730x450)	LCL69-447G-AF	1400x510x350	225
69-650	780	650	630	J69+I69 (4+3)	1176x(2x500+730)x450	2x LCL69-298G-AN	2x (500x420x500) <sup>S</sup>	2x270
69-995	1200	1000	1000	K69+KA69 (6+5)	1176x(3x730+500)x450	2x LCL69-447G-AF	2x (1400x510x350)	2x225
69-1K12	1344	1120	1100	K69+K69 (6+6)	4x (1176x730x450)	2x LCL69-447G-AF	2x (1400x510x350)	2x225
69-1K68	2016	1680	1650	N69+N69 (9+9)	6x (1176x730x450)	3x LCL69-447G-AF	3x (1400x510x350)	3x225
69-2K24	2688	2240	2200	Q69+Q69 (12+12)	8x (1176x730x450)	4x LCL69-447G-AF	4x (1400x510x350)	4x225

<sup>1</sup> Available for a limited time and as long as drive temperature permits

<sup>2</sup> Normal duty, 1 min every 10th minute, 150% 10 sec

<sup>S</sup> Side-by-side <sup>T</sup> Tower <sup>D</sup> Double deck

## Air cooled version

### Emotron AFG - Regenerative drive

#### 7. Emotron AFG46 AC power at mains voltage 400 V

AFG Model	Max <sup>1</sup> Input current I <sub>max</sub> [A]	ND 120 % <sup>2</sup>			Frame	IP20 module HxWxD (mm)	LCL-filter	Filter HxWxD (mm)	Filter weight (kg)
		Rated AC current [A]	AC Power [kW]	Apparent Power [kVA]					
46-031	47	31	19.3	21.5	C	512x178x292	LCL50-031G-AN	213x248x161 159x175x133	23+10
46-074	111	74	46	51	D	590x220x29	LCL50-074G-AN	410x300x240 <sup>T</sup>	75
46-109	164	109	68	76	E (1)	1036x270x450	LCL50-109G-AN	450x360x250 <sup>T</sup>	100
46-146	219	146	91	101	E (1)	1036x270x450	LCL50-146G-AN	480x360x250 <sup>T</sup>	105
46-175	263	175	110	122	F (1)	1036x270x450	LCL50-175G-AN	510x420x260 <sup>T</sup>	145
46-210	315	210	132	146	F (1)	1036x270x450	LCL50-210G-AN	540x420x260 <sup>T</sup>	155
46-259	389	259	161	180	G1 (1)	1036x270x450	LCL50-259G-AN	570x420x300 <sup>T</sup>	205
46-321	482	321	200	222	H1 (1)	1176x270x450	LCL50-321G-AN	600x420x300 <sup>T</sup>	210
46-420	630	420	264	291	H (2)	1036x500x450	LCL50-420G-AN	480x420x500 <sup>S</sup>	250
46-518	777	518	322	359	G2 (2)	1036x500x450	LCL50-518G-AF	1200x510x350	199
46-642	963	642	400	445	H2 (2)	1176x500x450	LCL50-642G-AF	1400x510x350	212
46-777	1166	777	483	540	G3 (3)	1036x730x451	LCL50-777G-AF	1400x510x350	243
46-963	1445	963	600	667	H3 (3)	1176x730x450	LCL50-963G-AF	1850x510x350	291
46-1036	1554	1036	644	718	G4 (4)	2x (1036x500x450)	2xLCL50-518G-AF	2x(1200x510x350)	2x199
46-1284	1926	1284	800	890	H4 (4)	2x (1176x500x450)	2xLCL50-642G-AF	2x(1400x510x350)	2x212
46-1554	2331	1554	966	1077	G6 (6)	2x (1036x730x450)	2xLCL50-777G-AF	2x(1400x510x350)	2x243
46-1926	2889	1926	1200	1334	H6 (6)	2x (1176x730x450)	2xLCL50-963G-AF	2x(1850x510x350)	2x291
46-2331	3497	2331	1453	1615	G9 (9)	3x (1036x730x450)	3xLCL50-777G-AF	3x(1400x510x350)	3x243
46-2889	4334	2889	1800	2001	H9 (9)	3x (1176x730x450)	3xLCL50-963G-AF	3x(1850x510x350)	3x291
46-3852	5778	3852	2400	2668	H12 (12)	4x (1176x730x450)	4xLCL50-963G-AF	4x(1850x510x350)	4x291

