

OPUS HE 24-4.5 R7U F  
OPUS HE 48-6.0 R7U F  
OPUS HE 60-6.0 R7U F  
OPUS HE 110-6.0 R7U F  
OPUS HE 125-6.0 R7U F  
OPUS HE 220-6.0 R7U F



## Product Description

OPUS HE power systems are robust, free convection cooled, N+1 redundant backup power solutions for critical infrastructure applications such as transmission and distribution substations, process industries, railway signalling and substations and telecommunications.

OPUS HE DC power systems consist of MHE rectifiers, VIDi+ controllers, Connections for mains and battery and load distribution. System is configurable to match with requirements of the application.

19" 7U Rack delivers maximum 6 kW output power at 48, 60, 110, 125 and 220 VDC and 4.5 kW at 24 VDC output. 19" 7U Racks include slots for maximum 3 rectifier modules, battery breakers and shunt for one string and bulk DC load output. Wall mounting, IP21 cover kit, temperature sensor, battery block voltage monitoring and BLVD are options. Master-slave set-up can be used to increase power higher than 6kW.

## Features

- Efficiency up to 97%
- Convection cooling – no fans
- Outputs 24, 48, 60, 110, 125, 220 VDC
- 6.0 kW output power, 24VDC 4.5kW
- Building block rack for cabinet integration, Master-Slave 2 x 7U rack – power up to 16kW
- VIDi+ I/O controller, local and remote interfaces 12 x relays, Ethernet, Modbus, IEC61850, SNMP, RS-232
- Flexible design with full front cabling
- Options: Wall mounting and IP21 kit, BLVD contactor, battery block voltage monitoring
- Safety:
  - Rack: EN61439-1, EN61439-2
  - Low voltage switchgear controlgear assemblies
  - Rectifiers: EN 62368-1, EN 50124-1 rail
- EMC:
  - Rack: EN61439-1, EN61439-2
  - Rectifiers: EN 61000-6-1 / -2 / -3 / -4 / -5
  - EN 50121-4 rail, ETSI EN 300386 (48/60V)

# Technical Specifications

General construction		Environment and standards	
Cooling	Natural convection	Temp. range	-25 ... +60°C, see derating, Start-up at -40°C
Protection	IP 20, Option IP21	Humidity max	95% relative humidity, non-condensing
Controller user interface	Display and local control in front panel	Altitude	Max 3km, full power up to 2km above sea level Derating 2% per 100 m between 2-3km
Connections	Behind front panel	Safety	Rack: EN61439-1, EN61439-2 Rectifiers: EN 62368-1, EN 50124-1 rail
Colour	Frame RAL 7024	EMC	Rack: EN61439-1, EN61439-2 Rectifiers: EN61000-6-1 / -2 / -3 / -4 Generic EN61000-6-5 Utility, surge level 2 EN 50121-4 Rail, ETSI EN 300 386 (48/60V)
Dimensions & weight	Height 7U (350 mm) Width 19" (482 mm) Depth 503 mm Weight 15 kg w/o rectifiers		

AC Input	OPUS HE 24-4.5 R7U F	OPUS HE 48-6.0 R7U F	OPUS HE 60-6.0 R7U F	OPUS HE 110-6.0 R7U F	OPUS HE 125-6.0 R7U F	OPUS HE 220-6.0 R7U F
AC connection	TN-S system, 3W + N + PE, (3-phases, neutral and protective earth wires)					
Nominal input	220-240 VAC / 3 x 380-415 VAC (TN-S system) <i>Options: 1-phase supply 100-250VAC, 3-phase Delta/IT supply 3 x 173-250VAC</i>					
Input range	Max range: 85 – 300 VAC / 3 x 147–528 VAC Rated full power range: 180 – 275 VAC / 3 x 312–476 VAC (TN-S system) See derating curves below, 1200W per rectifier at 120VAC / 3 x 208VAC Temporary high voltage range 275 - 300VAC / 3 x 476 - 528VAC, continuous supply not recommended					
Input frequency	Rated 45 - 66 Hz, reduced power at 35 - 45 Hz. Shut down at 35 Hz					
Nominal current	8A @ 220/380V		11A @ 220/380VAC			
Maximum phase current	12,5A @ 85-130V		12,5A @ 85-180VAC			
Recommended mains fuse	3 x 25 A (TN-S)					
Main Switch	20A, 4-pole (L1-L2-L3-N)					
Rectifier input protection	MCB C16A / rectifier module					

