

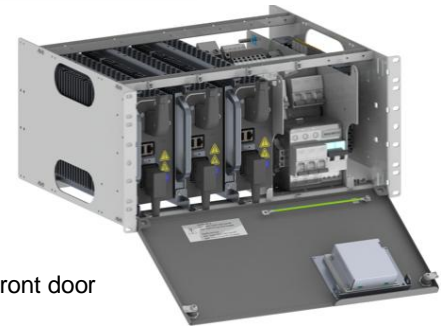
OPUS HE 24-4.5 R5U F  
 OPUS HE 48-6.0 R5U F  
 OPUS HE 60-6.0 R5U F  
 OPUS HE 110-6.0 R5U F  
 OPUS HE 125-6.0 R5U F  
 OPUS HE 220-6.0 R5U F



Default UIF position  
no front door



Optional front door  
Alternative UIF position in front door



### 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, VID12 controllers, Connections for mains and battery and load distribution. System is configurable to match with requirements of the application. Additionally 5U rack can be cost optimized and delivered as building block assembly KIT for local system building partner.

19" 5U Rack delivers maximum 6 kW output power at 48, 60, 110, 125 and 220 VDC and 4.5 kW at 24 VDC output. 19" 5U 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 5U rack – power up to 16kW
- VID12 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/-5 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 in front door or inside the rack, LAN connection, VID12	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/-5 Rail, ETSI EN 300 386 (48/60V)
Dimensions & weight	Height 5U (222 mm) Width 19" (482 mm) Depth 380 mm Weight 15 kg w/o rectifiers		

AC Input	OPUS HE 24-4.5 R5U F	OPUS HE 48-6.0 R5U F	OPUS HE 60-6.0 R5U F	OPUS HE 110-6.0 R5U F	OPUS HE 125-6.0 R5U F	OPUS HE 220-6.0 R5U 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					

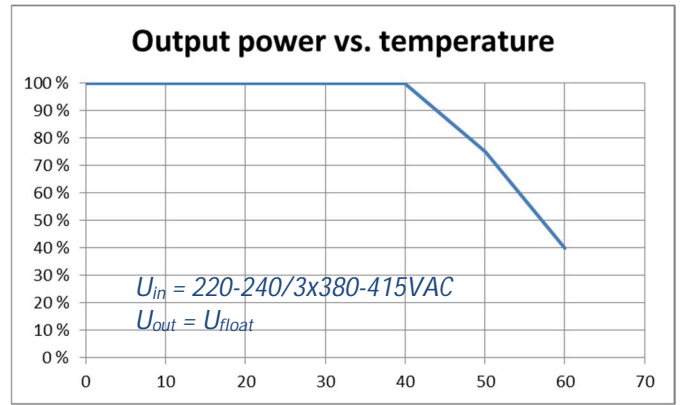
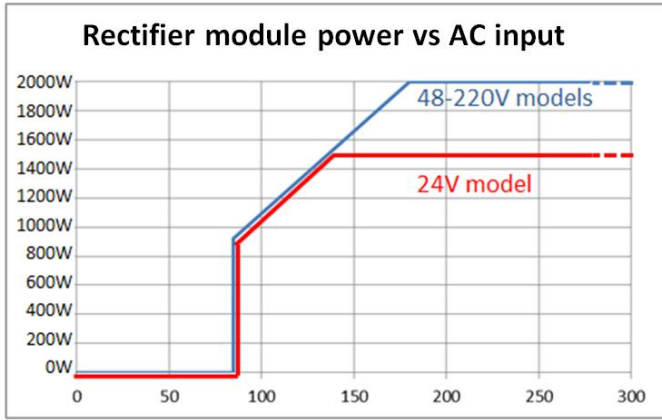
DC Output	OPUS HE 24-4.5 R5U F	OPUS HE 48-6.0 R5U F	OPUS HE 60-6.0 R5U F	OPUS HE 110-6.0 R5U F	OPUS HE 125-6.0 R5U F	OPUS HE 220-6.0 R5U F
Grounding	2-pole, floating					
Nominal voltage	24 VDC	48 VDC	60 VDC	108 VDC	120 VDC	216 VDC
Voltage factory setting	27.24 VDC	54.48 VDC	68.10 VDC	122.58 VDC	136.20 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

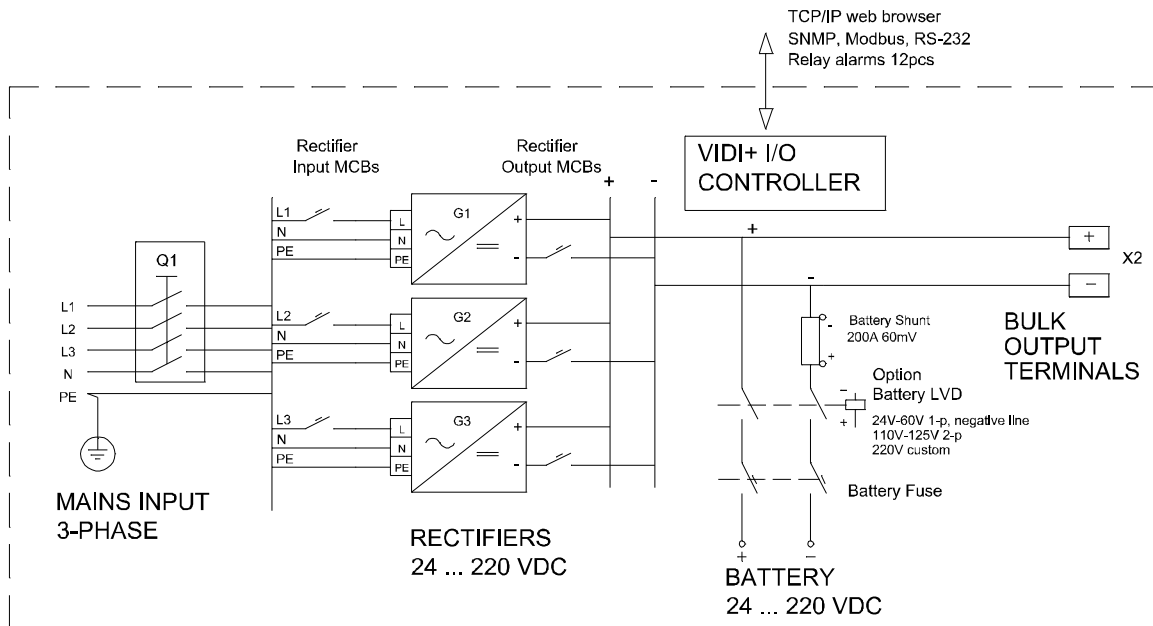
Battery connection	OPUS HE 24-4.5 R5U F	OPUS HE 48-6.0 R5U F	OPUS HE 60-6.0 R5U F	OPUS HE 110-6.0 R5U F	OPUS HE 125-6.0 R5U F	OPUS HE 220-6.0 R5U F
Protective device	MCB D125A 2-pole + aux	MCB D125A 2-pole + aux	MCB D125A 2-pole + aux	MCB D63A 2-pole + aux	MCB D63A 2-pole + aux	MCB D63A 2-pole + aux

