# TDK·Lambda

**Technical Specification**

# D1SE120-24-A3
# D1SE120-24-A4
# D1SE120-24-A5

**DIN-Rail power supply**
**1 phase / 120W / 24V**

## Industries & Applications

Automation | Industrial | Semi-Fab | Renewable | Comms | Test

ePLAN data portal

## Features & Benefits

- **AC or DC operation** enables use in a wide range of applications.
- **130% boost power capability** increases design flexibility and enable system retrofits.
- **Efficiencies of up to 92%** contribute to minimised energy consumption and an environmentally friendly energy footprint.
- **A peak inrush energy less than 0.6A²s** prevents input circuit breakers from nuisance tripping.
- **Push-in terminals** for tool-less installation and high vibration resistance.
- **Dedicated models with coated PCBs** to withstand harsh environments.
- **A sophisticated thermal design** for minimal installation clearances.

## Technical data abstract[1]

| | | |
|---|---|---|
| **Output voltage** | *nom.* | 24VDC |
| **Adjustment range** | *nom.* | 22.5 .. 29VDC |
| **Output current** | *nom.* | 5A |
| **Boost current** | *max.* | 6.5A |
| **Hold-up time** | *min.* | 23ms |
| **Overload behaviour** | | CC + Intermittent mode (Hiccup) |
| **Input voltage AC** | *nom.*<br>*max.* | 100 .. 240VAC<br>90 .. 264VAC |
| **Frequency range** | *max.* | 47 .. 63HZ |
| **Inrush current AC[2]** | *typ.* | 15 / 19 / 29A <1ms |
| **Inrush energy AC[2]** | *typ.* | 0.07 / 0.12 / 0.30A²s |
| **Input voltage DC** | *nom.*<br>*max.* | 110 .. 250VDC<br>93 .. 300VDC |
| **Inrush current DC** | *typ.* | 12 / 25VDC <2ms |
| **Inrush energy DC** | *typ.* | 0.07 / 0.25A²s |
| **Output power** | *nom.* | 120W |
| **Boost power** | *max.* | 156W / 80s |
| **Conversion efficiency[2]** | *typ.* | 88.4 / 90.2 / 92.0% |
| **Power losses[2]** | *typ.* | 15.7 / 13.0 / 10.4W |
| **No-load consumption[2]** | *max.* | 0.8 / 0.8 / 0.8W |
| **Power factor** | *typ.* | 0.92 |
| **Ambient operating temperature** | *nom.*<br>*max.* | -25 .. +55°Camb (-13 .. +158°Famb)<br>-25 .. +70°Camb (-13 .. +131°Famb) |
| **Service life MTBF[3]** | *min.* | 12.00M / 2.43M hrs |
| **Service lifetime[2]** | *min.* | 275 000 / 466 000 / 689 000hrs |
| **Dimensions (WxHxD)** | | 38x125x110mm<br>(1.50x4.92x4.33in) |
| **Weight** | *max.* | 460g (1.01lb) |

[1] All values refer to STC unless otherwise stated | [2] 100 / 120 / 240VAC | [3] 50% / 100% Pout_nom

## Certifications & Approvals

IECEE CB SCHEME
IEC EN 61010-1
IEC EN 61010-2-201
IEC EN 62368-1 (Ed.3)

c UL us LISTED
UL CSA 61010-1
UL CSA 61010-2-201
*E356563*

c UL us
UL CSA 62368-1 (Ed.3)
*E511889*

IS 13252-1
*R-41185469*
*In progress*

## Compliance & Registration

CE
EU Low Voltage Dir. 2014/35/EU
EU EMC Dir. 2014/30/EU
EU RoHS Dir. 2011/65/EU

UK CA
Safety and EMC Reg. 2016
Hazard. Substances Reg. 2012

China RoHS Law SJ/T 11363-2006





sales@prom-elec.com / ООО ПРОМЭЛЕКТРОНИКА

## Commercial information

| | |
|---|---|
| **Order codes** | D1SE120-24-A3<br>D1SE120-24-A4<br>D1SE120-24-A5 |
| **HS code** | 8504408290 |
| **Life-cycle status** | Launch |
| **Product revision** | G05 |
| **Single package** | |
| Width | 155mm (6.10in) |
| Height | 78.5mm (3.09in) |
| Depth | 145mm (5.71in) |
| Gross weight | 550g (1.21lb) |
| **Bulk package** | |
| Width | 313mm (12.32in) |
| Height | 176mm (6.93in) |
| Depth | 430mm (16.93in) |
| Quantity | 10 units |
| **Pallet** | |
| Width | 1020mm (40.16in) |
| Length | 1090mm (42.91in) |
| Quantity | 300 units |
| **Manufacturer warranty** | 3 years |

## Model selector

| Model name | Output Power | Output Voltage | Feature |
|---|---|---|---|
| **D1SE120-24-A3** | 120W | $24V_{DC}$ | |
| **D1SE120-24-A4** | 120W | $24V_{DC}$ | DC OK |
| **D1SE120-24-A5** | 120W | $24V_{DC}$ | DC OK, PCB coating |
| **D1SE240-24-A3** | 240W | $24V_{DC}$ | |
| **D1SE240-24-A4** | 240W | $24V_{DC}$ | DC OK |
| **D1SE240-24-A5** | 240W | $24V_{DC}$ | DC OK, PCB coating |
| **D1SE480-24-A3** | 480W | $24V_{DC}$ | |
| **D1SE480-24-A4** | 480W | $24V_{DC}$ | DC OK |
| **D1SE480-24-A5** | 480W | $24V_{DC}$ | DC OK, PCB coating |