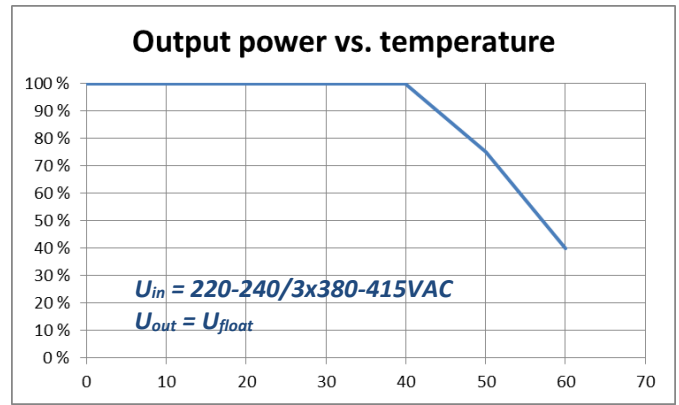
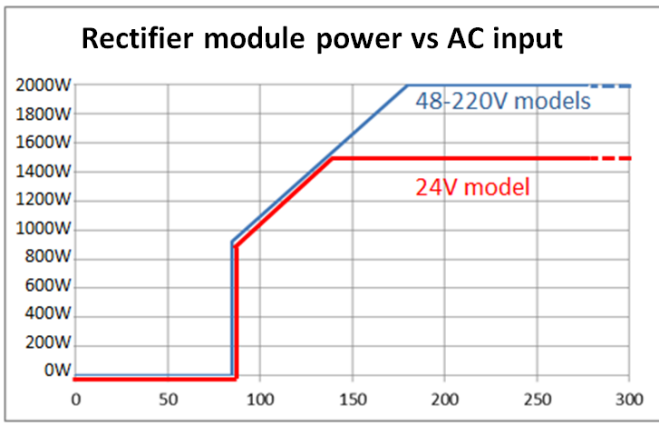
DC Output	OPUS HE 24-4.5 R7U F	OPUS HE 48-6.0 R7U F	OPUS HE 60-6.0 R7U F	OPUS HE 110-6.0 R7U F	OPUS HE 125-6.0 R7U F	OPUS HE 220-6.0 R7U F
Grounding	2-pole, floating					
Nominal voltage	24 VDC	48 VDC	60 VDC	108 VDC	120 VDC	216 VDC
Voltage factory setting	27.24 VDC	54.48 VDC	68.10 VDC	122.58 VDC	136.20 VDC	245.16 VDC
Voltage range	21-33 VDC	42-59 VDC	51-72 VDC	90-150 VDC	100-160 VDC	178-280 VDC
Quantity of rectifiers	Max 3 pcs					
Max current	187.5A @ 24V	125A @ 48V	100A @ 60V	55.5A @ 108V	50A @ 120V	27.8A @ 216V
Max Power	Max 4.5kW *)	Max 6kW	Max 6kW	Max 6kW	Max 6kW	Max 6kW
Static voltage regulation	± 1.5 % @ rack terminals (load, line, temp)			± 1 % @ rack terminals (load, line, temp)		
Rectifier output protection	MCB C63A	MCB C50A	MCB C40A	MCB C20A	MCB C20A	MCB C10A