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

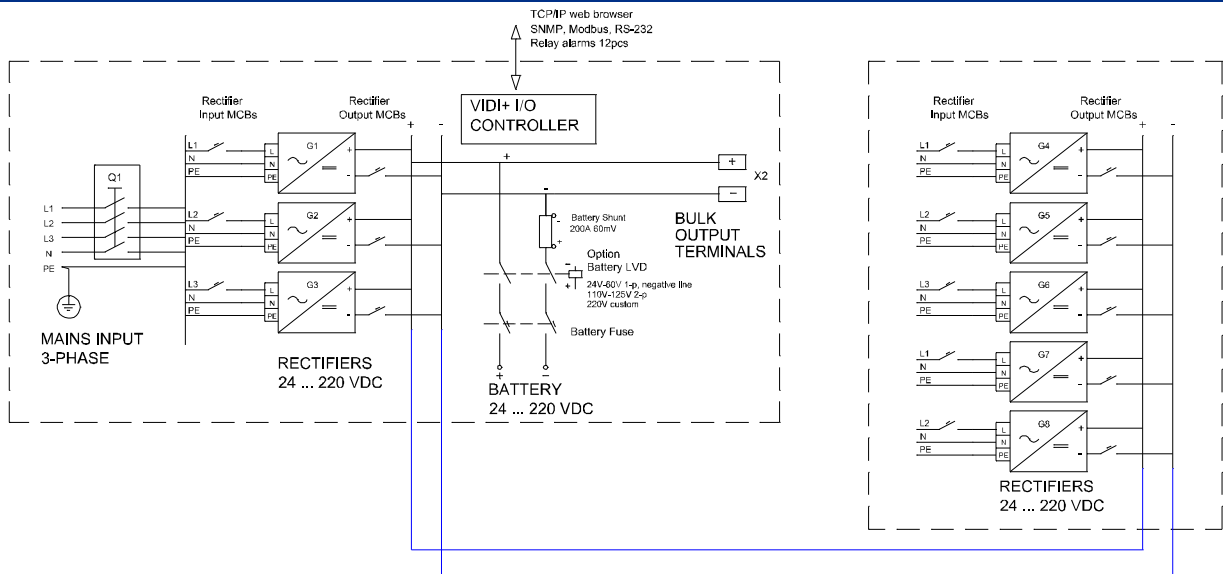
# Derating curves



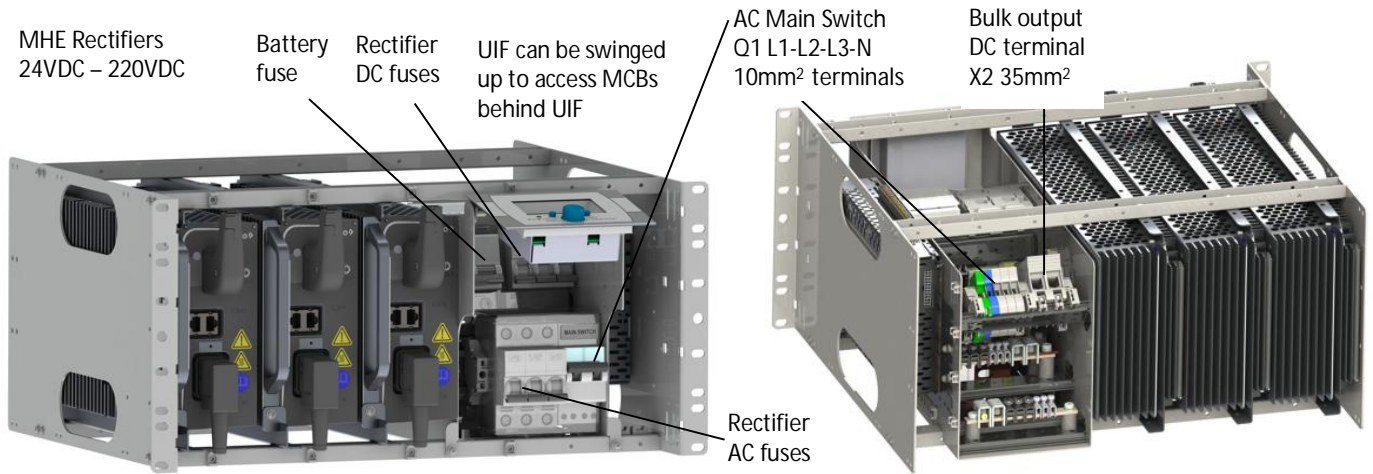
## Block Diagram, 2-pole floating systems