## Add-ons and accessories

### DUSH DC-UPS
In mission critical applications, the DUSH serves as a backup solution to deliver power from a battery.

**DUSH960-1248-0M**
20A input/output/battery, 12..48V programmable, buck-boost converter, battery interface, Modbus/RTU, LCD, 5A AUX output, push-in terminals

**DUSH960-1248-1M**
20A input/output/battery, 12..48V programmable, buck-boost converter, battery interface, Modbus/RTU, LED indication, push-in terminals

www.emea.lambda.tdk.com/uk/products/dush

### DBM Buffer Modules
In order to secure process uptime and reliability in 24V low-voltage systems, DBM buffer modules increase hold-up time or provide a reserve for peak loads.

**DBM20**
Buffer module, input/output 20A, electrolytic capacitors, signalling & control, screw terminals

**DBM20/E**
Buffer module, input/output 20A, electrolytic capacitors, signalling & control, spring terminal blocks

www.emea.lambda.tdk.com/uk/products/dbm20

### DRM Redundancy Modules
For building fault tolerant 12/24V systems, DRM redundancy modules can be used to decouple n+1 power supplies.

**DRM40**
40A output, 2x20A input, screw terminals, DC OK and balancing LEDs

**DRM40B**
40A output, 2x20A input, screw terminals

www.emea.lambda.tdk.com/uk/products/drm40

### DDA DC/DC Converters
Non-isolated step-down converters for creating additional DC bus voltages from a single DC input source.

**DDA250N**
Single output 20A at 3.3 .. 15V, input 9 .. 53V, DC OK LED, screw terminals

**DDA325N**
Dual output 14A at 3.3 .. 24V and 8A at -3.3 .. -24V, input 9 .. 40V, DC OK LEDs, screw terminals

**DDA500N**
Dual output 2x20A at 3.3 .. 15V, input 9 .. 53V, DC OK LEDs, screw terminals

www.emea.lambda.tdk.com/uk/products/dda

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## List of abbreviations

| | | |
|---|---|---|
| **avg.** | *average* | The arithmetic average calculated from a row of values. |
| **CC** | | Constant output current |
| **CGD** | | Corner grounded delta (AC power system) |
| **chap.** | | Chapter |
| **Dir.** | | Directive |
| **eCap** | | Electrolytic capacitor |
| **EMC** | | Electromagnetic Compatibility |
| **Iac** | | AC input current under a particular operating condition |
| **Iout** | | DC output current under a particular operating condition |
| **Iout_boost** | | Available current reserve beyond Iout_nom (w/o a drop in Uset) that can be delivered for a limited time. |
| **Iout_nom** | | Continuous nominal DC output current under STC. |
| **Iout_ol** | | Max. intermittent DC output current in an overload situation and a shortfall of Uset. |
| **Iout_sc** | | Max. short circuit DC output current and Uout close to zero. |
| **ITU** | | International Telecommunication Union |
| **max.** | *maximum* | The maximum value which a parameter can assume, or which must not be exceeded. |
| **MCB** | | Miniature circuit breaker |
| **min.** | *minimum* | The minimum value which a parameter can assume, or must not be fallen below. |
| **MOV** | | Metal Oxide Varistor |
| **MTBF** | | Mean Time Between Failure |
| **nom.** | *nominal* | The ideal or reference value of a technical parameter which is guaranteed under STC. All nominal values in this document refer to each other and represent the general specification of the device. |
| **OCP** | | Overcurrent protection |
| **OTP** | | Overtemperature protection |
| **OVP** | | Overvoltage protection |
| **PCB** | | Printed Circuit Board |
| **PELV** | | Protective Extra Low Voltage |
| **PE** | | Protective Earth |
| **PFC** | | Power Factor Correction |
| **Pout** | | Output power under a particular operating condition with reference to Pout_nom |
| **Pout_boost** | | Available power reserve beyond Pout_nom that can be delivered for a limited time. |
| **Pout_nom** | | Nominal output power |
| **PSU** | | Power supply unit |
| **Reg.** | | Regulation |
| **SELV** | | Safety Extra Low Voltage |
| **STC** | | Standard test conditions (see „1. General“ on page 6) |
| **typ.** | *typical* | The typical value of a parameter is not guaranteed but can be assumed under STC. The min. or max. value must be determined during the engineering process of the end application. |
| **Uout** | | DC output voltage under a particular operating condition |
| **Uout_nom** | | Nominal DC output voltage |
| **Uset** | | Manually set output voltage via voltage potentiometer |
| **UVP** | | Undervoltage protection |
| **Vac** | | AC input voltage under a particular operating condition |
| **Vac_nom** | | Nominal AC input voltage |
| */* | | Separator between two values. The conditions to which the values refer can be found in the last column of the table. |
| **..** | | Specifies a range of values. |
| **<** | | The parameter is less than or equal to the specified value |
| **>** | | The parameter is greater than or equal to the specified value |

## Table data structure

| **X. Technical category** | | | |
|---|---|---|---|
| Technical parameter | Characteristic (optional) | Values | Condition (optional) |

# 1. General

**Proper handling of the product**
The faultless and safe operation of the products requires proper transport, proper storage, set-up, assembly, installation, commissioning, operation and maintenance. The permissible ambient conditions must be observed. Instructions in the associated documentation must be observed.