\*) Battery MCB D125A, max battery current 125A

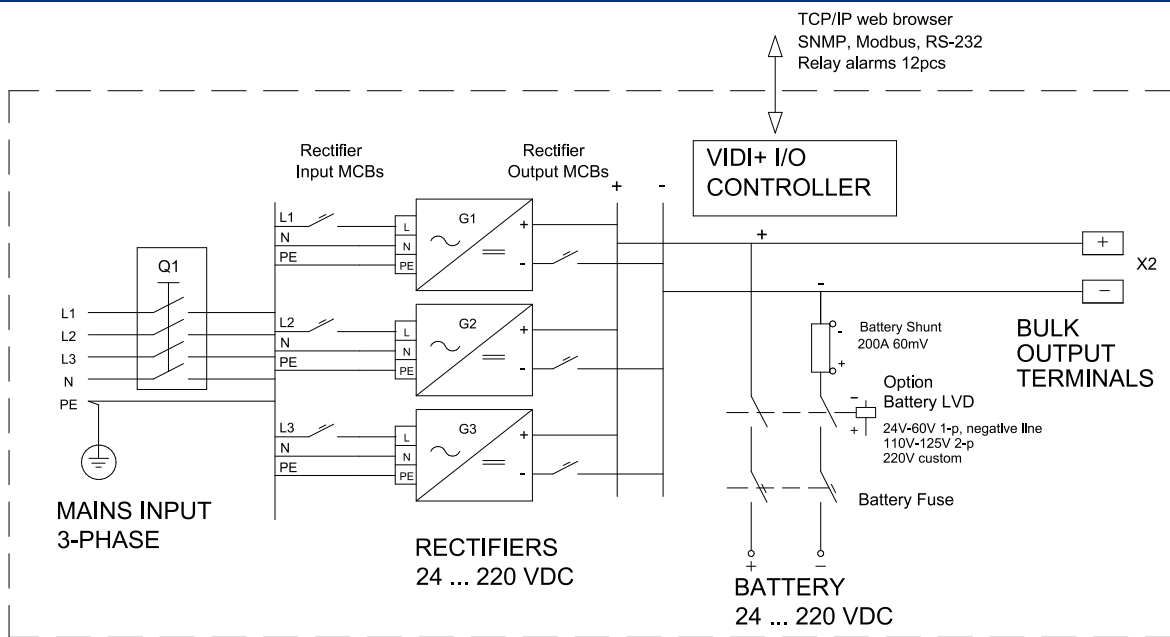
Battery connection	OPUS HE 24-4.5 R7U F	OPUS HE 48-6.0 R7U F	OPUS HE 60-6.0 R7U F	OPUS HE 110-6.0 R7U F	OPUS HE 125-6.0 R7U F	OPUS HE 220-6.0 R7U F
Protective device	MCB D125A 2-pole + aux	MCB D125A 2-pole + aux	MCB D125A 2-pole + aux	MCB D63A 2-pole + aux	MCB D63A 2-pole + aux	MCB D63A 2-pole + aux

Connection terminals	
Mains terminal	Q1 Main switch, 10 mm <sup>2</sup> screw terminals, L1-L2-L3-N-PE
DC output	Bulk output X2, screw terminals 35 mm <sup>2</sup>
Battery	MCB screw terminals, 1.5...35 mm <sup>2</sup> flexible cable, 1...50 mm <sup>2</sup> rigid cable
Alarms, Inputs	Configurable relay alarms 4 pcs (option up to 12), Spring terminals 0.75mm <sup>2</sup> ... 1.5mm <sup>2</sup> cable Configurable alarm/temp. inputs 4 pcs (option up to 12), Spring terminals 0.75mm <sup>2</sup> ... 1.5mm <sup>2</sup> cable