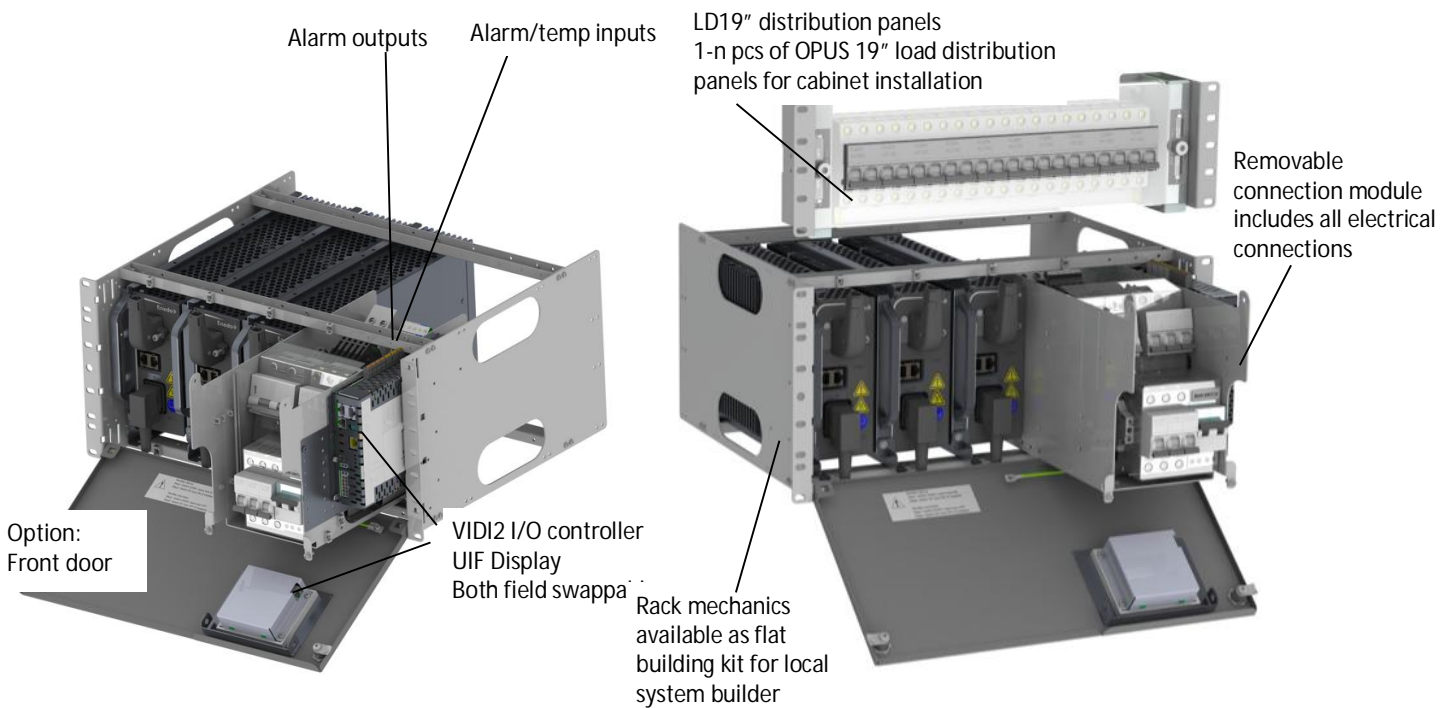
## Block Diagram, Master-Slave connection up to 16kW