**Protection enclosure required**
The device must be installed in a protective housing or control cabinet to which only qualified personnel have access.

**Humid environments**
Do not operate the device in a damp environment or in an environment where condensation is likely to occur.

**Switch or circuit-breaker mounting position**
A switch or circuit-breaker must be mounted near the equipment.

**Observe country-specific regulations**
In addition to the product documentation, the relevant country-specific regulations for the installation of the device must be observed.

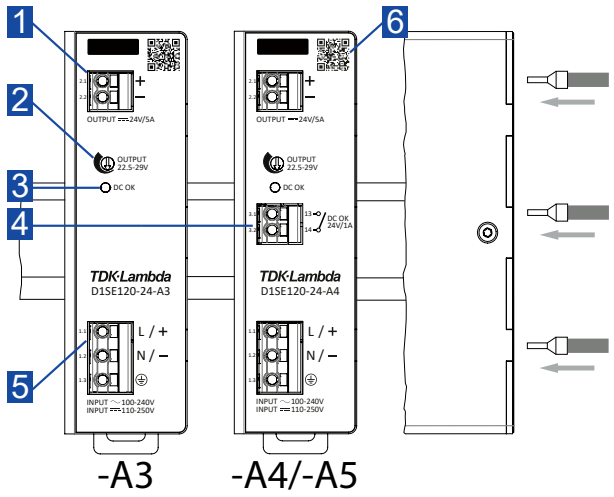
**Prohibited electrical/mechanical modifications**
The product must not be modified in any way electrically or mechanically. Modifications can result in fatal injuries and damage to property.

**Expiry of the manufacturer's warranty**
The power supply is maintenance-free. Repairs can only be carried out by the manufacturer. Opening the housing voids the manufacturer's warranty.

**Use of third-party products**
If third-party products and components are used for power or voltage increase, buffering (primary or secondary side), EMC filtering, redundancy or for load protection, it must be approved by TDK-Lambda.

**Standard test conditions**
Unless otherwise stated, all values are specified in normal mounting position, at full load, nominal input and output voltages, 25°C (131°F) ambient temperature and a run-in time of 5 minutes.

## 1.1 Description of user elements




1 Push-in terminal, DC output
2 Single turn potentiometer for adjusting the output voltage
3 Green DC-OK status LED
4 Push-in terminal for signal contacts
5 Push-in terminal, AC input
6 Web link to product documentation

For more detailed information on the input/ouput wiring and the connection of the signalling contacts, please refer to „10. Wiring & Connection“ on page 15.

**Fig. 1:** Description of user elements

## 2. Electrical output

| | | | |
|---|---|---|---|
| **Output voltage** [Uout_nom] | *nom.* | 24VDC | |
| **Adjustment range** [Uset] | *nom.* | 22.5 .. 29VDC | |
| **Adjustment tolerance** | *max.* | ±3% | at upper/lower end position of voltage potentiometer |
| **Factory default** | | 24VDC (±0.1%) | |
| **Output current** [Iout_nom] | *nom.* | 5A | 22.5 .. 29VDC |
| **Boost current** [Iout_boost] | *max.* | 6.5A / 80s | < 55°Camb |
| **Overload behaviour** | | Constant current + Intermittent mode (Hiccup) | see Fig. 3 |
| **Short-circuit proof** | | Yes, auto-recovery | |
| **Instant SC current** [Iout_sc] | *max.* | 33A / <1ms | |
| **SC hiccup current** | *max.*<br>*avg.* | 25A / 50ms<br>6A / 10s | |
| **Start-up delay** | *typ.* | 0.5s | |
| **Rise time** | *typ.*<br>*typ.* | 8ms<br>15ms | 0% Pout_nom<br>100% Pout_nom, resistive load |
| **Voltage overshoot** | *typ.* | -0.05VDC | |
| **Fall time** | *typ.* | 31ms | |
| **Hold-up time** | *min.* | 23ms | 100 .. 240VAC |
| **Output capacitance** | *max.* | 2870µF | |
| **Capacitive load start-up** | *max.* | 5 000µF | 22.5 .. 29VDC |
| **Feedback voltage** | *max.* | 32VDC | |
| **Feedback energy** | *max.* | 0.643J | |
| **Return current** | *max.* | 4mA | OFF mode |
| **Line regulation** | *max.* | 0.02% | 90 .. 264VAC |
| **Load regulation** | *max.* | 0.25% | 90 .. 264VAC |
| **Dynamic response** | *typ.* | 200mVpp | 90 .. 264VAC, 10 .. 100% Pout_nom, transient frequency 10Hz |
| **Ripple & noise voltage*** | *max.*<br>*max.* | 30mVpp<br>45mVpp | 90 .. 264VAC, +25 .. +70°Camb<br>90 .. 264VAC, -25 .. +25°Camb |

*The measurement was performed with a short twisted pair cable using a 120µF eCap and a 0.1µF cCap connected in parallel. A bandwidth limit of 20MHz is required.

