Premium
Powering Your Challenge

VDX-10K

10 kVA AC/AC converter

GENERAL FEATURES:

Sine wave output voltage
Suitable for motors control
Adjustable output frequency
Adjustable output voltage
Remote ON/OFF opto-coupled
Alarm by isolated relay contacts
Configurable input: Reverse or Mid power
Remote control via RS232 or CAN Bus
Railway according to EN50155:2021
Fire and smoke: EN45545-2:2020

3 YEAR WARRANTY INDUSTRY
ROHS REACH
5 YEAR WARRANTY RAILWAY
EN50155
EN45545 fire & smoke

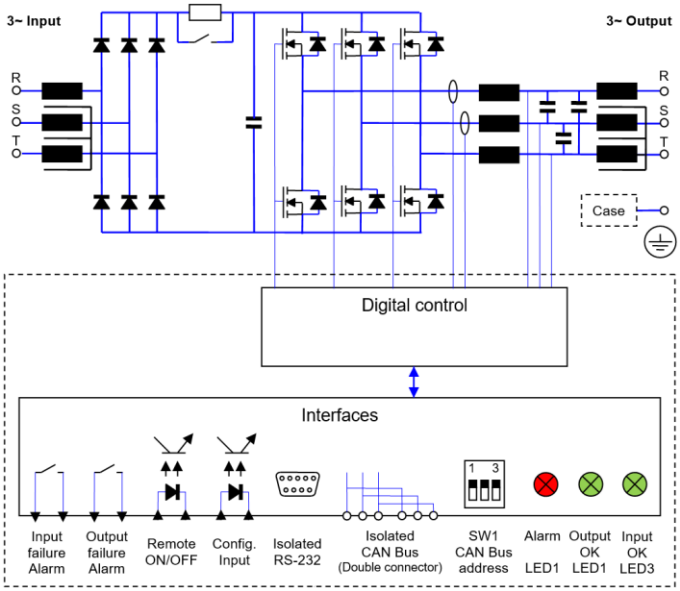
MODEL	**VDX-10K-4501**
Voltage line	400V three phase

INPUT	
Nominal AC Voltage	400 Vac three phase sinusoidal
Minimum AC Voltage	360 Vac
Maximum AC Voltage	460 Vac
Frequency range	47…63 Hz
Power factor	> 0.55
Inrush current	< 10 A
Efficiency	> 95%
OUTPUT	
Nominal output voltage (Von)	400 Vac Three phase sinusoidal
Output voltage range	15…110% of Von nominal (adjust via remote control)
Output frequency	5…100 Hz via RS-232 and CANBUS
Nominal output Current	14.43A
Maximum peak current	18.75A for 0.56s (See overload protection curve)
Load regulation	< 4.5%
Line regulation	< 2% @ Vin ≥ 415 Vac < (Vin-15) + 2% @ Vin < 415 Vac
Output wave distortion THD	< 5% (average of 16 samples)
Output HF ripple	< 2.5%
Maximum Active power	10 kW Nominal
Maximum Apparent power	10 kVA Nominal
Maximum continuous current	14.43 A
ENVIRONMENTAL	
Storage temperature	-25 … 80 °C
Operating temperature: Full load Operating temperature: 62.5 % load Operating temperature: 25 % load	-40 … 55 °C (EN50155:2021 OT2) -40 … 70 °C (EN50155:2021 OT4) -40 … 85 °C (EN50155:2021 OT6)
Relative humidity without condensation	5 … 95%
Maximum altitude	2000m at full load, 2500m at 95% of load
Cooling	Internal controlled internal fan
Shock and Vibrations according to	EN61373:2011 Category 1 Class B body mounted
MTBF (MIL-HDBK-217-E; Gb, 25°C)	100.000 h
EMC	
Immunity according	EN50121-3-2:2016/A1:2019
Emissions according	EN50121-3-2:2016/A1:2019
SAFETY	
Dielectric strength: (Input & Output) / Earth	1800 Vrms / 50Hz / 1min
Dielectric strength: (Input & Output) / Signals	1500 Vrms / 50Hz / 1min
Dielectric strength: Signals / Earth	500 Vrms / 50Hz / 1min
Safety according to	EN62368-1, EN50124-1 Railway app. (Insulation coordination)
Pollution degree	PD2
Overvoltage category	OV2
Fire and smoke	EN45545-2:2020
MECHANICAL	
Weight	< 6250 g
Case material	Aluminium 5754 H111
Case Finish	Anodized AA15
Protection degree	IP20
PCB protection	Acrylic transparent coating with UV mark
PROTECTIONS	
Against overloads	Current and I^2T limited (see overload protection curve)