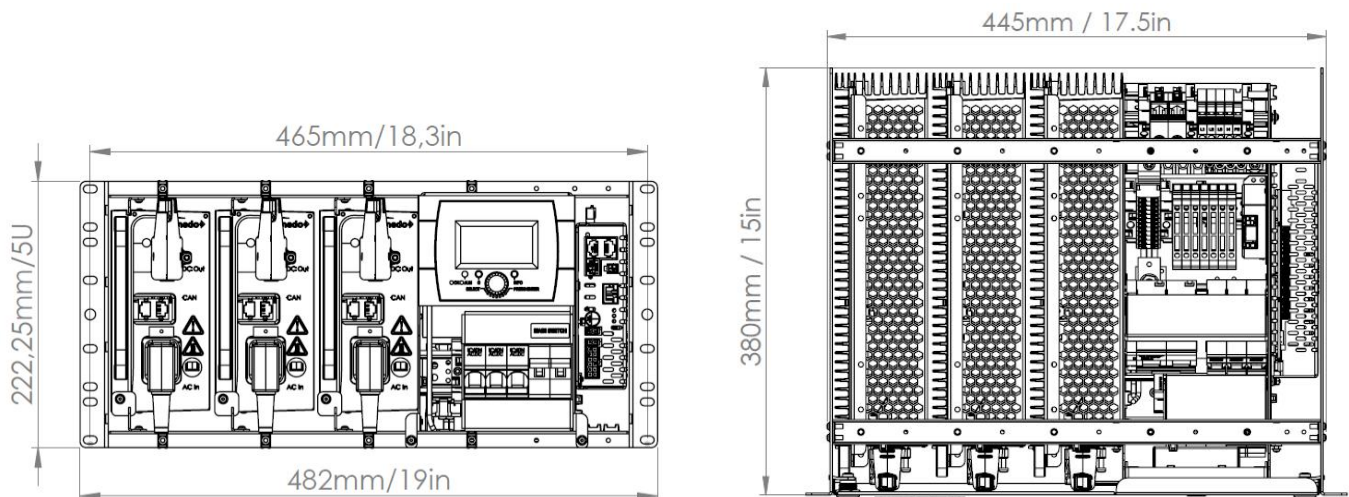
## Layout drawings, basic rack system



## OPUS HE 5U Rack Modules and 19" Distribution panels



## Dimensions





## Order Information, complete 5U racks

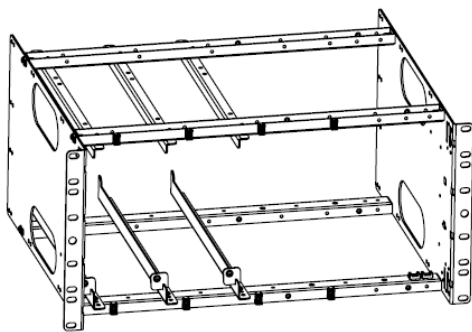
Systems, Description	Order number	Voltage / Current	Rectifiers	Order number
OPUS HE 24-4.5 R5U F	922XW16076	24VDC / 62.5A – 187.5A	MHE24-1500	92I280
OPUS HE 48-6.0 R5U F	922XW16074	48VDC / 41.7A – 125A	MHE48-2000	92I160
OPUS HE 60-6.0 R5U F	922XW16095	60VDC / 33.3A – 100A	MHE60-2000	92I290
OPUS HE 110-6.0 R5U F	922XW16077	110V / 18.5A – 55.5A	MHE110-2000	92I250
OPUS HE 125-6.0 R5U F	922XW16082	125V / 16.7A – 50A	MHE125-2000	92I260
OPUS HE 220-6.0 R5U F	922XW16098	220V / 9.3A – 27.8A	MHE220-2000	92I270
OPUS HE 5U SLAVE RACK	832X016097	24-220V / up to 10kW	MHE	Any voltage

Controllers, Description	Order number	Options, Description	Order number
VIDI2 System controller	94I640	VIDI2-EFD module KIT	832X015957

Options, Description	Order number	Options, Description	Order number
Temperature Sensor	94M268	BLVD 24V 200A 1-P R 5U P	D02236
Battery Midpoint cable 5m	D01992	BLVD 48/60V 200A 1-P R 5U P	D02212
Wall mounting and IP21 kit 5U	832xxxxxxx	BLVD 110/125V 100A 2-P R 5U F	D02235

Load Distribution panels	Order number	Load Distribution panels	Order number
10 x MCB 2-p, FMU, 24V-60V, 19" 3U	832X016086	8 x MCB 2-p+aux, 24V-220V, 19" 3U	832X016110
10 x MCB 2-p, FMU, 110-220V, 19" 3U	832X016087	14 x MCB 1-p+aux, 24-220V, 19" 3U	832X016111

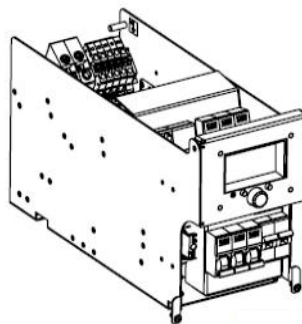
## Order Information, 5U building block sets



D02062 B  
MECHANICAL RACK FOR 3 RECTIFIERS

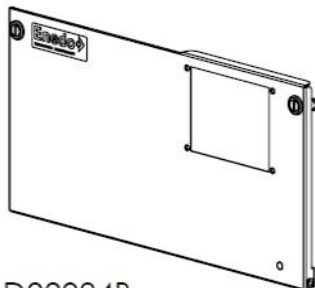
Unassembled, delivered as flat packing

Connection modules

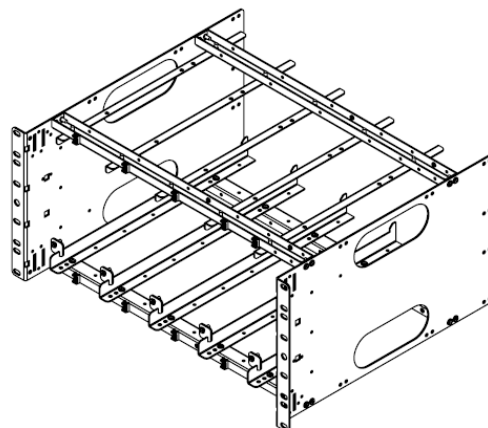


24VDC = 832X016101  
 48VDC = 832X016102  
 60VDC = 832X016103  
 110VDC = 832X016104  
 125VDC = 832X016105  
 220VDC = 832X016106

All connections are done in connection module. Module is fully tested with VIDI & UIF and ready for local panel builder.



D02094B  
FRONT PANEL KIT



832X016097A  
RACK FRAME ASSEMBLY FOR 5xMHE

Unassembled, delivered as flat packing



VIDI2 System Controller  
UIF User interface display

VIDI Auxiliary Controllers:  
VIDI-BM Battery block Monitoring  
VIDI-LVD Low Voltage Disconnecter  
VIDI-SAM Serial Adapter Module

IEC61850 SCADA Converter



## Product Description

VIDI2 Controller Platform is powerful tool to set ideal parameters and monitoring architecture for critical OPUS HE backup power systems. True redundancy principle of OPUS power systems applies also for the controller, which means that controller can be changed or updated without any power break in the system.

Controller has intelligent and easy to use local interface and web access to monitor the system behaviour and plan the controlled maintenance process during the expected 15-20 year life time of the power system. System has diagnostics for the battery health and expected battery life time, which typically defines the timing for the modernization investment.

On top of default power system features included in main VIDI2, additional features can be added by auxiliary VIDI controllers. Such aux controllers are VIDI-BM battery block voltage monitoring, VIDI-LVD additional LVD driver, VIDI-SAM inverter controller and IEC61850 converter for SCADA networks.