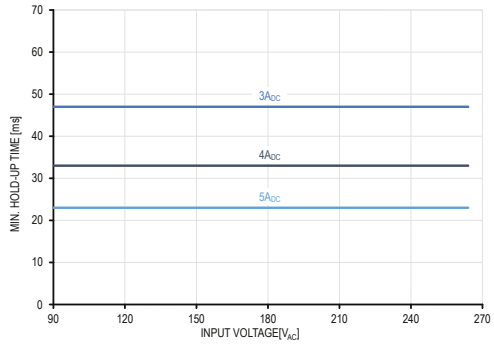



**Fig. 2:** Hold-up times under different load conditions and in dependence of the input voltage

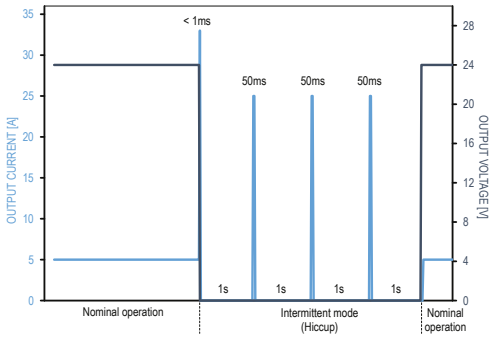



**Fig. 3:** Output current and timing during short-circuit and intermittent mode (Hiccup)

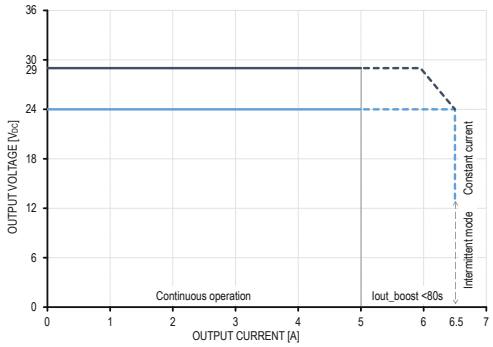



**Fig. 4:** Boost current capability up to 55°Camb

Unless otherwise stated, all values are specified in normal mounting position, at full load, nominal input and output voltages, 25°C (77°F) ambient temperature and a run-in time of 5 minutes.

## 3. Electrical input AC

| | | | |
|---|---|---|---|
| **AC power systems** | | TT, TN, IT, CGD | |
| **Input voltage** [Uin_nom] | *nom.* | 100 .. 240VAC | 1AC, N, PE |
| **Input voltage** [Uin_max] | *max.* | 90 .. 264VAC | |
| **Mains frequency** | *nom.* | 50/60Hz | |
| **Frequency range** | *max.* | 47 .. 63Hz | |
| **Input current** | *max.* | 1.5A | |
| **Input current RMS** | *typ.*<br>*typ.*<br>*typ.* | 1.5A<br>1.2A<br>0.7A | 100VAC<br>120VAC<br>240VAC |
| **Crest factor** | *typ.*<br>*typ.*<br>*typ.* | 1.8<br>1.7<br>2.0 | 100VAC<br>120VAC<br>240VAC |
| **Turn-ON voltage** | *typ.* | 80VAC | |
| **Turn-OFF voltage** | *typ.* | 80VAC | |
| **Input capacitance** | *max.* | 1.4µF | |
| **Inrush current** | *typ.*<br>*typ.*<br>*typ.* | 15A <1ms<br>19A <1ms<br>29A <1ms | 100VAC, 25°Camb, cold start<br>120VAC, 25°Camb, cold start<br>240VAC, 25°Camb, cold start |
| **Inrush energy** | *typ.*<br>*typ.*<br>*typ.* | 0.07A²s<br>0.12A²s<br>0.30A²s | 100VAC, 25°Camb, cold start<br>120VAC, 25°Camb, cold start<br>240VAC, 25°Camb, cold start |