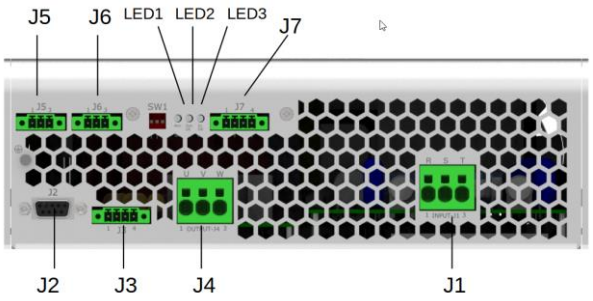
Against over-temperature	Shutdown with auto-recovery
CONTROL	
Output OK LED	Green
Input OK LED	Green
Alarm LED	Red
Input alarm	Open when alarm. Maximum rating: 0.16 A at 160 Vdc
Output alarm	Open when alarm. Maximum rating: 0.16 A at 160 Vdc
Remote OFF input	OFF applying 15…143 Vdc (acc. to EN50155), Impedance >35 kΩ
Configurable input (reverse or mid-power)	ON: applying 15…143 Vdc (acc. to EN50155), Impedance >35 kΩ

Note-1: Is not recommended to handle connectors below -25°C

BLOCK DIAGRAM

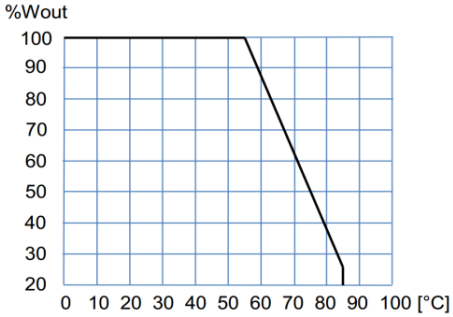


CONNECTIONS



J1-1	Input R	Cables 2.5 … 4mm²
J1-2	Input S	
J1-3	Input T	
J4 – 1	Output U	
J4 – 2	Output V	
J4 – 3	Output W	
J3 - 1	+ Configurable input	Phoenix Contact MC1.5/4-GF-3.81 Recommended female: Phoenix Contact MC1.5/4-STF-3.81
J3 - 2	- Configurable input	
J3 - 3	+ Remote	
J3 - 4	- Remote	
J7 - 1, 2	Output alarm	
J7 - 3, 4	Input alarm	
J5 - 1	CAN L	Phoenix Contact MC1.5/3-GF-3.81 Recommended female: Phoenix Contac MC1.5/3-STF-3.81
J5 - 2	CAN H	
J5 - 3	GND CAN	
J6 - 1	CAN L	
J6 – 2	CAN H	
J6 - 3	GND CAN	
J2 - 2	RS-232 Rx	Female D-Sub DB9
J2 - 3	RS-232 Tx	
J2 - 5	RS-232 GND	
J2 rest	Not connected	
J8	Earth	M5 stud (Max torque 3 Nm)

POWER DERATING vs AMBIENT TEMP.



RS232 communication port

DESCRIPTION

The VDX-10k consists of three phase sine-wave AC-AC converter.

The unit allows:

- Shutdown the output applying a voltage from 15 to 143Vdc on pins 3 and 4 of J3.
- Start-up motors by means of a soft start. In the start-up, the output voltage rises linearly from 0V to set voltage and the frequency from the initial to the set one. The start-up ramp slope may be configured via RS-232 or CAN Bus
- Set the rotation speed of a motor according to the appropriate Voltage/Frequency ratio.
- Configurable input (pin 1 and 2 of J3) allows to configure the unit via RS-232 or CAN Bus for the functions below:
  - Reverse mode (by default): Changing the rotation direction for the next start-up of a motor by applying a voltage between 15 and 143V.
  - Mid power mode: Changing the output frequency in V/F mode from nominal to a mid-power frequency by applying a voltage between 15 and 143V.
- Monitoring the status of the input and output voltage through the contacts of two separate solid-state relays.
- Set and monitor parameters via RS-232.

The VDX-10k is equipped with a maximum average power protection as well as maximum output peak current protection. This protects the semiconductors even when an output short-circuit occurs. It also features a disable function for input under-voltage.

INSTALLATION

- The unit has 6 threaded holes for the fixation on a mounting surface.
- The unit has internal fans. For an appropriate cooling, the air input and output should be free of elements that cause and an air flow reduction (minimum recommended distance to other objects 90mm).
- Make connections as shown in the figure.

For safety reasons, the following requirements must be met:

- Provide the equipment with some kind of protective enclosure that complies with the electrical safety directives in effect within the country where the equipment is installed.
- Include an input fuse with a rating immediately higher than the maximum input current.
- Use cables of adequate cross-section to connect inputs and outputs. The following table lists the maximum currents and the minimum cross-sections for the cables used for each power connection.

	Input 400Vac	Output 400Vac
Maximum current	30 A	14.4A
Cable cross-section	**4 mm²**	**2.5 mm²**

It is possible to control and monitor de unit via RS232 by means a terminal emulator like "Tera Term" or "Putty".
Also it is possible to control and monitor de unit directly using the protocol showed in table:

Protocol configuration: ASCII code, 57600 bauds, parity none, 8 bits, 1bit stop

Header		Function	Parameter		Returns	Explanation
P	R	L	V		PTV■■■.■	Input voltage in Volts
			U		PTURS=■■■■ *[13]*UST=■■■■ *[13]*UTR=■■■■	Output voltage in Volts RMS Phase-Phase (*[13]* = char 13 of ASCII code)
			I		PTIR=■■.■■*[13]*IS=■■.■■ *[13]*IT=■■.■■	Output current in Amps RMS (*[13]* = char 13 of ASCII code)
			T		PTT■■■.■	Internal temperature in K
			F		PTF■■■.■	Nominal output frequency in Hz
			f		PTf■■■.■	Actual output frequency in Hz
			y		PTu■■■.■	Actual output voltage set-point in V
			S		PTS■■■.■	Inverter state **999.9** → Enabled **000.0** → Disabled **222.2** → Blocked by overload **111.1** → Blocked by overload or shortcircuit
			M		PTM■■■■	Model number
			R		PTR■■■■	Firmware version
			Other		PTE	Command not supported
		G	1	■■■.■	OK / ERR	Set the low input voltage timed shutdown in V
			2	■■■.■	OK / ERR	Set the minimum alarm input voltage in V
			3	■■■.■	OK / ERR	Change the status bit (after start up enabled with SW3 =LOCAL and disabled with SW3 =REMOTE) **999.9** → Inverter enabled **000.0** → Inverter disabled
			4	■■■.■	OK / ERR	Set the output voltage Phase-Phase in Vrms (Vo)(output must be stopped) 060.0≤ ■■■.■ ≤ 400.0
			5	■■■.■	OK / ERR	Set the maximum output current in Arms 20% I_{nom} ≤ ■■■.■ ≤ 100% I_{nom}
			6	■■■.■	OK / ERR	Set the nominal output frequency in Hz (Fo) (output must be stopped) 005.0 ≤ ■■■.■ ≤ 100.0
			7	■■■.■	OK / ERR	Set the alarm maximum output current 0 < ■■■.■ ≤ 100% $I_{max\_warning}$
			8	■■■.■	OK / ERR	**111.1** → Reset the inverter
			L	■■■.■	OK / ERR	Set the minimum input starting voltage in Volts
			O	■■■.■	OK / ERR	Set the initial frequency in the startup (Fi) 005.0 ≤ ■■■.■ ≤ 100.0
			P	■■■.■	OK / ERR	Set the ramp-up in increment of "N" cycles per Hz in mode V/F, frequency changes or start-up (Note-1) 001.0 ≤ ■■■.■ ≤ 100.0
			Q	■■■.■	OK / ERR	Set the ramp-down in decrement of "N" cycles per Hz in mode V/F (Note-1) 002.0 ≤ ■■■.■ ≤ 100.0
			Y	■■■.■	OK / ERR	Change the working mode of the input J3-1,J3-2 **111.1** → Input as reverse phase control (default) **222.2** → Input as mid-power control (Note-2)
			X	■■■.■	OK / ERR	Set the mid-power frequency for V/F mode by the use of input J3-1,J3-2 005.0 ≤ ■■■.■ ≤ 100.0
		M	1	■■■.■	OK / ERR	Set a new output frequency in Hz (output must be run and not stored in memory) 005.0 ≤ ■■■.■ ≤ 100.0
			2	■■■.■	OK / ERR	Set a new output voltage in Volts (output must be run and not stored in memory) 060.0 ≤ ■■■.■ ≤ 400.0
			3	■■■.■	OK / ERR	Set a new output frequency in Hz in mode V/F (output must be run and not stored in memory) 005.0 ≤ ■■■.■ ≤ 100.0
			4	■■■.■	OK / ERR	Changes the output phase order (output must be run and not stored in memory) **111.1** → Phase RST (direct phase) **222.2** → Phase SRT (reverse phase)

CAN communication port (optional)

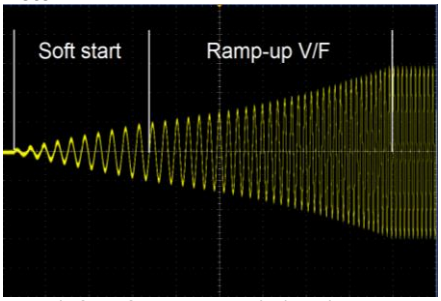
It is possible to control and monitor the unit using the CAN connection with the CANOpen protocol. It is provided an .eds file with all the objects available.

Protocol configuration: 125kbit/s, NODE ID: 10 to 17. Selectable by means of dip switch, binary combination + 10.

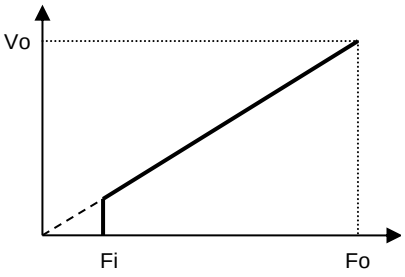
The most relevant objects can be found in the following table:

Index	Subindex	Name	Type	Attribute	Explanation
0x6001	**0x00**	**Input voltage**	**UINT32**	ro	Input voltage in tenths of Volt
0x6003	**0x01**	**Vrs**	**UINT32**	ro	Output voltage in Volts Phase R-S
0x6003	**0x02**	**Vst**	**UINT32**	ro	Output voltage in Volts Phase S-T
0x6003	**0x03**	**Vtr**	**UINT32**	ro	Output voltage in Volts Phase T-R
0x6004	**0x01**	**IR**	**UINT32**	ro	Output current in hundredths of Amp Phase R
0x6004	**0x02**	**IS**	**UINT32**	ro	Output current in hundredths of Amp Phase S
0x6004	**0x03**	**IT**	**UINT32**	ro	Output current in hundredths of Amp Phase T
0x6005	**0x00**	**Internal temperature Secondary**	**UINT32**	ro	Internal temperature1 in tenths of K
0x6007	**0x00**	**Nominal output frequency**	**UINT32**	ro	Nominal output frequency in Hz
0x6008	**0x00**	**Actual output frequency**	**UINT32**	ro	Actual output frequency in Hz
0x6009	**0x00**	**Actual output voltage set-point**	**UINT32**	ro	Actual output voltage set-point in V
0x600A	**0x00**	**Inverter state**	**UINT16**	ro	Inverter state 3 → Enabled **0** → Disabled **2** → Blocked by overload **1** → Blocked by overload or shortcircuit
0x600B	**0x00**	**Product ID**	**UINT16**	ro	Model number
0x600C	**0x00**	**Firmware version**	**UINT16**	ro	Firmware version
0x6100	**0x00**	**Low input voltage timed shutdown**	**UINT32**	rw	Set the low input voltage timed shutdown in tenths of V
0x610B	**0x00**	**Input voltage minimum warning**	**UINT32**	rw	Set the minimum alarm input voltage in tenths of V
0x6101	**0x00**	**AC status bit**	**UINT8**	rw	Change the status bit (after start up enabled with SW3 =LOCAL and disabled with SW3 =REMOTE) **1** → Inverter enabled **0** → Inverter disabled
0x6102	**0x00**	**Nominal output voltage**	**UINT32**	rw	Set the output voltage Phase-Phase in Vrms (Vo) (output must be stopped) 60≤ X ≤ 400
0x6103	**0x00**	**Maximum output current**	**UINT32**	rw	Set the maximum output current in Arms (per mille) 200‰ I_{nom} ≤ ■■■■ ≤ 1000‰ I_{nom}
0x6104	**0x00**	**Nominal frequency**	**UINT32**	rw	Set the nominal output frequency in Hz (Fo) (output must be stopped) 5 ≤ x ≤ 100
0x6105	**0x00**	**Alarm maximum output current**	**UIN32**	rw	Set the alarm maximum output current in Arms (per mille) 0‰ ≤ x ≤ 1000‰ $I_{max\_warning}$
0x6106	**0x00**	**Inverter reset**	**UINT8**	wo	**1** → Reset the inverter
0x6107	**0x00**	**Minimum starting input voltage**	**UINT32**	rw	Set the minimum input starting voltage in tenths of Volts
0x6108	**0x00**	**Start frequency**	**UINT32**	rw	Set the initial frequency in the startup (Fi) 5 ≤ x ≤ 100
0x6109	**0x00**	**Ramp up value**	**UINT32**	rw	Set the ramp-up in increment of “N” cycles per Hz in mode V/F, frequency changes or start-up (Note-1) 1 ≤ x ≤ 100
0x610A	**0x00**	**Ramp down value**	**UINT32**	rw	Set the ramp-down in decrement of “N” cycles per Hz in mode V/F (Note-1) 2 ≤ x ≤ 100
0x6120	**0x00**	**confi_inversion**	**UINT8**	rw	Change the working mode of the input J3-1,J3-2 0 → Input as reverse phase control (default) **1** → Input as mid-power control (Note-2)
0x6121	**0x00**	**Mid_power _frequency**	**UINT32**	rw	Set the mid-power frequency for V/F mode by the use of input J3-1,J3-2 5 ≤ x ≤ 100
0x6200	**0x00**	**Runtime target frequency**	**UINT32**	wo	Set a new output frequency in Hz (output must be run and not stored in memory) 5 ≤ x ≤ 100
0x6201	**0x00**	**Runtime output voltage**	**UINT32**	wo	Set a new output voltage in Volts (output must be run and not stored in memory) 60 ≤ x ≤ 400
0x6202	**0x00**	**Runtime frequency V/F**	**UINT32**	wo	Set a new output frequency in Hz in mode V/F (output must be run and not stored in memory) 5 ≤ ■■■■ ≤ 100
0x6203	**0x00**	**Change phase order**	**UINT32**	wo	Changes the output phase order (output must be run and not stored in memory) **1** → Phase RST (direct phase) **2** → Phase SRT (reverse phase)

Note 1:

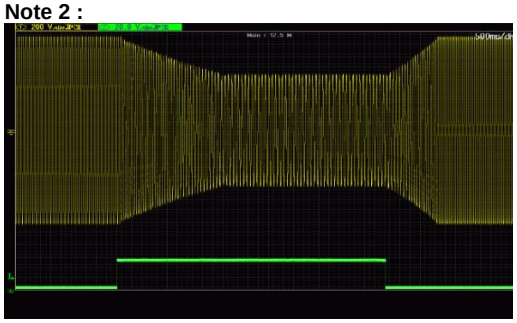


Example for Soft-start = 10 and V/F cycles =1:
Soft start time = 0.62s and Ramp-up time = 1.7s
for changes from 16Hz to 50Hz