## Features

- Universal controller for all 24 VDC to 220 VDC OPUS DC Power Systems
- Modular structure for optimal performance and system redundancy
- User friendly local UIF and remote web interface
- Comprehensive features and parameter settings
- 12 x configurable relay alarms
- Ethernet TCP/IP, Modbus TCP/IP, RS-232, IEC61850 SCADA, Profibus, SNMP
- Large event log file with real time clock time stamps
- EMC:
  - Generic EN 61000-6-1 / -2 / -3 / -4
  - Power Utility EN 61000-6-5, surge level 2
  - Railway EN 50121-4 & EN 50121-5
  - Telecom ETSI EN 300386
- Safety:
  - EN/IEC/UL 62368-1
  - EN 50124-1 Railway insulation coordination

# Technical Specifications VID12 & UIF

Electrical	VID12
Input voltage range	20 – 290 VDC, shut-down $U_{in} < 18VDC$ or $> 290 VDC$
Input power	<10W (excluding LVD contactor current)
Protections	Internal input fuse 2-pole F5A, input polarity protection diode

Communication Ports	VID12
LAN	10/100 Ethernet, RJ-45 connector
Serial communication	RS-232, 9600-115200 kbps

Monitoring and Control, Local	UIF
Local Display	128 x 64 Graphical LCD with Backlight
Local Operation	Dial button, Info button and cancel button
Local LED indication	3 color system Status LED
Info	Dedicated button to open info text
Default view	Charge mode, system voltage, number of active alarms
Languages	Factory defaults: English, Finnish, Russian Custom packages: e.g. German, French, Spanish, Dutch, Czech Republic

Monitoring and Control, Remote	VID12
Mechanical data	IP 20, Dimensions (L x H x W) : 218 x 41 x 139 mm, Weight : 400 g
Remote PC connection	Connect via LAN
Local PC connection	LAN port or serial port RS-232
Alarms	Configurable relays, E-mail, SNMP traps
Remote user interface	Web interface, 4 access levels
Remote terminal	Text mode interface over Telnet/SSH
Supported Protocols	HTTP, HTTPS, Telnet, SSH, SMTP, SNMPv2, SNMPv3 NTP, DHCP, Modbus TCP/IP, RS-232, IEC61850 SCADA via adapter, Profibus via adapter
Languages	Factory defaults: English, Finnish, Russian Custom packages: e.g. German, French, Spanish, Dutch, Czech Republic

System Features	VID12
Measurements	System Output Voltage and current Battery current, measured from 60mV shunt Load current, calculated Rectifier AC input voltage Rectifier DC output voltage and current Inverter DC input and AC output voltages and currents Bypass input and output values Temperatures: system, battery, rectifiers, inverters
Functions	CAN-bus to rectifiers (CAN1) and system modules (CAN2) Energy Save Mode, with MHE rectifiers Alarm configuration, Alarm Matrix System parameters upload and download in XML format Real Time Clock with Battery Backup Plug-and-Play Support, Automatic Module Configuration Inventory Management for Installed Modules
Battery or load LVD	1 x Contactor Coil Driver + Aux contact (more LVDs with VID1-LVD)
Alarm Relays	12 pcs of configurable alarms, max contact ratings 60V/0,5A Optional 220V rated relay package, 8 x relays
Alarm/Temperature Inputs	12 pcs of configurable inputs (external alarm, ext control, temp.meas)
Earth fault detection	External EFD resistor module, measurement range 8-500kΩ Detects leakage in DC+ or DC- rail
Max quantity of modules per system	40 x MHE, 1 x UIF, 16 x VID1-BM, 8 x VID1-LVD, 1 x VID1-SAM, total max 48
Log data	512 last alarms, 100 last events, System power log, Cumulative battery temperatures and discharge cycles

Battery Management features	VIDI2
Battery tests	Manual battery test Periodic battery test (e.g. twice per year) Natural battery test, starts on mains fault Battery test by remote input Battery connection quick test (e.g. once per week) Battery Life Time analysis, Temp & Cycles Battery mid-point measurement Battery block voltage measurement (VIDI-BM)
Charge modes	Float charge Manual boost charge Periodic boost charge Automatic boost charge Temperature compensation in all charge modes Maintenance manual charge mode
Functions	Charge current limiting Discharged Ah-counter Time window for battery tests

Alarms														
Example of Alarm Configuration in Alarm Matrix, full freedom for 12 relays (e.g. urgent / non-urgent alarms)														
Alarm	Enabled	Delay	Relay 1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
System Over Temperature	x	10s	x											
Low System Voltage	x	1s	x											
High System Voltage	x	1s	x											
Low System Voltage Warning	x	10s	x											
High System Voltage Warning	x	10s	x											
Mains Fault	x	3s		x										
Earth Fault	x	10s		x										
Rectifier Fault	x	1s	x											
Inverter Fault	x	10s	x											
Bypass Fault	x	10s	x											
Battery test fault	x	1s			x									
Battery asymmetry	x	10s			x									
Battery lifetime warning	x	10s			x									
Battery fuse fault	x	10s	x											
Load fuse fault	x	10s	x											
External Alarm Groups 1-4		10s												
...														
Totally +40 alarms														

Applicable Standards	VIDI2
EMC	Generic IEC61000-6-1, IEC61000-6-2, IEC61000-6-3, IEC61000-6-4 Power Utility immunity EN61000-6-5 Telecom ETSI EN 300 386 Railway EN 50121-4, EN 50121-5
Environment	Operation: ETS 300 019-2-3 cl T3.2 Storage: ETS 300 019-2-1 cl T1.2
Safety	EN/IEC/UL 62368-1 Railway EN 50124-1, (Indoor use, Not connected to contact line, Pollution degree 2, Overvoltage category 2)
Approvals	CE CB pending, UL/CSA pending, EAC pending
Quality	Manufacture and design conform to ISO 9001, ISO 14001