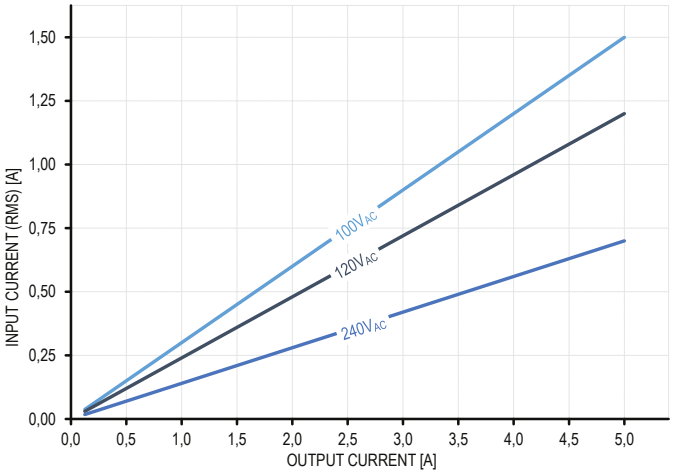



**Fig. 5:** Typical input current per phase in dependence of the load current

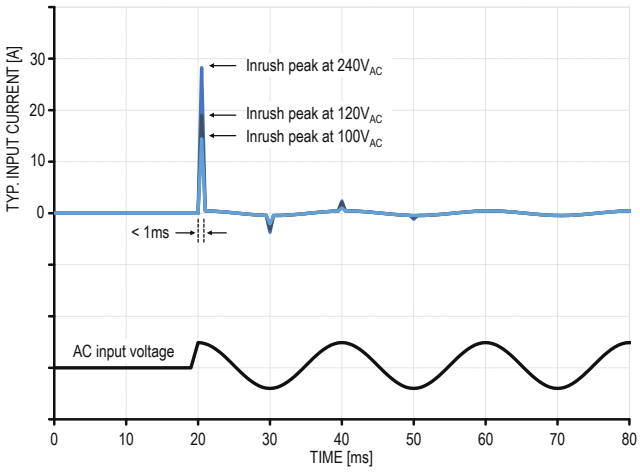



**Fig. 6:** AC inrush current and energy during start-up phase

Unless otherwise stated, all values are specified in normal mounting position, at full load, nominal input and output voltages, 25°C (77°F) ambient temperature and a run-in time of 5 minutes.

## 4. Electrical input DC

| | | | |
|---|---|---|---|
| **Input voltage** | *nom.*<br>*max.* | 110 .. 250$V_{DC}$<br>93 .. 300$V_{DC}$ | external DC fuse required, see "Device protection" on page 17 |
| **Input current** | *max.* | 1.5A | |
| **Turn-ON voltage** | *min.* | 80$V_{DC}$ | |
| **Turn-OFF voltage** | *max.* | 80$V_{DC}$ | |
| **Inrush current** | *typ.*<br>*typ.* | 12A <2ms<br>25A <2ms | 110$V_{DC}$, 25°$C_{amb}$, cold start<br>250$V_{DC}$, 25°$C_{amb}$, cold start |
| **Inrush energy** | *typ.*<br>*typ.* | 0.07$A^2s$<br>0.25$A^2s$ | 110$V_{DC}$, 25°$C_{amb}$, cold start<br>250$V_{DC}$, 25°$C_{amb}$, cold start |

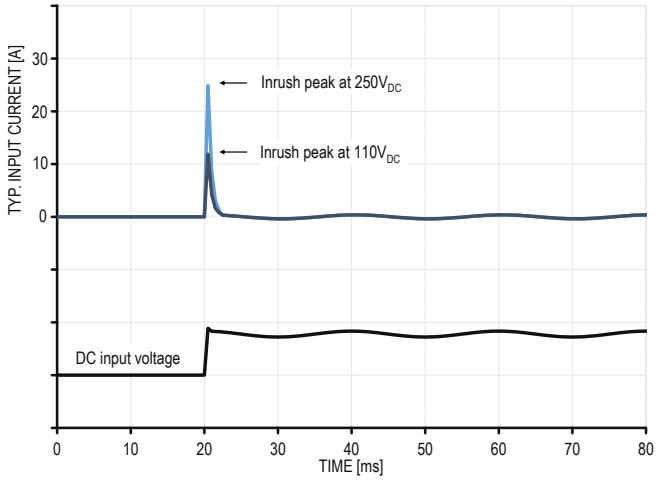



**Fig. 7:** DC inrush current and energy during start-up phase

## 5. Performance

| | | | |
|---|---|---|---|
| **Output power** [Pout_nom] | *nom.* | 120W | |
| **Boost power** [Pout_boost] | *max.* | 156W / 80s | 90 .. 264VAC |
| **Duty cycle** | *max.* | 0.1 | 90 .. 264VAC, 55°Camb |
| **Power factor** | *typ.* | 0.92 | |
| **Active input power** | *typ.* | 135.7W | 100VAC |
| | *typ.* | 133.0W | 120VAC |
| | *typ.* | 130.4W | 240VAC |
| **Reactive input power** | *typ.* | 57.8Var | 100VAC |
| | *typ.* | 56.7Var | 120VAC |
| | *typ.* | 55.6Var | 240VAC |
| **Apparent input power** | *typ.* | 147.6VA | 100VAC |
| | *typ.* | 144.6VA | 120VAC |
| | *typ.* | 141.8VA | 240VAC |
| **Conversion efficiency** | *typ.* | 88.4% | 100VAC, 100% Pout_nom |
| | *typ.* | 90.2% | 120VAC, 100% Pout_nom |
| | *typ.* | 92.0% | 240VAC, 100% Pout_nom |
| | *avg.* | 87.8% | 100VAC, 25 .. 100% Pout_nom |
| | *avg.* | 89.3% | 120VAC, 25 .. 100% Pout_nom |
| | *avg.* | 90.5% | 240VAC, 25 .. 100% Pout_nom |
| **Power losses** | *typ.* | 15.7W | 100VAC, 100% Pout_nom |
| | *typ.* | 13.0W | 120VAC, 100% Pout_nom |
| | *typ.* | 10.4W | 240VAC, 100% Pout_nom |
| | *avg.* | 16.7W | 100VAC, 25 .. 100% Pout_nom |
| | *avg.* | 14.4W | 120VAC, 25 .. 100% Pout_nom |
| | *avg.* | 12.6W | 240VAC, 25 .. 100% Pout_nom |
| **No-load consumption** | *max.* | 0.8W | 100VAC, 0% Pout_nom |
| | *max.* | 0.8W | 120VAC, 0% Pout_nom |
| | *max.* | 0.8W | 240VAC, 0% Pout_nom |

*Average efficiency under 25%, 50%, 75% and 100% load conditions, according to eco-design requirements of EU commission regulation 2019/1782.