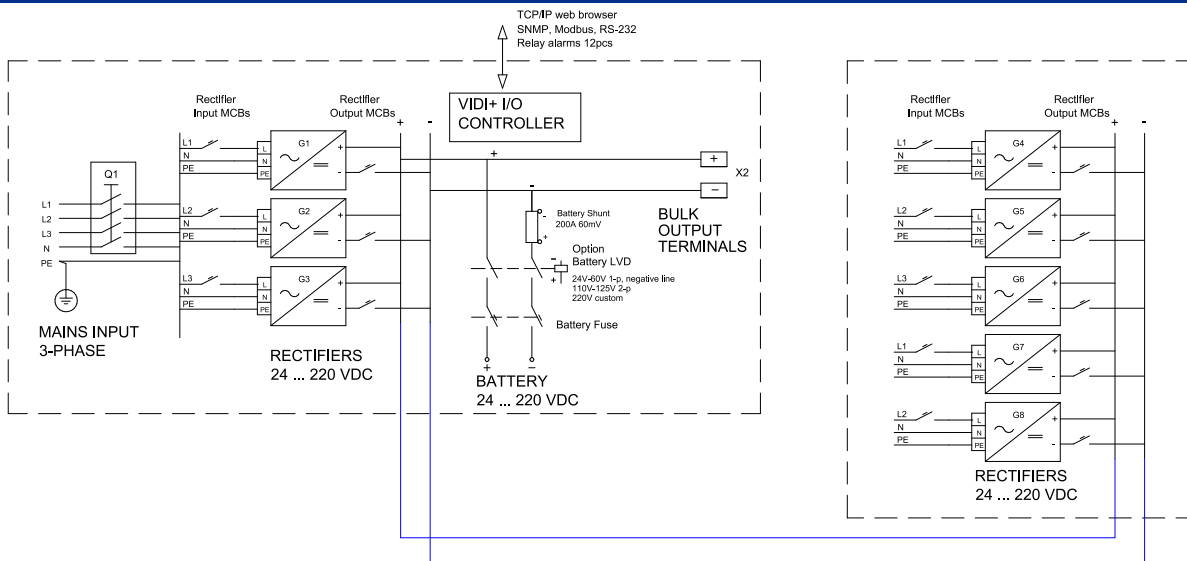
# Derating curves



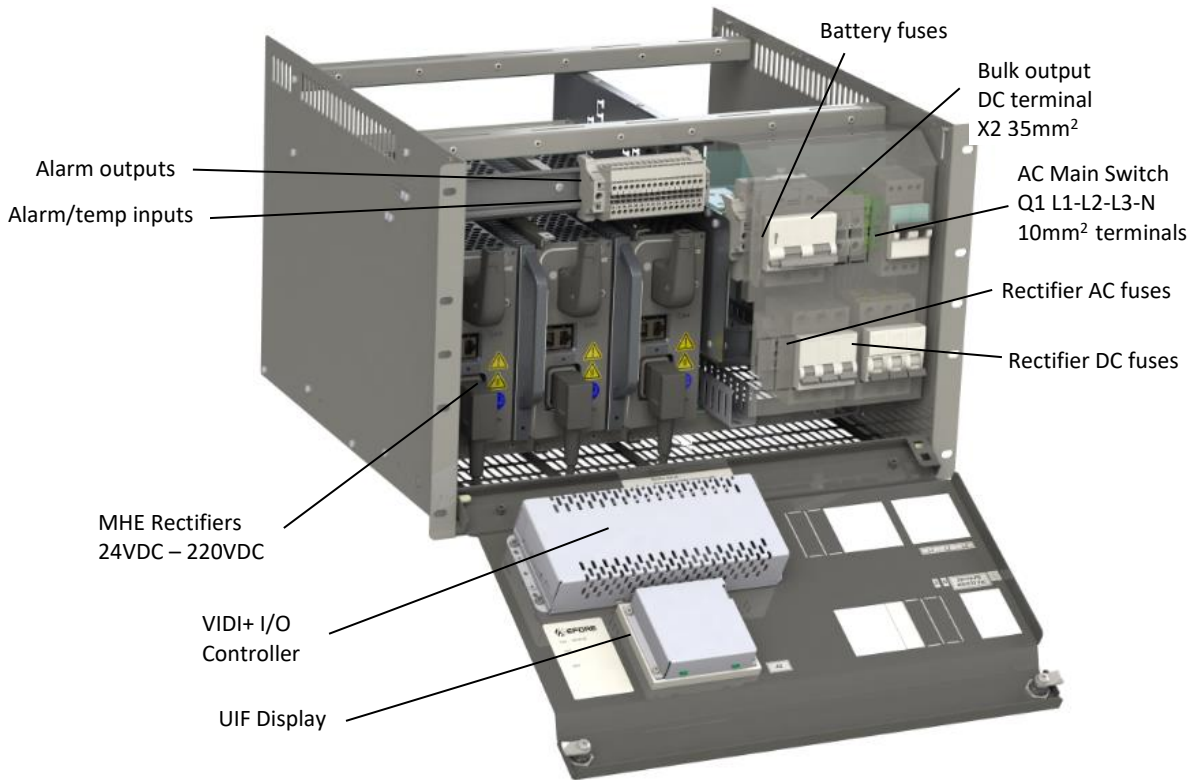
## Block Diagram, 2-pole floating systems



## Block Diagram, Master-Slave connection up to 16kW



## Layout drawings



## 19" 7U Master-Slave rack to increase power up to 16kW, mechanical rack only – no wiring done in slave rack



Systems, Description	Order number
OPUS HE R7U SLAVE 5 x MHE	9220X0015100

## Order Information

Systems, Description	Order number	Voltage / Current	Rectifiers	Order number
OPUS HE 24-4.5 R7U F	9220X0011282	24VDC / 62.5A – 187.5A	MHE24-1500	92I280
OPUS HE 48-6.0 R7U F	9220X0011288	48VDC / 41.7A – 125A	MHE48-2000	92I160
OPUS HE 60-6.0 R7U F	9220X0014569	60VDC / 33.3A – 100A	MHE60-2000	92I290
OPUS HE 110-6.0 R7U F	9220X0011271	110V / 18.5A – 55.5A	MHE110-2000	92I250
OPUS HE 125-6.0 R7U F	9220X0014574	125V / 16.7A – 50A	MHE125-2000	92I260
OPUS HE 220-6.0 R7U F	9220X0011277	220V / 9.3A – 27.8A	MHE220-2000	92I270