## Technical Specifications VIDI-BM Battery Monitoring Module

Electrical	VIDI-BM
Power Input voltage range	18 – 280 VDC
Communication	PowerCAN connection to VIDI+ Controller
Block Voltage Measurement	Inputs: 4 pcs 12V nominal, Accuracy < 20mV, polarity protection
System voltage measurement range	0 – 280 VDC
Current Sense	1 pc shunt voltage measurement, 60 mV
Alarm inputs	2 pcs configurable alarm/temperature inputs
Status indication	LED Green/Red
Mechanical data	IP20, Dimensions (H xW x D) : 75 x 160 x 27 mm, Weight : 320 g

## Technical Specifications VIDI-LVD Low Voltage Disconnection Module

Electrical	VIDI-LVD
Power Input voltage range	18 – 280 VDC
Communication	PowerCAN connection to VIDI+ Controller
Coil Contact Driver	Maximum allowed continuous coil current: 2A
Coil Driver output voltage	System voltage
Aux contact for contactor	Indication of the actual core position of the latched contactor
System voltage measurement range	0 – 280 VDC
Current Sense	1 pc shunt voltage measurement, 60 mV
Alarm inputs	2 pcs configurable alarm/temperature inputs
Status indication	LED Green/Red
Mechanical data	IP20, Dimensions (H xW x D) : 75 x 160 x 27 mm, Weight : 320 g

## Technical Specifications VIDI-SAM Serial Adapter Module for inverters

Electrical	VIDI-SAM
Power Input voltage range	18 – 280 VDC
Communication	PowerCAN connection to VIDI+ Controller
Auxiliary communications	RS-232, RS-485, CAN
System voltage measurement range	0 – 280 VDC
Current Sense	1 pc shunt voltage measurement
Alarm inputs	2 pcs configurable alarm/temperature inputs
Mechanical data	IP20, Dimensions (H xW x D) : 75 x 160 x 27 mm, Weight : 320 g

## Technical Specifications IEC61850 SCADA converter

Electrical	IEC61850 SCADA and Profibus converters
Power Input voltage range	18 - 31 VDC, DC/DC converters for nom. 48-220V systems
Communication internal	Modbus/TCP LAN connection to VIDI+ Controller
Communication external	LAN port, IEC61850 or Profibus protocol
Mechanical data	IP20, Dimensions H 71,9mm x W 78,6mm x D 100mm, Weight: 231g

## Technical Specifications Profibus converter

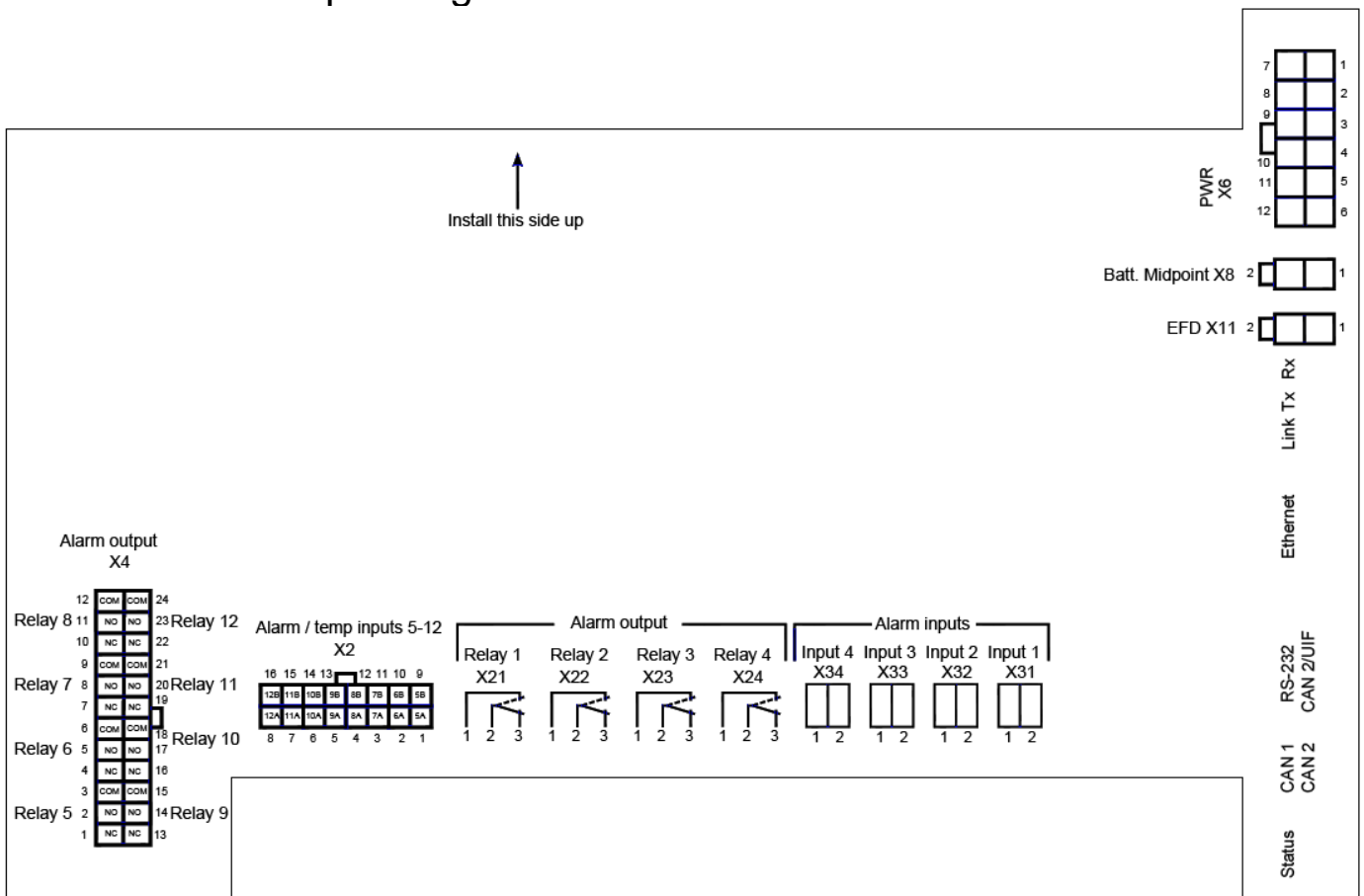
Electrical	IEC61850 SCADA and Profibus converters
Power Input voltage range	18 - 31 VDC, DC/DC converters for nom. 48-220V systems
Communication internal	Modbus/TCP LAN connection to VIDI+ Controller
Communication external	LAN port, IEC61850 or Profibus protocol
Mechanical data	IP20, Dimensions H 100 mm x W 112mm x D 71,9mm, Weight: 231g