Mode V/F curve

Note 2 :



Example for change from 50Hz / 400V to 30HZ and 240V
with ramp-down of 2 cycles /Hz and ramp-up de 1 Cycle/Hz.
Yellow: output voltage and Green: Mid-Power input signal

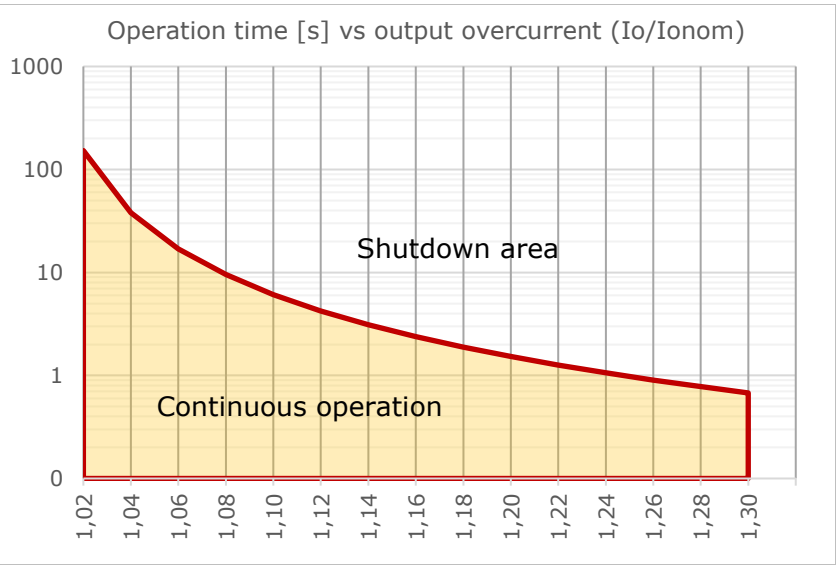
WORKING PARAMETERS

(Configurable parameters are underlined)

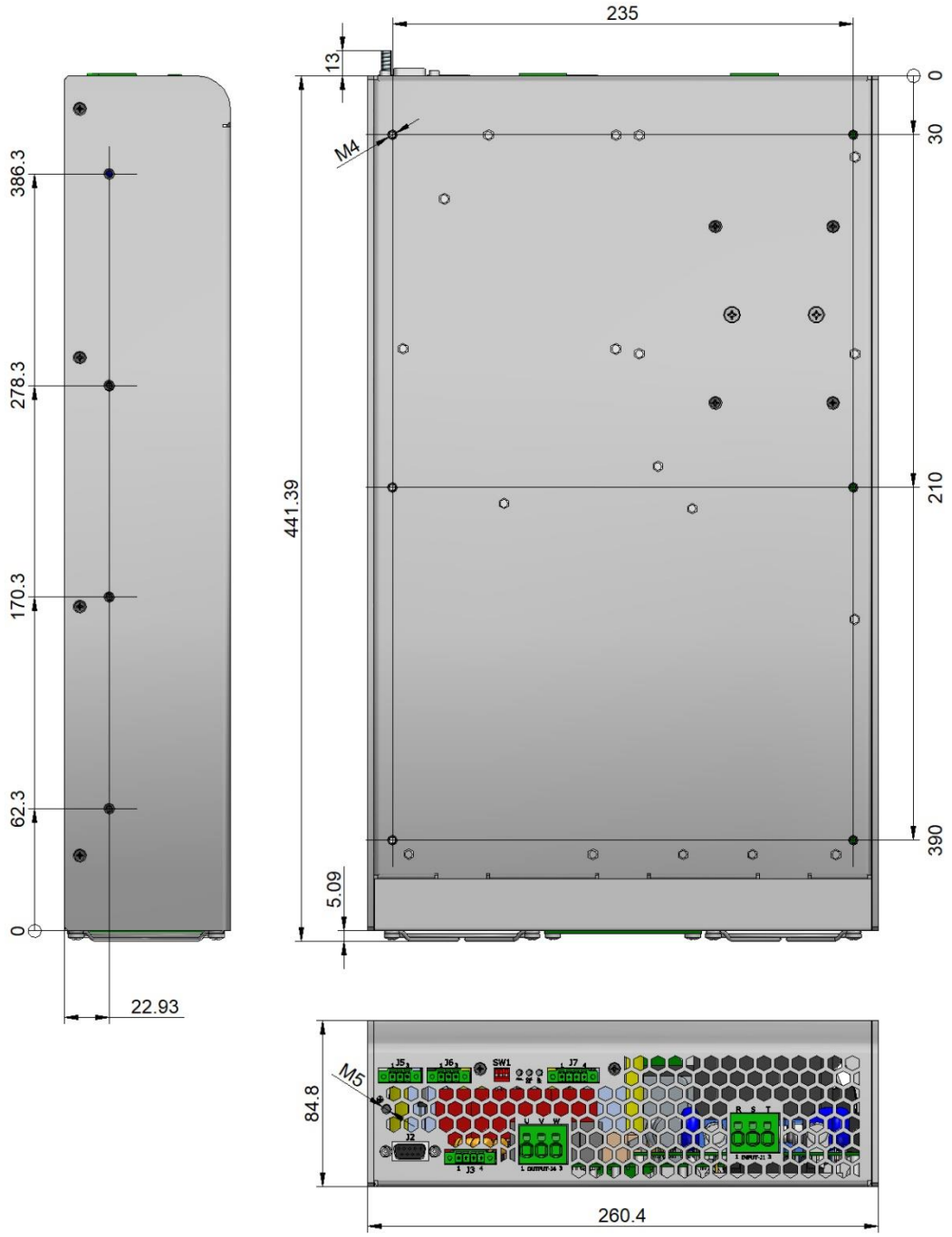
Thermal protection		
Internal warning temperature (output alarm)	88	ºC
Internal shutdown temperature	92	ºC
Internal restart temperature	75	ºC
Internal temperature of fan start-up	45	ºC
Input voltage parameters	**440Vac**	
High input voltage shutdown instantaneous	460	Vac
High input voltage timed shutdown (t) (Input alarm)	450	Vac
Start-up voltage	350	Vac
Low input voltage timed shutdown (t) (Input alarm)	340	Vac
Low input voltage instantaneous shutdown	330	Vac
Time to shutdown (t)	500	ms
Output voltage parameters		
Output voltage phase-phase	400	Vac
Output under-voltage shutdown	< 85% of setting 1000ms	
Warning voltage (output alarm)	< 90% of setting 200ms	
Initial start-up frequency	5	Hz
Soft start duration	1 cycle	
Ramp-up V/F	1 Hz/cycle	
Output current parameters		
Maximum continuous output current	14.43	A
Warning current (output alarm)	13.71	A
Maximum overload I^2t	See figure below	
Time between restart attempts	4	s
Number of attempts of consecutive overload	5	
Working failures and reset		
Lock for continuous overload or internal failure	Unlimited time	
Reset time by input disconnection	> 2	min