Controllers, Description	Order number	Options, Description	Order number
VID+ I/O System controller	94G910	VIDI-BM Block voltage monitoring	9040X0002338

Options, Description	Order number	Options, Description	Order number
Temperature Sensor	94M268	BLVD 24V 200A 1-P R 7U P	8320X0005019
Wall mounting and IP21 kit 7U	8320X0004982	BLVD 48/60V 200A 1-P R 7U P	8320X0005017
		BLVD 110/125V 100A 2-P R 7U F	8320X0004952

MHE 24-1500  
MHE 48-2000  
MHE 60-2000  
MHE 110-2000  
MHE 125-2000  
MHE 220-2000

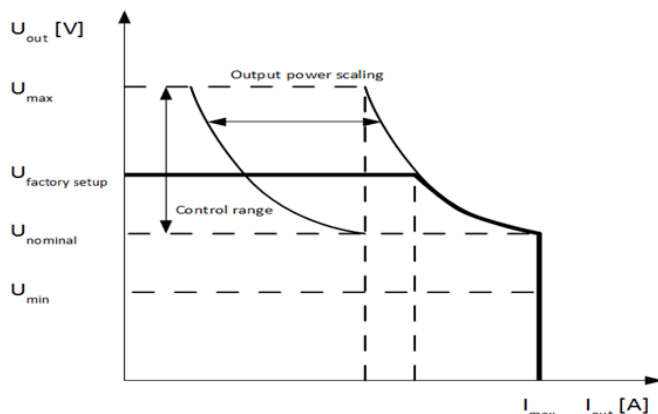


### Product Description

The MHE rectifier utilizes Enedo's long experience and latest technology on high performance industrial power supplies. On top of generic IEC and UL/CSA certifications MHE rectifiers are certified for rail and metro system applications. Rectifiers meet demanding requirements of utility, industrial, rail and telecom applications with modern high efficiency modular technology.

MHE rectifiers are convection cooled and requires no fans. Rated output power is 2000 W in 48 V – 220 V output versions and 1500 W in 24 V version. Rectifier input is single phase, range 85-300 VAC.

Rectifiers can be operated either with a VIDi+ system controller or as stand-alone modules with or without batteries in the output.



### Features

- Efficiency up to 97 %
- Convection cooled – No Fans
- MTBF 1 800 000 h @ 25°C, Telcordia SR-332
- Output models 24, 48, 60, 110, 125, 220 VDC
- 2000 W output power, 24 VDC 1500 W
- Lacquered PCB for rail and metro applications
- Nominal Input voltage 100-250 VAC, range 85-300 VAC
- Soft-start generator input feature
- Active load current sharing
- Internal over temperature protection
- Digital communication over CAN bus with VIDi controller
- Flexible design with full front cabling
- EMC:
  - Generic EN 61000-6 -1 / -2 / -3 / -4
  - Power Utility EN61000-6-5, surge level 2
  - Railway EN 50121-4 / -5 (signaling & substation)
  - Telecom ETSI EN 300386
- Safety:
  - EN/IEC/UL/CSA 62368-1
  - EN 50124-1 Railway insulation coordination