#### 8. Emotron AFG69 AC power at mains voltage 690 V

AFG Model	Max <sup>1</sup> Input current I <sub>max</sub> [A]	ND 120 % <sup>2</sup>			Frame	IP20 module HxWxD (mm)	LCL-filter	Filter HxWxD [mm]	Filter weight (kg)
		Rated AC current [A]	AC Power [kW]	Apparent Power [kVA]					
69-149	224	149	160	178	F69 (1)	1176x270x450	LCL69-149G-AN	540x420x260 <sup>T</sup>	160
69-298	447	298	320	356	H69 (2)	1176x500x450	LCL69-298G-AN	500x420x500 <sup>S</sup>	270
69-447	671	447	480	534	I69 (3)	1176x730x450	LCL69-447G-AF	1400x510x350	225
69-596	894	596	640	712	J69 (4)	2x(1176x500x450)	2xLCL69-298G-AN	2x(500x420x500) <sup>S</sup>	2x270
69-894	1341	894	960	1068	K69 (6)	2x(1176x730x450)	2xLCL69-447G-AF	2x(1400x510x350)	2x225
69-1192	1788	1192	1280	1424	M69 (8)	4x(1176x500x450)	4xLCL69-298G-AF	4x(1200x510x350)	4x186
69-1341	2012	1341	1440	1602	N69 (9)	3x(1176x730x450)	3xLCL69-447G-AF	3x(1400x510x350)	3x225
69-1788	2682	1788	1920	2136	Q69 (12)	4x(1176x730x450)	4xLCL69-447G-AF	4x(1400x510x350)	4x225

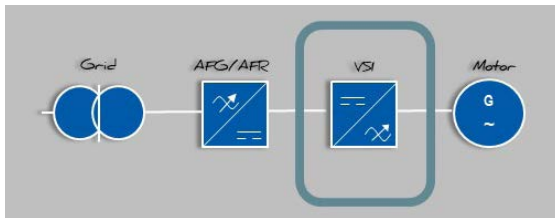
<sup>1</sup> Available for a limited time and as long as drive temperature permits

<sup>2</sup> Normal duty, 1 min every 10th minute, 150% 10 sec

<sup>S</sup> Side-by-side <sup>T</sup> Tower <sup>D</sup> Double deck



# Controlling generator power with Emotron VSI



Emotron VSI units are motor inverters used for creating variable 3-phase AC-voltage and frequency to control an AC motor/generator (asynchronous, PMSM or SynRM). One or more VSI (Voltage Source Inverter) units are connected and fed from a DC-voltage source, e.g. the DC-bus output of an AFR or AFG DC-supply unit or a DC-grid. VSI units can handle full power in both directions, i.e. motoring and generating.

The VSI is available in both FDU (V/Hz) and VFX (Direct torque control) versions.

A VSI unit consists of a 3-phase igbt-bridge, DC-capacitor link, DC-fuses and a control unit. DC-connections are not required to be low-inductance and can be done with standard power cables. VSI units with a power above 200kW are built up with multiple parallel PEBB's (Power Electronic Building Blocks) for easy handling.

## MAIN FEATURES

- Wide power range up to 4000 kW (380-690Vac)
- VFX (with Direct Torque Control) and FDU (V/Hz) types available
- PM and induction machines supported
- Micro-grid functionality (with Sinusfilter)
- PEBB redundancy available
- DC-fuses included
- DNV marine approval
- IP20 modules
- Optional Output choke
- Air- or liquid cooled (Slim-LC)