OVERLOAD PROTECTION

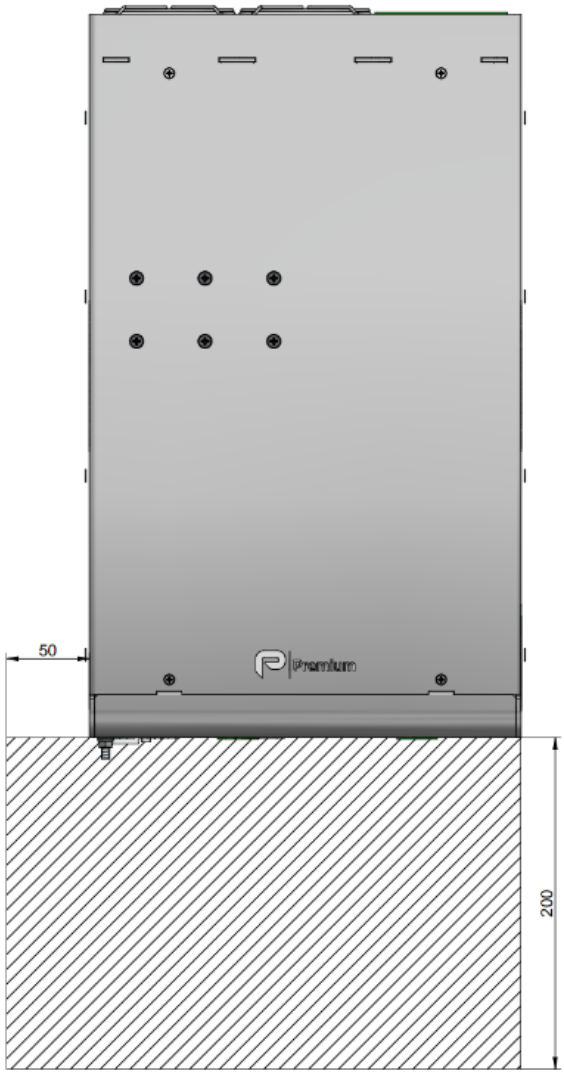
Protection against overloads and short-circuits	By **current** limiting at Iopk. By **I^2t**. The unit shutdowns when the current-time is over the continuous operation curve.
Overload protection recovery	Every 4 seconds after shutdown, the unit tries to restart up to 5 times. If the overload persists, the unit reminds shutdown until an **input reconnection**.