# Technical Specifications

AC Input	MHE 24-1500	MHE 48-2000	MHE 60-2000	MHE 110-2000	MHE 125-2000	MHE 220-2000
Input voltage	Nominal 100VAC - 250VAC					
Input range	Max range 85 – 300 VAC Rated full power range: 48-220V models 180VAC – 275VAC, 24V models 140-275VAC See derating curves at page 3, 1200W power available at nominal 120VAC input Temporary high voltage range 275-300VAC, continuous supply voltage above 275VAC not recommended					
Start-up / shut down limits	Start-up voltage 90VAC / Shut down at 85 VAC Shut down over voltage limit 300VAC / re-start at 290VAC					
Input frequency	Rated 45 - 66 Hz, reduced power at 35 - 45 Hz. Shut down at 35 Hz					
Maximum current	12.5A @ U <sub>in</sub> 85-130V	12.5A @ U <sub>in</sub> 85-180V	12.5A @ U <sub>in</sub> 85-180V	12.5A @ U <sub>in</sub> 85-180V	12.5A @ U <sub>in</sub> 85-180V	12.5A @ U <sub>in</sub> 85-180V
Max current at U <sub>nom</sub> 220VAC	8 A	11 A	11 A	11 A	11 A	11 A
Inrush current	ETS 300 132-1, Active limitation typical <20A					
Power factor (typical)	>0.99 at 85-275VAC input					
THD (typical)	< 5% @ 100%, < 9% @ 50% at 85-275VAC input					
Input protection	External MCB 16A C-curve (24V C10A or C16A), Internal varistor and gas discharge tube for transient surge protection, Automatic shut-off above 300 VAC (restart at 290 VAC)					
Generator start-up ramp	7 seconds ramp from 200W to full 2kW controlled by Input power, used with generator input supply (User programmable feature, enable/disable, default disable)					
Start-up delay	Default start-up time approx. 5 sec, User Programmable additional delay 0-120s (+15% / 0%).					

DC Output	MHE 24-1500	MHE 48-2000	MHE 60-2000	MHE 110-2000	MHE 125-2000	MHE 220-2000
Voltage range	21-33 VDC	42-59 VDC	51-72 VDC	90-150 VDC	100-160 VDC	178-280 VDC
Voltage factory setting	27.24 VDC	54.48 VDC	68.10 VDC	122.58 VDC	136.20 VDC	245.16 VDC
Maximum current @ nominal output	62.5 A @ 24 V	41.7 A @ 48 V	33.3 A @ 60 V	18.5 A @ 108 V	16.7 A @ 120 V	9.3 A @ 216 V
Constant output power	1500 W	2000 W				
Current limit	< 65 A	< 45 A	< 35 A	< 20 A	< 20 A	< 10 A
Type of Current limit	MHE rectifier supplies constant short circuit current 500sec, then hiccup mode in 500sec cycles					
Hold-up time	> 20 ms at 80% load, output voltage reduces from float voltage to nominal					
Static voltage regulation	± 0.5 % (load, line, temperature)					
Dynamic load regulation	± 5.0 % for 10%-90% or 90%-10% load step, recovery time < 2.0 ms					
Ripple and noise	< 50 mVp-p	< 100 mVp-p	< 115 mVp-p	< 225 mVp-p	< 250 mVp-p	< 450 mVp-p
Output protection	Output overvoltage shutdown Power limiting & shutdown based on: temperature, input voltage and frequency, derating curves page 3					

Features	MHE 24-1500	MHE 48-2000	MHE 60-2000	MHE 110-2000	MHE 125-2000	MHE 220-2000
Efficiency, typical 30-70% load, V <sub>in</sub> 230VAC	> 95 %	> 96 %	> 96 %	> 96 %	> 96%	> 95%
MTBF, calculated	> 1 800 000 h @ 25°C, Telcordia SR-332, Method I-D, Ground Fixed uncontrolled environment					
Dielectric strength, type test	Input – GND (basic), 2 kVAC or 2.83 kVDC, 1 min Input - Output (reinforced) 3.75kVac or 5.3 kVDC, 1 min Output – GND (basic) 2 kVAC or 2.83 kVDC, 1 min					
Load current share	± 5 % from true average current between the modules (>50% load, controlled by VID1)					
Alarms	Mains fault alarm, Low output voltage alarm, Overvoltage shutdown alarm, Rectifier alarm, Temperature Alarm, Totally +40 configurable system alarms via VID1 controller					