# Technical Data VSI

## Slim-LC - Liquid cooled version

### 1. Emotron VSI typical motor power at mains voltage 400 V

VSI Model FDU/VFX	Max <sup>1</sup> output current I <sub>max</sub>	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		Frame	IP20 module HxWxD (mm)
		Rated current I <sub>nom</sub> [A]	Power [kW]	Rated current I <sub>nom</sub> [A]	Power [kW]		
48-250-CL-VSI	300	250	132	200	110	F (1)	1120x170x503
48-295-CL-VSI	354	295	160	236	132	G1 (1)	1120x170x503
48-365-CL-VSI	438	365	200	292	160	H1 (1)	1120x170x503
48-590-CL-VSI	708	590	315	472	250	G2 (2)	1120x314x503
48-730-CL-VSI	876	730	400	584	315	H2 (2)	1120x314x503
48-885-CL-VSI	1062	885	500	708	400	G3 (3)	1120x457x503
48-1100-CL-VSI	1320	1100	630	880	500	H3 (3)	1120x457x503
48-1460-CL-VSI	1752	1460	800	1168	630	H4 (4)	1120x601x503
48-1820-CL-VSI	2184	1820	1000	1456	800	H5 (5)	1120x(457+314)x503
48-2190-CL-VSI	2628	2190	1200	1752	1000	H6 (6)	1120x(2x457)x503
48-2550-CL-VSI	3060	2550	1400	2040	1120	H7 (7)	1120x(601+457)x503
48-2920-CL-VSI	3504	2920	1600	2336	1300	H8 (8)	1120x(2x601)x503

### 2. Emotron VSI typical motor power at mains voltage 690 V

VSI Model FDU/VFX	Max <sup>1</sup> output current I <sub>max</sub>	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		Frame	IP20 module HxWxD (mm)
		Rated current I <sub>nom</sub> [A]	Power [kW]	Rated current I <sub>nom</sub> [A]	Power [kW]		
69-250-CL-VSI	300	250	250	200	200	F69 (1)	1120x170x503
69-500-CL-VSI	600	500	500	400	400	H69 (2)	1120x314x503
69-750-CL-VSI	900	750	710	600	600	I69 (3)	1120x457x503
69-1000-CL-VSI	1200	1000	1000	800	800	J69 (4)	1120x601x503
69-1250-CL-VSI	1500	1250	1250	1000	1000	KA69 (5)	1120x(457+314)x503
69-1500-CL-VSI	1800	1500	1500	1200	1200	K69 (6)	1120x(2x457)x503
69-2000-CL-VSI	2400	2000	2000	1600	1600	M69 (8)	1120x(2x601)x503
69-3000-CL-VSI	3600	3000	3000	2400	2400	Q69 (12)	1120x(3x601)x503
69-4000-CL-VSI	4800	4000	4000	3200	3200	U69 (16)	1120x(4x601)x503

<sup>1</sup> Available for a limited time and as long as drive temperature permits

<sup>2</sup> Normal duty, 1 min every 10th minute

<sup>3</sup> Heavy duty, 1 min every 10th minute

<sup>4</sup> Width cabinet without/with cooling section water/water

## Emotron VSI - Air cooled version

### 3. Emotron VSI typical motor power at mains voltage 400 V

VSI Model FDU/VFX	Max <sup>1</sup> output current I <sub>max</sub>	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		Frame	IP20 module HxWxD (mm)
		Rated current I <sub>nom</sub> [A]	Power [kW]	Rated current I <sub>nom</sub> [A]	Power [kW]		
48-109-VSI	131	109	55	87	45	E (1)	1036x270x450
48-175-VSI	210	175	90	140	75	E (1)	1036x270x450
48-250-VSI	300	250	132	200	110	F (1)	1036x270x450
48-295-VSI	354	295	160	236	132	G1 (1)	1036x270x450
48-365-VSI	438	365	200	292	160	H1 (1)	1176x270x450
48-500-VSI	600	500	250	400	220	H (2)	1036x500x450
48-590-VSI	708	590	315	472	250	G2 (2)	1036x500x450
48-730-VSI	876	730	400	584	315	H2 (2)	1176x500x450
48-885-VSI	1062	885	500	708	400	G3 (3)	1036x730x451
48-1100-VSI	1320	1100	630	880	500	H3 (3)	1176x730x450
48-1460-VSI	1752	1460	800	1168	630	H4 (4)	2x (1176x500x450)
48-1820-VSI	2184	1820	1000	1458	800	H5 (5)	1176x(730+500)x450
48-2190-VSI	2628	2190	1200	1752	1000	H6 (6)	2x (1176x730x450)
48-2550-VSI	3060	2550	1400	2040	1120	H7 (7)	1176x(500+730+500)x450
48-2920-VSI	3504	2920	1600	2336	1300	H8 (8)	1176x(730+500+730)x450