DIMENSIONS

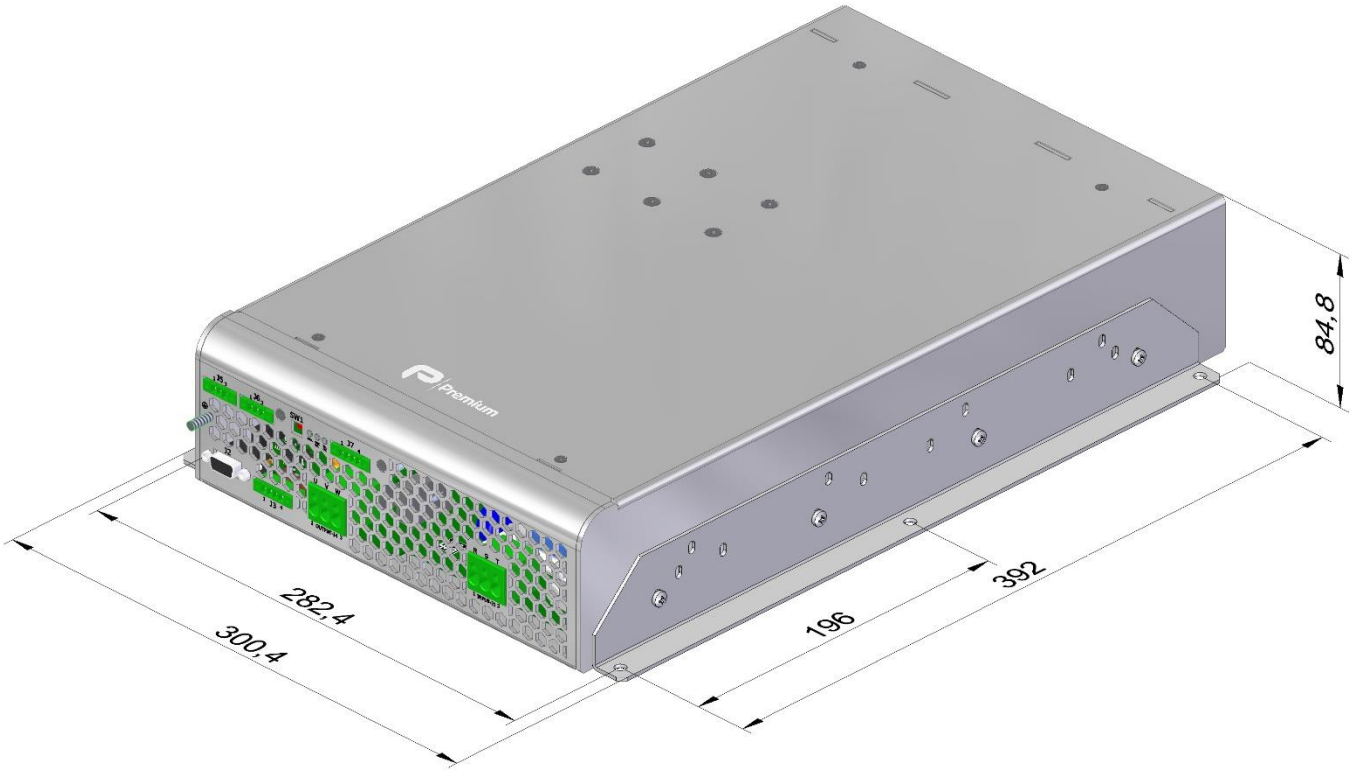


NOTE: All the fixing holes are M4. Maximum screw length inside de inverter 5mm. Max torque 2.5 Nm


50
200

ACCESSORIES

Description	Notes	CODE
Mounting brackets kit	Contains two brackets and screws	NP-9282
Aerial connectors J5 & J6	Aerial connectors for CAN interface	2 × 26011010
Aerial connectors J3 & J7	Aerial connectors for remote/config.input and alarms interfaces	2 × 26010493



EU, UKCA DECLARATION OF CONFORMITY

The undersigned, representing the following:

Manufacturer: PREMIUM, S. A.,
Address: C/ Dolors Aleu 19-21, 08908 L'Hospitalet de Llobregat, SPAIN

herewith declares that the product:

Type: AC/AC converter
Models: **VDX-10K-4501**

is in conformity with the provisions of the following directives or regulations:

2014/35/EU SI 2016 No 1101	Low voltage / The electrical equipment (safety) regulations
2014/30/EU SI 2016 No 1091	EMC / Electromagnetic compatibility regulations
2011/65/EU Annex II and its amendment 2015/863/EU SI 2012 No. 3032	RoHS / Restriction of the use of certain hazardous substances in electrical and electronic equipment

and that standards and/or technical specifications referenced below have been applied:

EN 62368-1: 2020	Safety. Audio/video, information and communication technology equipment
EN 61000-6-3: 2007	Generic emission standard
EN 61000-6-2: 2005	Generic immunity standard
EN 50155: 2021	Railway applications. Electronic equipment used on rolling stock material
EN 50121-3-2: 2016/A1:A19	Railway applications. EMC Rolling stock equipment

* Optional, See annexe

CE marking year: **2022**; UKCA marking year: **2022**

Notes:

For the fulfilment of this declaration the product must be used only for the aim that has been conceived, considering the limitations established in the instructions manual or datasheet.