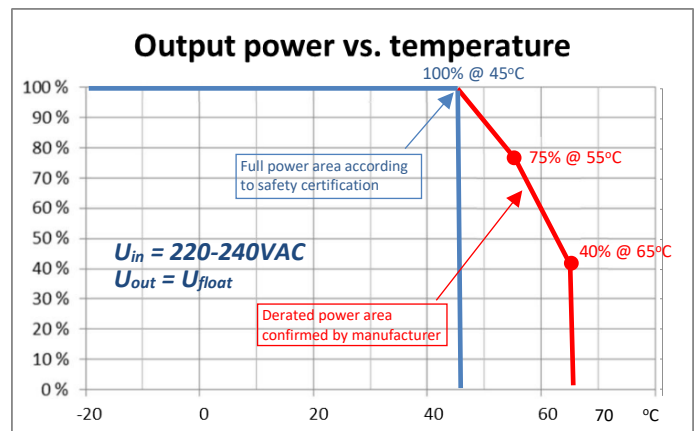
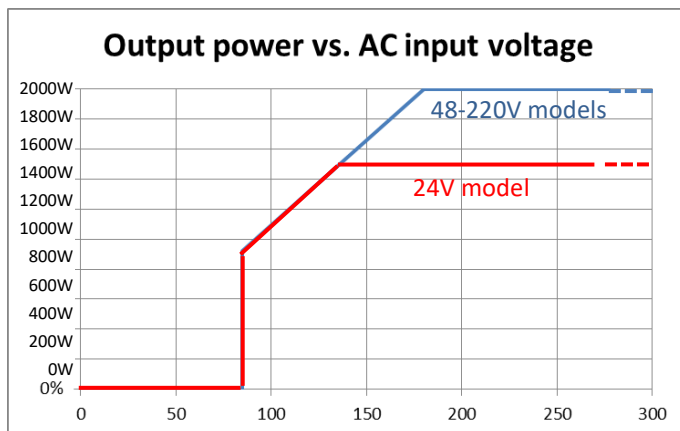
Dimensions (HxWxD)	169 x 83 x 357
	mm, see drawing
Weight	4.6 kg
Protection class, IEC 60529	IP20 when counter-connector in place, DC connector IP10 without counter-connector

<b>Connections</b>	
Connector, AC	Appliance inlet IEC 60320-1, C20 style, 16 A male
Connector, DC	Phoenix terminal PC 5/ 4-G-7.62, 4 x 4mm <sup>2</sup> (+ + - -)
Connector, PowerCAN	2 pcs RJ-45

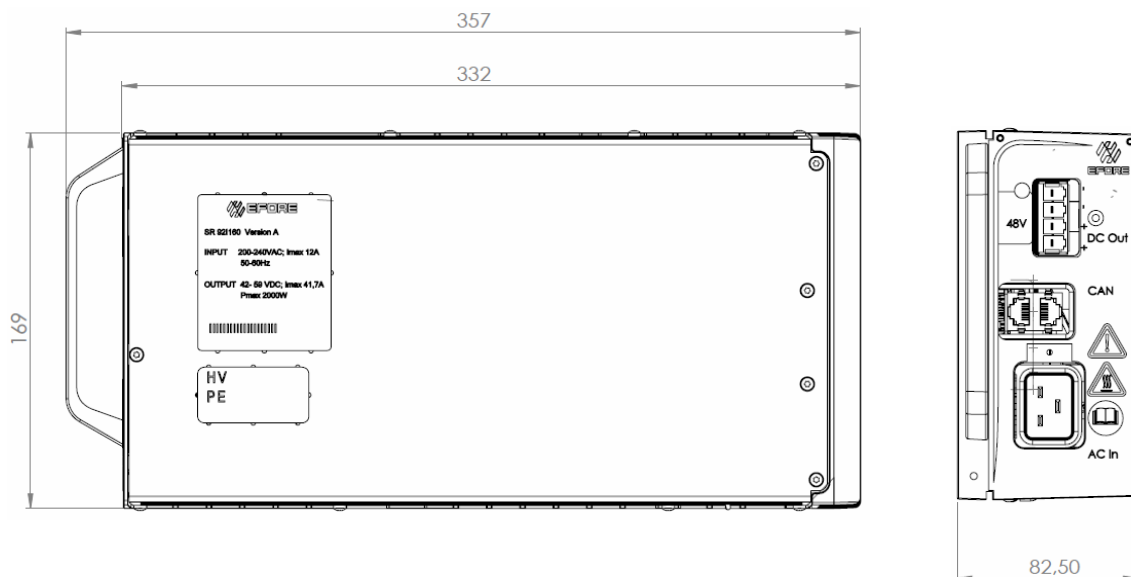
<b>Environmental</b>	
Cooling	Natural convection
Acoustic noise	< 40 dB
Operating temperature	Full power according to Safety Certification -25°C ... +45°C, Start-up at -40°C Derated power at +45°C ... +65°C, max 40% power at 65°C, see curve below
Storage temperature	-40 °C ... +85 °C
Environmental protection	Lacquered PCB
Humidity	95 % relative humidity, non-condensing
Altitude according to EN 62368-1	Full power: 2000 m (6500 feet) above sea level De-rating -2% / 100m above 2000m, max altitude 5000m