### 4. Emotron VSI typical motor power at mains voltage 690 V

VSI Model FDU/VFX	Max <sup>1</sup> output current I <sub>max</sub>	ND 120 % <sup>2</sup>		HD 150 % <sup>3</sup>		Frame	Width IP20 module WxHxD (mm)
		Rated current I <sub>nom</sub> [A]	Power [kW]	Rated current I <sub>nom</sub> [A]	Power [kW]		
69-109-VSI	131	109	110	87	90	F69 (1)	1176x270x450
69-200-VSI	240	200	200	160	160	F69 (1)	1176x270x450
69-300-VSI	360	300	315	240	250	H69 (2)	1176x500x450
69-400-VSI	480	400	400	320	315	H69 (2)	1176x500x450
69-595-VSI	720	600	600	480	450	I69 (3)	1176x730x450
69-800-VSI	960	800	800	640	630	J69 (4)	2x (1176x500x450)
69-995-VSI	1200	1000	1000	800	800	KA69 (5)	1176x(730+500)x450
69-1K2-VSI	1440	1200	1200	960	900	K69 (6)	2x (1176x730x450)
69-1K4-VSI	1680	1400	1400	1120	1120	L69 (7)	1176x(500+730+500)x450
69-1K6-VSI	1920	1600	1600	1280	1250	M69 (8)	1176x(730+500+730)x450
69-1K8-VSI	2160	1800	1800	1440	1400	N69 (9)	3x (1176x730x450)
69-2K0-VSI	2400	2000	2000	1600	1600	O69 (10)	2x (1176x(730+500)x450)
69-2K2-VSI	2640	2200	2200	1760	1700	P69 (11)	1176x(3x730+500)x450
69-2K4-VSI	2880	2400	2400	1920	1900	Q69 (12)	4x (1176x730x450)
69-2K6-VSI	3120	2600	2600	2080	2000	R69 (13)	1176x(3x730+2x500)x450
69-2K8-VSI	3360	2800	2800	2240	2200	S69 (14)	1176x(4x730+500)x450
69-3K0-VSI	3600	3000	3000	2400	2400	T69 (15)	5x (1176x730x450)

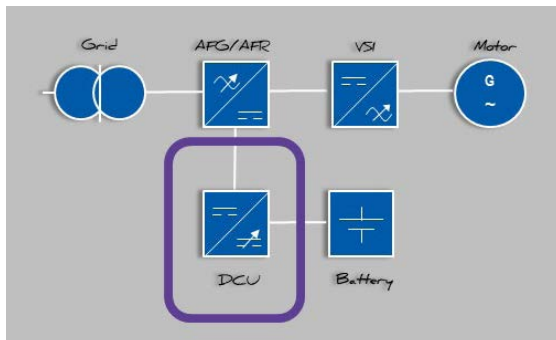
<sup>1</sup> Available for a limited time and as long as drive temperature permits

<sup>2</sup> Normal duty, 1 min every 10th minute

<sup>3</sup> Heavy duty, 1 min every 10th minute



# Connecting your DC sources with Emotron DCU



Emotron DC/DC converter units allows you full flexibility in adding DC sources to harness the power of renewable energy sources and energy storage. It may be used either for low-to-high “DC booster” or high-to-low voltage conversions and is often used for battery voltage boosting in microgrid applications. It allows for a bidirectional power flow and is built in a flexible modular design.

The Emotron DCU is ideal for all forms of energy storage systems such as batteries, fuel cells and super capacitors. It may also be used for all forms of renewable energy production such as solar cells, windmills, hydropower, wave generators and thermal power, when adjustment of DC voltage level is required.

It may be delivered either as an IP20 module kit with DC filter or in an optional IP54 cabinet enclosure including DC-fuses, precharging and filters.