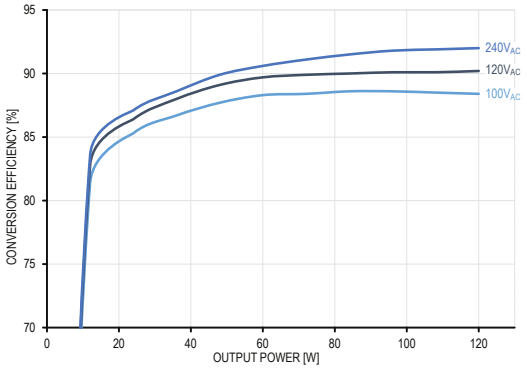



**Fig. 8:** Conversion efficiency in dependence of the output power

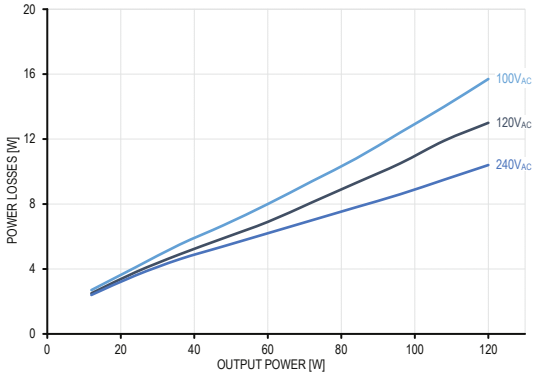



**Fig. 9:** Power losses in dependence of the output power

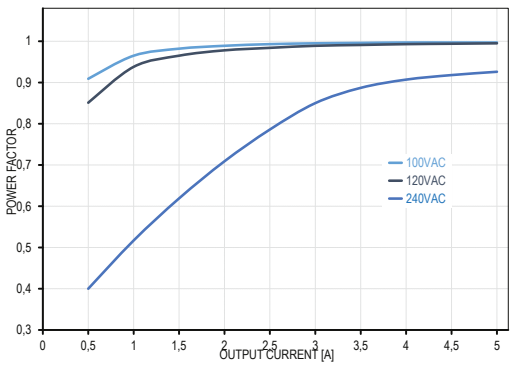



**Fig. 10:** Power factor in dependence of the output current

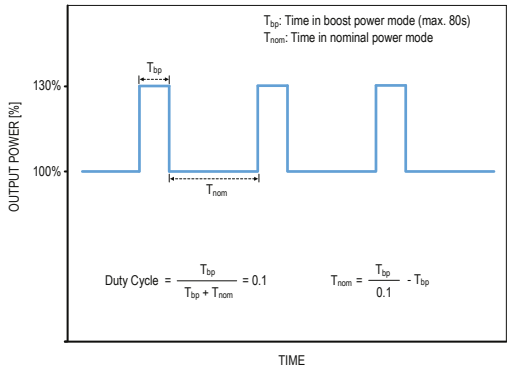



**Fig. 11:** Period and frequency of use of boost power at 55°Camb in normal mounting position

Unless otherwise stated, all values are specified in normal mounting position, at full load, nominal input and output voltages, 25°C (77°F) ambient temperature and a run-in time of 5 minutes.