<b>Applicable Standards</b>	
EMC	Generic IEC61000-6-1, IEC61000-6-2, IEC61000-6-3, IEC61000-6-4 Power Utility immunity EN61000-6-5, surge level 2, 2kV line to ground Railway EN 50121-4 signaling systems, EN50121-5 substation environment Telecom ETSI EN 300 386
Safety	EN 62368-1:2014+A11:2017, UL 62368-1 2nd Ed. CAN/CSA C22.2 NO. 62368-1-14 Railway EN 50124-1, Indoor use, Not connected to contact line, Pollution degree 2, Overvoltage category 2
Environment	Operation: ETS 300 019-2-3 cl T3.2 Storage: ETS 300 019-2-1 cl T1.2
Certifications	CE Declaration of Conformity CB Certificate, CB test report UL 62368-1 and CAN/CSA C22.2 NO. 62368-1-14 Certificate & Listing report TÜV Rail and metro system certification: 50121-4/-5, EN 50124-1
Quality	Manufacturing and design conform to ISO 9001, ISO 14001

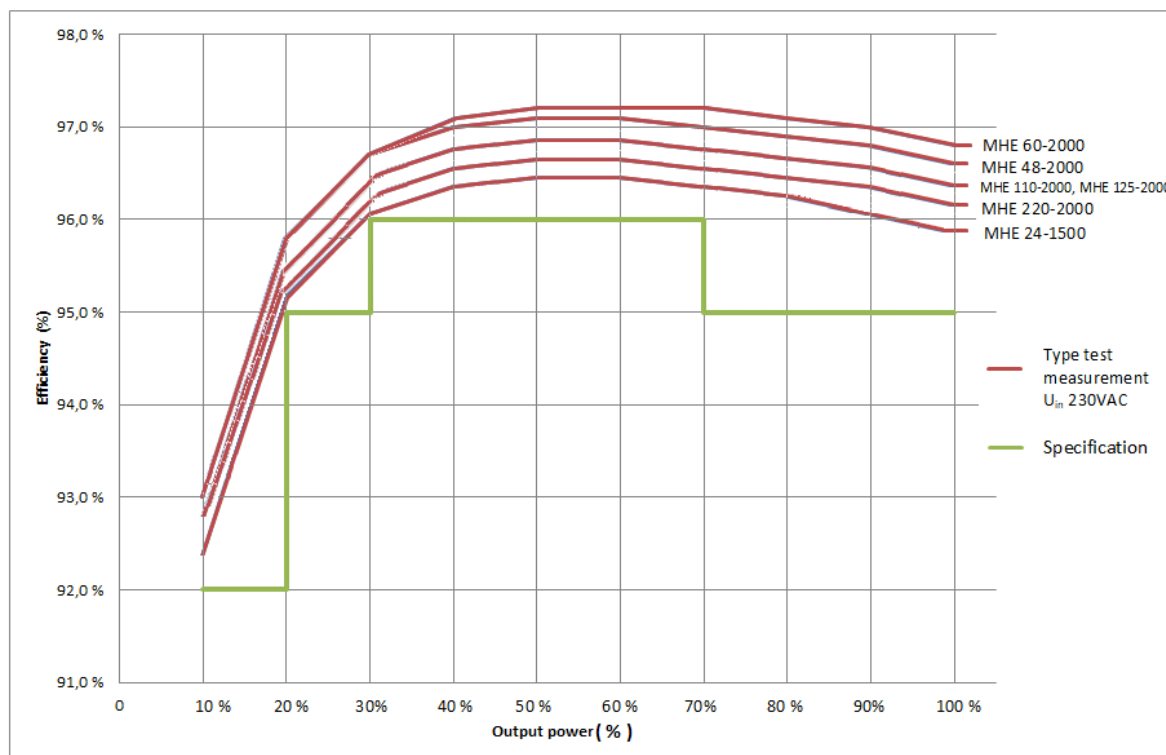
## Derating curves



## Main dimensions



## Efficiency curves



## Order Information

Description	Order number	Voltage / Current
MHE 24-1500	921280	24VDC / 62.5A
MHE 48-2000	921160	48VDC / 41.7A
MHE 60-2000	921290	60VDC / 33.3A
MHE 110-2000	921250	110VDC / 18.5A
MHE 125-2000	921260	125VDC / 16.7A
MHE 220-2000	921270	220VDC / 9.3A