## MAIN FEATURES

- Power range 23-1100 kW
- High side voltage range: 450-760 Vdc (DCU48) resp. 550-1120 Vdc (DCU69)
- Low side voltage range: 15-85% of High side voltage
- Low side voltage accuracy <1% of high side voltage range
- Low voltage side DC-filter (LC) included
- IP20 module kit or optional IP54 cabinet available
- DC-fuses included
- Voltage measurement feedback unit included
- DC precharging circuit available as option
- Control modes for low side or high side voltage control
- Air or liquid cooling
- Energy counter values for readout
- DNV Marine approval (liquid cooled)
- Wide range of communication module selections
- WiFi and Bluetooth wireless communication
- Project specific adaptation possible
- 

## IP 20 MODULAR VERSION

The IP20 modular version of the Emotron DCU is delivered in complete kits providing ultimate flexibility in own builds. Kits are complete with:

- Inverter modules, air-cooled or liquid cooled
- Filter units, air-cooled
- Precharging units where applicable
- Optional communication interface
- Wireless (WiFi or Bluetooth) App communication

# Technical Data DCU

## Slim-LC - Liquid cooled version

### 1. Emotron DCU rated DC-data for DCU48 units

DCU Model	ND 120 % <sup>2</sup>			Frame	IP20 module HxWxD (mm)	Filter inductor L3dc (LV)	Filter inductor data	Filter inductor dimensions (HxWxD) mm	Filter inductor weight kg	Filter capacitor Cdc (optional)
	Rated current LV [A]	Rated power <sup>1</sup> LV [kW]	Current <sup>3</sup> HV [A]							
DCU48-109-CL	164	82	137	E	1120x170x503	LDC48-3x55-AN	3x2.7mH	435x210x170 <sup>T</sup>	46	4mF
DCU48-175-CL	263	131	219	E	1120x170x503	LDC48-3x88-AN	3x1.7mH	530x210x170 <sup>T</sup>	62	6mF
DCU48-250-CL	375	187	312	F	1120x170x503	LDC48-3x125-AN	3x1.2mH	560x250x215 <sup>T</sup>	92	8mF
DCU48-365-CL	548	274	456	H1	1120x170x503	LDC48-3x183-AN	3x0.81mH	590x325x275 <sup>T</sup>	151	12mF
DCU48-500-CL	750	375	625	H	1120x314x503	2xLDC48-3x125-AN	2x3x1.2mH	2x(560x250x215) <sup>T</sup>	2x92	2x 8mF
DCU48-730-CL	1095	548	912	H2	1120x314x503	2xLDC48-3x183-AN	2x3x0.81mH	2x(590x325x275) <sup>T</sup>	2x151	2x12mF
DCU48-1095-CL	1642	821	1368	H3	1120x457x503	3xLDC48-3x183-AN	3x3x0.81mH	3x(590x325x275) <sup>T</sup>	3x151	3x12mF
DCU48-1460-CL	2190	1095	1824	H4	1120x601x503	4xLDC48-3x183-AN	4x3x0.81mH	4x(590x325x275) <sup>T</sup>	4x151	4x12mF

### 2. Emotron DCU rated DC-data for DCU69 units

DCU Model	ND 120 % <sup>2</sup>			Frame	IP20 module HxWxD (mm)	Filter inductor L3dc (LV)	Filter inductor data	Filter inductor dimensions (HxWxD) mm	Filter inductor weight kg	Filter capacitor Cdc (optional)
	Rated current LV [A]	Rated power <sup>1</sup> LV [kW]	Current <sup>3</sup> HV [A]							
DCU69-109-CL	164	143	137	F69	1120x170x503	LDC69-3x55-AN	3x4.56mH	530x200x185 <sup>T</sup>	65	2.67mF
DCU69-250-CL	375	328	312	F69	1120x170x503	LDC69-3x125-AN	3x2.0mH	680x285x250 <sup>T</sup>	175	5.33mF
DCU69-400-CL	600	525	500	H69	1120x314x503	2x LDC69-3x100-AN	2x3x2.5mH	2x (590x269x166) <sup>T</sup>	2x120	2x4.0mF
DCU69-500-CL	750	656	625	H69	1120x314x503	2X LDC69-3x125-AN	2x3x2.0mH	2x (680x285x250) <sup>T</sup>	2x175	2x5.33mF
DCU69-750-CL	1125	984	937	I69	1120x457x503	3X LDC69-3x125-AN	3x3x2.0mH	3x (680x285x250) <sup>T</sup>	3x175	3x5.33mF
DCU69-1000-CL	1500	1312	1250	J69	1120x601x503	4X LDC69-3x125-AN	4x3x2.0mH	4x (680x285x250) <sup>T</sup>	4x175	4x5.33mF