## 6. Ambient conditions

| | | | |
|---|---|---|---|
| **Ambient operating temperature** | *nom.*<br>*max.* | -25 .. +55°$C_{amb}$ (-13 .. +131°$F_{amb}$)<br>-25 .. +70°$C_{amb}$ (-13 .. +158°$F_{amb}$) | normal mounting position |
| **Start-up temperature** | *max.* | -40°C (-40°F) | |
| **Ambient storage temperature** | *max.* | -40 .. +85°$C_{amb}$ (-40 .. +185°$F_{amb}$) | |
| **Power derating*** | *min.*<br>*min.*<br>*min.*<br>*min.*<br>*min.*<br>*min.* | 1.6W/°$C_{amb}$ (0.89W/°$F_{amb}$)<br>2.4W/°$C_{amb}$ (1.33W/°$F_{amb}$)<br>1.6W/°$C_{amb}$ (2.22W/°$F_{amb}$)<br>0.8W/°$C_{amb}$ (0.44W/°$F_{amb}$)<br>1.6W/°$C_{amb}$ (0.89W/°$F_{amb}$)<br>0.8W/°$C_{amb}$ (0.44W/°$F_{amb}$) | 120VAC, >55°$C_{amb}$ (131°$F_{amb}$)<br>120VAC, >55°$C_{amb}$ (131°$F_{amb}$), 90° rotated<br>120VAC, >55°$C_{amb}$ (131°$F_{amb}$), 180° rotated<br>240VAC, >55°$C_{amb}$ (131°$F_{amb}$)<br>240VAC, >55°$C_{amb}$ (131°$F_{amb}$), 90° rotated<br>240VAC, >55°$C_{amb}$ (131°$F_{amb}$), 180° rotated |
| **Cooling concept** | | Natural convection | |
| **Relative storage humidity**<br>IEC 60068-2-30 | *max.* | 95% | non-condensing |
| **Relative operation humidity**<br>IEC 60068-2-30 | *max.* | 95% | non-condensing |
| **Operating altitude** | *nom.*<br>*max.* | 3000mASL (9842ftASL)<br>6000mASL (19685ftASL) | <br>not UL approved, reduced OVC |
| **Percentage power derating** | *min.* | 5% per 1000m (3281ft) | >3000mASL (>9842ftASL) |
| **Temperature derating** | *min.* | 5K per 1000m (9K per 2181ft) | >3000mASL (>9842ftASL) |
| **Atmospheric pressure** | *nom.*<br>*max.* | 689hPa<br>469 .. 1070hPa | |
| **Pollution degree** | | 2 | |
| **Vibration sinusoidal**<br>IEC 60068-2-6 | | 2g / 10 .. 500Hz, 1 hour/direction X,Y,Z | mounted on DIN rail |
| **Shock test sinosoidal halfwave**<br>IEC 60068-2-27 | | 30g / 11ms ±5ms, 3 bumps/direction, 9 bumps total | mounted on DIN rail |
| **Audible noise** | | Some audible noises may be heard during no load, overload or short circuit. | |

*Not actively controlled

For altitudes above 3000mASL (9842ftASL) the next lower OVC must be considered.