## Technical Specifications, common

Environmental	VIDI2, VIDI-BM, VIDI-LVD, VIDI-SAM
Cooling	Natural convection
Acoustic noise	< 40 dB
Operating temperature	VIDI2 & UIF: -25 / +70°C, Start-up at -40°C VIDI AUX Controllers: -20 / +50°C IEC61850 & Profibus: -20 / +60°C
Storage temperature	-40 / +85 °C
Humidity	95 % (relative humidity, non-condensing)

Connectors		VIDI2
PWR X6	PWR, voltage meas, shunt, LVD	Molex Mini-Fit Jr™
BATTERY MIDPOINT X8		Molex Mini-Fit Jr.
EFD X11	to Earth Fault resistor module	Molex Mini-Fit Jr.
ETHERNET		RJ-45 8/8 modular plug
RS-232		Molex Micro-Fit 3.0™
CAN2 / UIF		RJ-11 6/6 modular plug
CAN1/2		RJ-45 8/8 modular plug
ALARM INPUT X31-X34	4 x input/temp	Phoenix screw/spring terminal
ALARM OUTPUT X21-X24	4 x relay alarm	Phoenix screw/spring terminal
ALARM INPUT X2	8 x input/temp	Molex Micro-Fit 3.0™
ALARM OUTPUT X4	8 x relay alarm	Molex Micro-Fit 3.0™

## VIDI2 Connector pin diagrams



C01354

## Order Information

Main System controller	
VIDI2 System controller unit	94I640
UIF User Interface Display	94M364
Auxiliary Controller kits	
VIDI BM kit. Includes Battery monitoring module and cable set	9040X0002338
VIDI LVD kit. Includes Low Voltage Disconnect controller module and cable set.	8320X0003275
VIDI SAM kit. Serial adapter module. Used with OPUS EIM and DUAL inverters.	8320X0004402
IEC61850 SCADA converter (Wago 750-8202/025-002)	8320X0015545
Profibus Converter (Wago Wago 750-8216/025-001)	C01354
Auxiliary Measurement devices	
VIDI2-EFD module KIT, Earth Fault Detection Resistor Module	832X015957

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

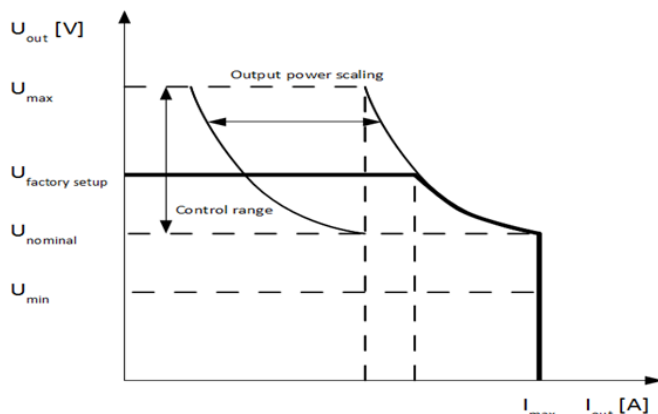


### Product Description

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					



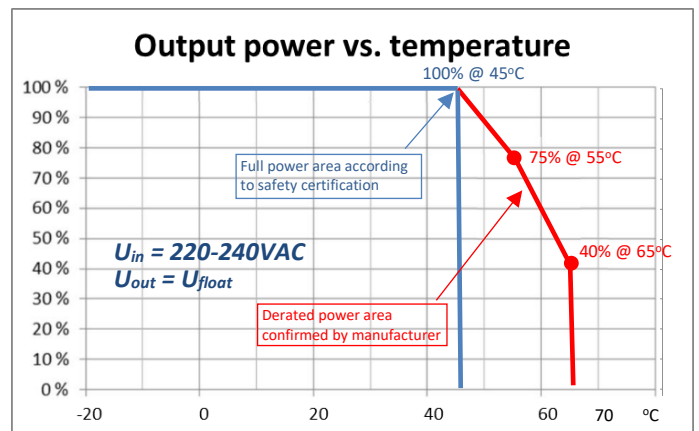
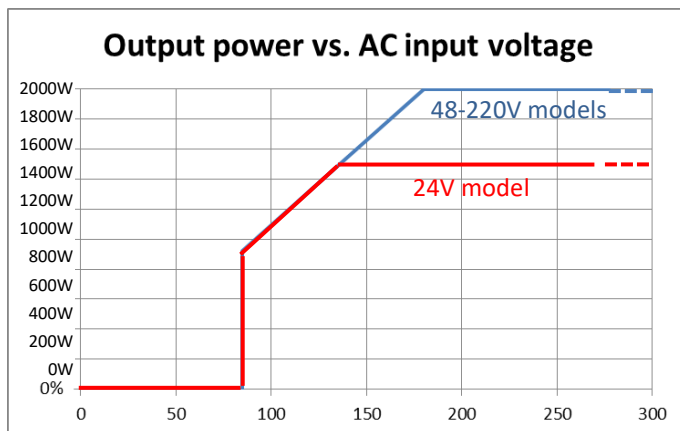
Dimensions (HxWxD)	169 x 83 x 357
	mm, see drawing
Weight	4.6 kg
Protection class, IEC 60529	IP20 when counter-connector in place, DC connector IP10 without counter-connector