LV=Low voltage side, HV=High voltage side

<sup>1</sup> Rated power LV for DCU48 is at 500 Vdc, Rated power LV for DCU69 is at 875 Vdc

<sup>2</sup> Normal duty, 1 min every 10th minute

<sup>3</sup> Current HV for DCU48 is at 600 Vdc, Current HV for DCU69 is at 1050 Vdc

<sup>T</sup> Tower



# Emotron DCU - Air cooled version

## 3. Emotron DCU rated DC-data for DCU48 units

DCU model	ND 120 % <sup>2</sup>			Frame	IP20 module HxWxD (mm)	Filter inductor L3dc (LV)	Filter induction data	Filter inductor dimensions (HxWxD) mm	Filter inductor weight kg	Filter capacitor Cdc (optional)
	Rated current LV [A]	Rated power <sup>1</sup> LV [kW]	Current <sup>3</sup> HV [A]							
DCU48-031-54	46,5	23	37	C	512x178x292	LDC48-3x17-AN	3x10.0mH	355x148x146 <sup>T</sup>	22	0.75mF
DCU48-046-54	69	34	57	C	512x178x292	LDC48-3x23-AN	3x6.6mH	400x145x140 <sup>T</sup>	21	1.13mF
DCU48-074-54	111	55	92	D	590x220x295	LDC48-3x37-AN	3x4.05mH	410x180x155 <sup>T</sup>	34	2.25mF
DCU48-109-20	164	82	137	E	1036x270x450	LDC48-3x55-AN	3x2.7mH	435x210x170 <sup>T</sup>	46	4mF
DCU48-175-20	263	131	219	E	1036x270x450	LDC48-3x88-AN	3x1.7mH	530x210x170 <sup>T</sup>	62	6mF
DCU48-250-20	375	187	312	F	1036x270x450	LDC48-3x125-AN	3x1.2mH	560x250x215 <sup>T</sup>	92	8mF
DCU48-365-20	548	274	456	H1	1176x270x450	LDC48-3x183-AN	3x0.81mH	590x325x275 <sup>T</sup>	151	12mF
DCU48-500-20	750	375	625	H	1036x500x450	2X LDC48-3x125-AN	2x3x1.2mH	2x (560x250x215) <sup>T</sup>	2x92	2x8mF
DCU48-730-20	1095	548	912	H2	1176x500x450	2X LDC48-3x183-AN	2x3x0.81mH	2x (590x325x275) <sup>T</sup>	2x151	2x12mF
DCU48-1095-20	1642	821	1368	H3	1176x730x450	3X LDC48-3x183-AN	3x3x0.81mH	3x (590x325x275) <sup>T</sup>	3x151	3x12mF
DCU48-1460-20	2190	1095	1824	H4	2x(1176x500x450)	4X LDC48-3x183-AN	4x3x0.81mH	4x (590x325x275) <sup>T</sup>	4x151	4x12mF

## 4. Emotron DCU rated DC-data for DCU69 units

DCU model	ND 120 % <sup>2</sup>			Frame	IP20 module HxWxD (mm)	Filter inductor L3dc (LV)	Filter induction data	Filter inductor dimensions (HxWxD) mm	Filter inductor weight kg	Filter capacitor Cdc (optional)
	Rated current LV [A]	Rated power <sup>1</sup> LV [kW]	Current <sup>3</sup> HV [A]							
DCU69-025-54	37,5	33	31	C69	512x178x314	LDC69-3x13-AN	3x 21.0mH	360x150x135 <sup>T</sup>	27	0.55mF
DCU69-058-54	87	76	72	D69	590x220x295	LDC69-3x29-AN	3x 9.0mH	490x169x116 <sup>T</sup>	41	1.1mF
DCU69-109-20	164	143	137	E69	1176x270x450	LDC69-3x55-AN	3x 4.56mH	530x200x185 <sup>T</sup>	65	2.67mF
DCU69-200-20	300	262	250	F69	1176x270x450	LDC69-3x100-AN	3x 2.5mH	590x269x166 <sup>T</sup>	120	4.0mF
DCU69-400-20	600	525	500	H69	1176x500x450	2X LDC69-3x100-AN	2x3x 2.5mH	2x (590x269x166) <sup>T</sup>	2x120	2x 4.0mF
DCU69-600-20	900	788	750	I69	1176x730x450	3X LDC69-3x100-AN	3x3x 2.5mH	3x (590x269x166) <sup>T</sup>	3x120	3x 4.0mF
DCU69-800-20	1200	1050	1000	J69	2x(1176x500x450)	4X LDC69-3x100-AN	4x3x 2.5mH	4x (590x269x166) <sup>T</sup>	4x120	4x 4.0mF