L'Hospitalet de Llobregat, 26-05-2022

Albert Sole
Technical Director

PREMIUM S.A. is an ISO9001and ISO14001 certified company by **Bureau Veritas**

ANNEXE

<table>
<tr><th colspan="3">Applicable values for the different sections of the norm EN50155: 2021</th></tr>
<tr><td>4.3.1</td><td>Working altitude</td><td>Up to 2000m</td></tr>
<tr><td>4.3.2</td><td>Ambient temperature</td><td>For options B and T: Class OT2 (-40 to 55 °C): load < 100 %
For options B and T: Class OT4 (-40 to 70 °C): load <62.5 %
For options B and T: Class OT6 (-40 to 85 °C): load <25 %</td></tr>
<tr><td>4.3.3</td><td>Switch-on extended operating temp.</td><td>ST1</td></tr>
<tr><td>4.3.4</td><td>Rapid temperature variations</td><td>H1</td></tr>
<tr><td>4.3.5</td><td>Shocks and vibrations</td><td>According EN61373:2010 Category 1 class B</td></tr>
<tr><td>4.3.6</td><td>EMC Electromagnetic Compatibility

EN50121-3-2: 2016/A1:2019</td><td>
<table>
<tr><th>Test</th><th>Norm</th><th>Port</th><th>Frequency</th><th>Limits</th></tr>
<tr><td rowspan="4">Radiated emissions</td><td rowspan="4">EN61000-6-4</td><td rowspan="4">Case</td><td>30MHz…230MHz</td><td>40dB(µV/m) Qpk at 10m</td></tr>
<tr><td>230MHz…1GHz</td><td>47dB(µV/m) Qpk at 10m</td></tr>
<tr><td>1…3GHz</td><td rowspan="2">Do not apply
Internal freq. < 108MHz</td></tr>
<tr><td>3…6GHz</td></tr>
<tr><td rowspan="2">Conducted emissions</td><td rowspan="2">IEC55016-2-1</td><td rowspan="2">Input</td><td>150kHz…500kHz</td><td>99dB(µV) Qpk</td></tr>
<tr><td>500kHz…30MHz</td><td>93dB(µV) Qpk</td></tr>
<tr><td>THD total Harm. distortion</td><td>EN61000-4-30</td><td>Output</td><td>50Hz-2KHz</td><td><8%</td></tr>
</table>
<table>
<tr><th>Test</th><th>Norm</th><th>Port</th><th>Severity</th><th>Conditions</th><th>P</th></tr>
<tr><td rowspan="2">Electrostatic discharge</td><td rowspan="2">IEC61000-4-2</td><td rowspan="2">Case</td><td>±8kV</td><td>Air (isolated parts)</td><td rowspan="2">B</td></tr>
<tr><td>±6kV</td><td>Contact (conductive parts)</td></tr>
<tr><td rowspan="4">Radiated high-frequency</td><td rowspan="4">IEC61000-4-3</td><td rowspan="4">X/Y/Z Axis</td><td>20V/m</td><td>0.08…1.0GHz M. 80% 1kHz</td><td rowspan="4">A</td></tr>
<tr><td>10V/m</td><td>1.4…2.1GHz M. 80% 1kHz</td></tr>
<tr><td>5V/m</td><td>2.1…2.5GHz M. 80% 1kHz</td></tr>
<tr><td>3V/m</td><td>5.1…6Ghz M. 80% 1kHz</td></tr>
<tr><td rowspan="3">Fast transients</td><td rowspan="3">IEC61000-4-4</td><td>Input</td><td>±2kV</td><td rowspan="3">Tr/Th: 5/50 ns</td><td rowspan="3">A</td></tr>
<tr><td>Output</td><td>±2kV</td></tr>
<tr><td>Signal</td><td>±2kV</td></tr>
<tr><td rowspan="2">Surge</td><td rowspan="2">IEC61000-4-5</td><td>Input L to L</td><td>±1kV</td><td rowspan="2">Tr/Th: 1.2/50µs</td><td rowspan="2">B</td></tr>
<tr><td>Input L to PE</td><td>±2kV</td></tr>
<tr><td rowspan="3">Conducted RF</td><td rowspan="3">IEC61000-4-6</td><td>Input</td><td>10V</td><td rowspan="3">0.15...80MHz M. 80% 1kHz</td><td rowspan="3">A</td></tr>
<tr><td>Output</td><td>10V</td></tr>
<tr><td>Signal</td><td>10V</td></tr>
<tr><td>Magnetic field</td><td>IEC61000-4-8</td><td>X/Y/Z Axis</td><td>300A/m</td><td>0Hz, 16.7Hz, 50/60Hz</td><td>A</td></tr>
</table>
P= Performance criteria, L= Line, PE= Protective Earth
</td></tr>
<tr><td>4.3.7</td><td>Relative humidity</td><td>Up to 95%</td></tr>
<tr><td>7.2.7</td><td>Input reverse polarity protection</td><td>By external fuse</td></tr>
<tr><td>10.7</td><td>Protective coating for PCB assemblies</td><td>Class PC2</td></tr>
<tr><td>13.3</td><td>Tests list</td><td>
1 Visual Inspection — Routine
2 Performance test — Routine
3 Power supply test — Routine
4 Insulation test — Routine
5 Low temperature storage test — -
6 Low temperature start-up test — Type
7 Dry heat test — Type
8 Cyclic damp heat test — Type
9 Salt mist test — -
10 Enclosure protection test (IP code) — -
11 EMC test — Type
12 Shocks and vibrations test — Type
13 Equipment stress screening test — Routine: 8h at 40°C and load 100%
14 Rapid Temperature variation test — Type
</td></tr>
</table>