<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

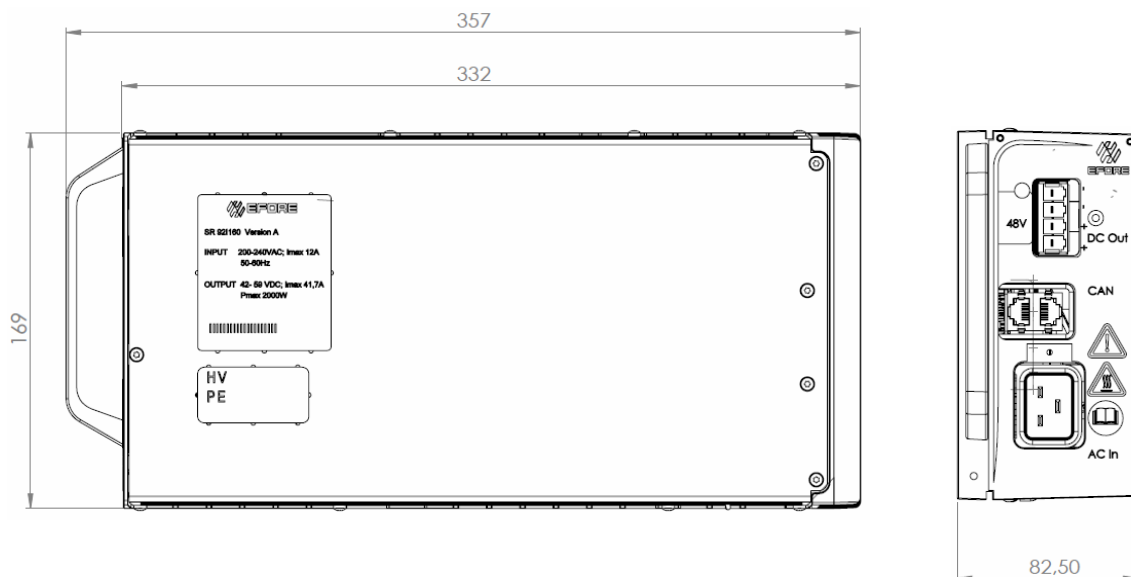
<b>Environmental</b>	
Cooling	Natural convection
Acoustic noise	< 40 dB
Operating temperature	Full power according to Safety Certification -25°C ... +45°C, Start-up at -40°C Derated power at +45°C ... +65°C, max 40% power at 65°C, see curve below
Storage temperature	-40 °C ... +85 °C
Environmental protection	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

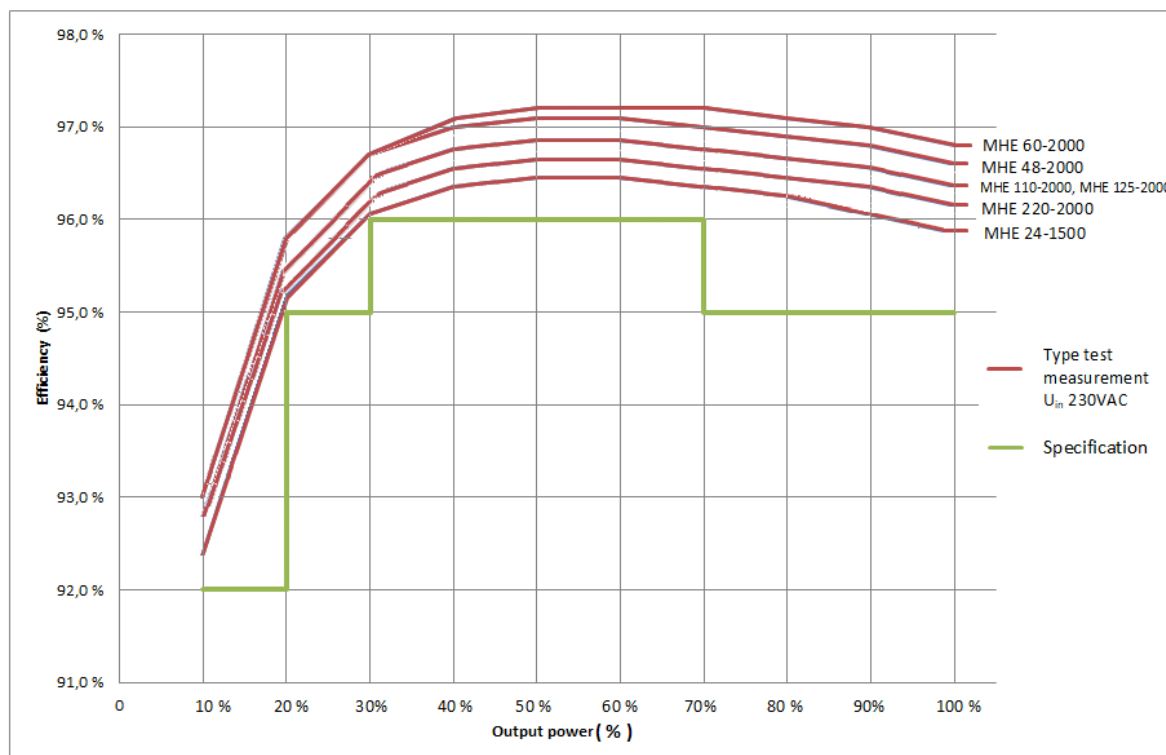
## Derating curves



## 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