LV=Low voltage side, HV=High voltage side

<sup>1</sup> Rated power LV for DCU48 is at 500 Vdc, Rated power LV for DCU69 is at 875 Vdc

<sup>2</sup> Normal duty, 1 min every 10th minute

<sup>3</sup> Current HV for DCU48 is at 600 Vdc, Current HV for DCU69 is at 1050 Vdc

<sup>T</sup> Tower



# General electrical specifications

(valid for both Liquid cooled and Air cooled versions)

General		
Mains voltage:	AFR46/VFXR46/FDUL46 AFG46/VFXG46/FDUG46 AFR69/VFXR69/FDUL69 AFG69/VFXG69/FDUG69	380–460 V +10 %/–15 % 380–460 V +10 %/–15 % 480–690 V +6 %/–15 % 480–690 V +6 %/–15 %
Mains frequency:		48 to 52 Hz and 58 to 62 Hz
Input total power factor:		1,0
Output DC voltage:	AFR46/AFR69/AFG46/AFG69	(1,0 - 1,2) * $\sqrt{2}$ * Mains supply voltage
Output AC voltage:	VFXR/VFXG/FDUL/FDUG46/69	(0 - 1,2) * Mains supply voltage
Output frequency:	VFXR/VFXG/FDUL/FDUG46/69	0–599 Hz
Switching frequency:	AFR46/AFR69/AFG46/AFG69 VFXR/VFXG/FDUL/FDUG46/69	3 kHz (adjustable 3–6 kHz) 3 kHz (adjustable 1,5–6 kHz (max=8 kHz @ Fnmot > 400 Hz), FDUL/FDUG only)
Efficiency at nominal load:	AFR46/AFR69/AFG46/AFG69 VFXR/VFXG/FDUL/FDUG46/69	98 % 97 %
Harmonics to supply, THDI:		< 5 %

All AFE/AFG units assembled in an IP54 cabinet including main switch + main contactor or motorized circuit breaker, LCL filter, charging unit, and output chokes.

## Environmental conditions

### Operation

Parameter	Normal operation
Nominal ambient temperature	0 deg C – 40 deg C (Air cooled) / 0 deg C – 45 deg C (Liquid cooled) For operation at higher temperatures, see below.
Atmospheric pressure	86–106 kPa
Relative humidity, non-condensing	5–95 %
Contamination, according to IEC 60721-3-3	No electrically conductive dust allowed. Cooling air must be clean and free from corrosive materials. Chemical gases, class 3C2 (Coated boards 3C3). Solid particles, class 3S2.
Vibrations	According to IEC 60068-2-6, Sinusoidal vibrations: 10<f<57 Hz, 0.075 mm 57<f<150 Hz, 1g
Max altitude	0–1,000 m, 460 V AFE units, with derating 1%/100m of rated current up to 4,000 m. Coated boards recommended > 2,000m 690 V AFE units, with derating 1%/100m of rated current up to 2,000 m.

### Storage

Parameter	Storage
Temperature	-20 till +60 °C
Atmoapheric pressure	86–106 kPa
Relative humidity, non-condensing	0-90 %

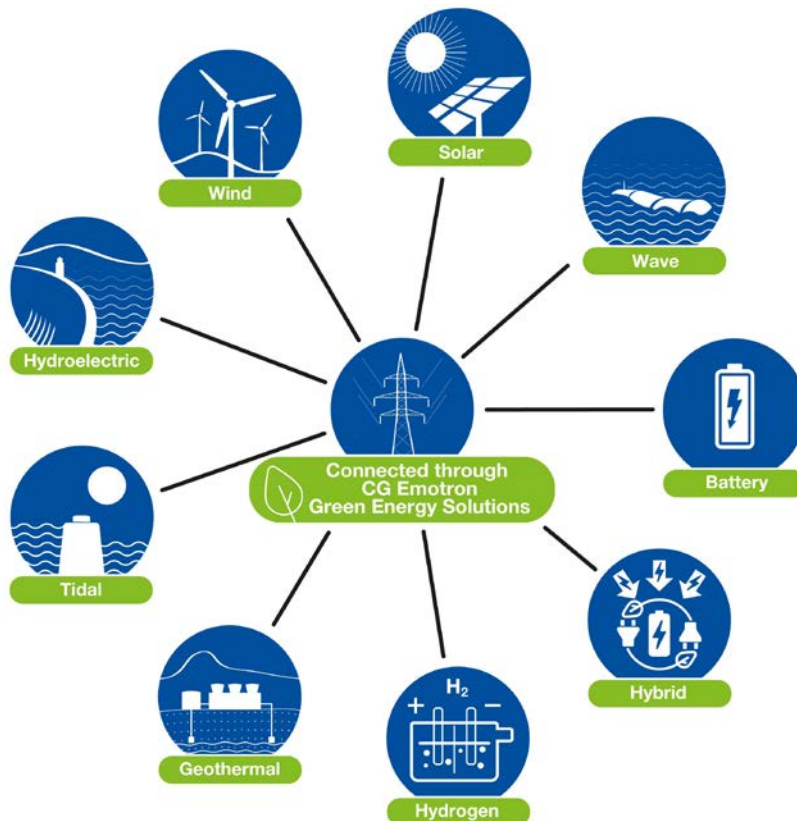
## Operation at higher temperatures

All Emotron AFE/AFG/VSI/DCU units are made for operation at maximum of 40/45 deg C (air/liquid) ambient temperature. However it is possible to use the AFE/AFG/VSI/DCU units at higher temperatures with some loss in performance, using derating.

Derating Liquid cooled AFE/AFG/VSI/DCU: -1% per degree Celsius. Maximum is +10 deg C (55 deg C)  
Derating Air cooled AFE/AFG/VSI/DCU: -2.5% per degree Celsius. Maximum is +5 deg C (45 deg C)

# Basic I/O Data

Control signal inputs - Analogue (differential), 4 channels	
Analogue Voltage/current:	0-±10 V/0-20 mA via switch
Max. input voltage:	+30 V/30 mA
Input impedance:	20 kΩ (voltage) / 250 Ω (current)
Resolution:	11 bits + sign
Hardware accuracy:	1% type + 1 ½ LSB (Least Significant Bit) fsd (full scale deflection)
Non-linearity:	1½ LSB
Control signal inputs - Digital, 8 channels	
Input voltage:	High: >9 VDC, Low: <4 VDC
Max. input voltage:	+30 VDC
Input impedance:	<3.3 VDC: 4.7 kΩ / ≥3.3 VDC: 3.6 kΩ
Signal delay:	≤8 ms
Control signal outputs - Analogue, 2 channels	
Output voltage/current:	0-10 V/0-20 mA via parameter setting
Max. output voltage:	+15 V @5 mA cont.
Short-circuit current (∞):	+15 mA (voltage), +140 mA (current)
Output impedance:	10 Ω (voltage)
Resolution:	10 bit
Maximum load impedance for current	500 Ω
Hardware accuracy:	1.9% of full scale deflection (voltage), 2.4% of full scale deflection (current)
Offset:	3 LSB
Non-linearity:	2 LSB
Control signal outputs - Digital, 2 channels	
Output voltage:	High: >20 VDC @50 mA, >23 VDC open
Shortcircuit current(∞):	Low: <1 VDC @50 mA 100 mA max (together with +24 VDC)
Relays, 3 pcs	
Contacts	0.1 – 2 A/U <sub>max</sub> 250 VAC or 42 VDC
Reference voltages	
+10VDC	+10 VDC @10 mA Short-circuit current +30 mA max
-10VDC	- 10 VDC @10 mA
+24VDC	+24 VDC Short-circuit current +100 mA max (together with Digital Outputs)



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