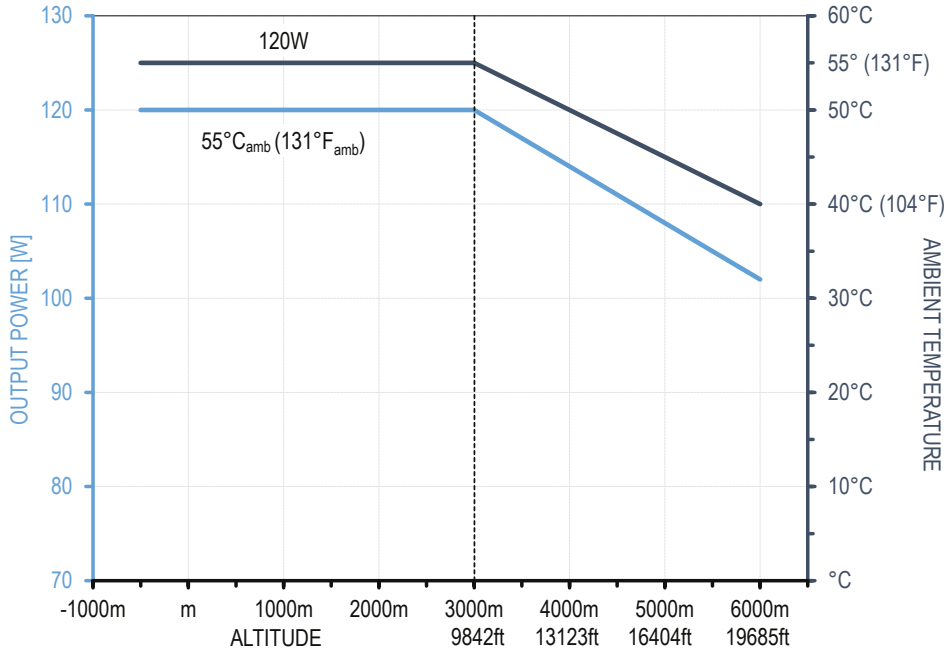



**Fig. 12:** Output power and ambient temperature derating at increasing altitudes

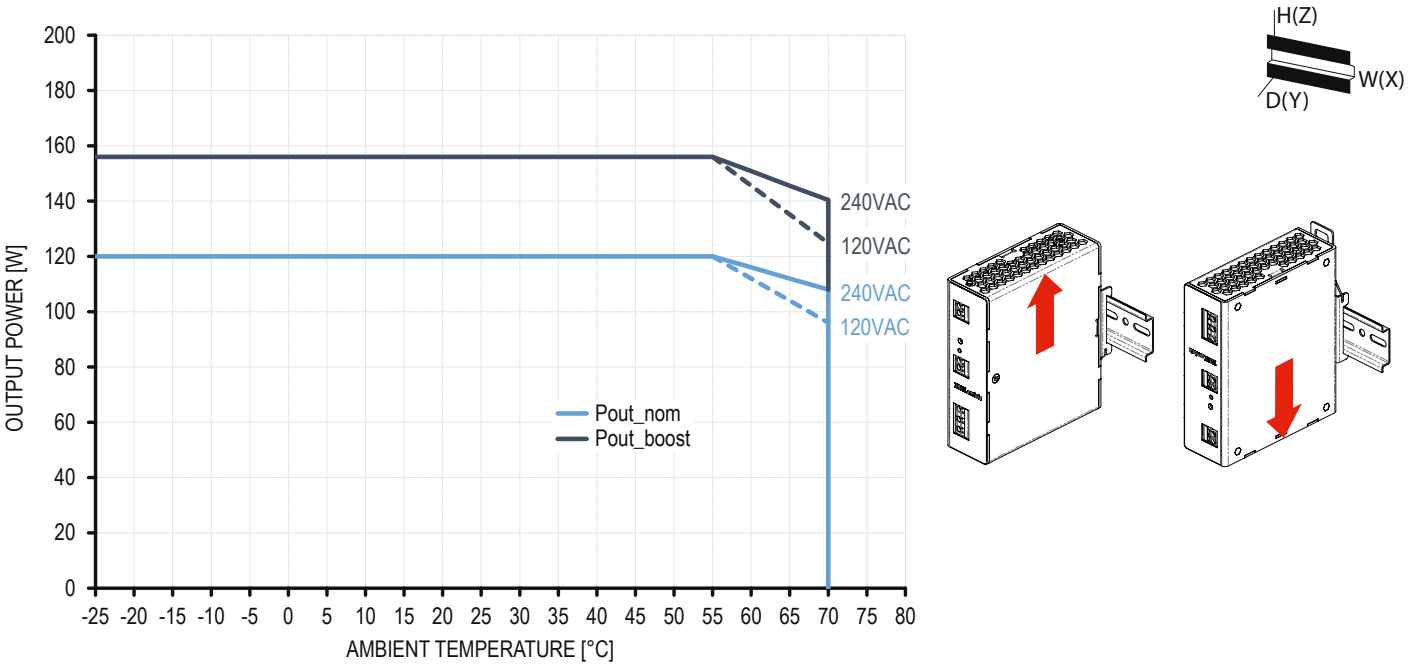



**Fig. 13:** Available output power in dependence of the ambient temperature for nomal and 180° rotated mounting positions

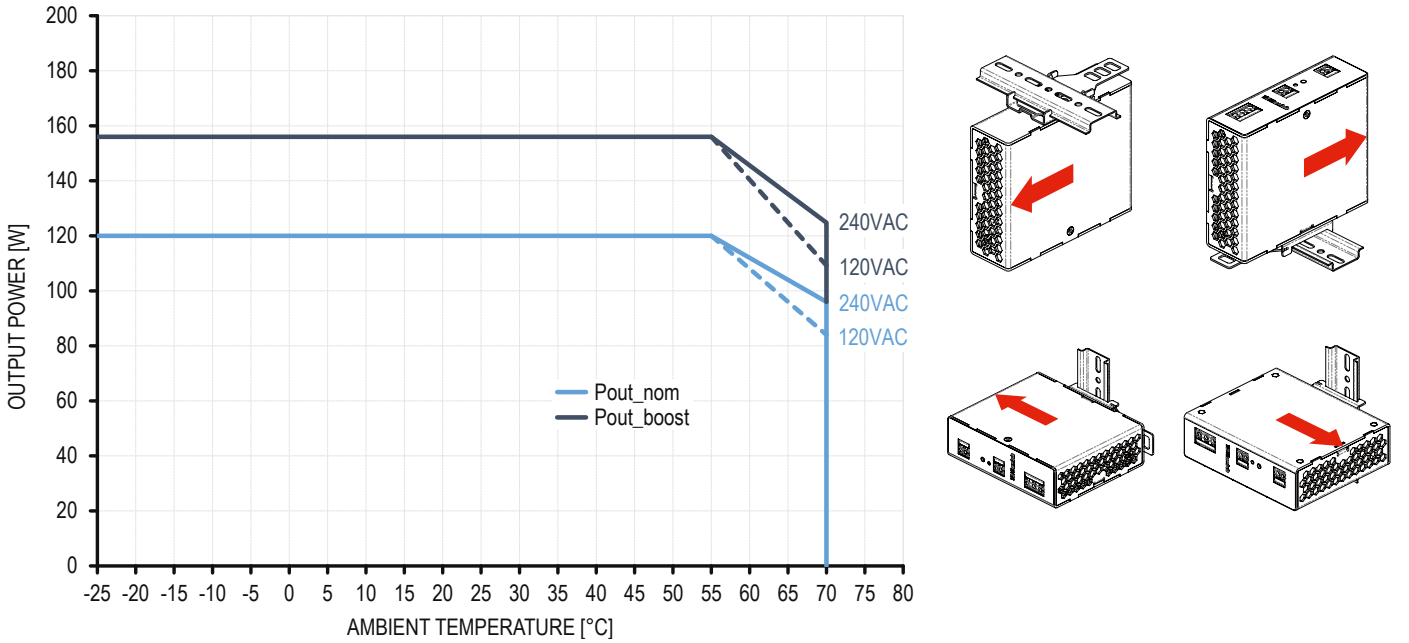



**Fig. 14:** Available output power in dependence of the ambient temperature for 90° rotated mounting position

### 6.1 Flowing mixed gases

The power supplies with conformally coated PC boards have been type tested according to IEC EN 60068-2-60 - Test Ke: Flowing mixed gas corrosion test. During the inspection after the exposure, no signs of corrosion have been detected.

| | |
|---|---|
| **Method** | 4 |
| **Gas composition $SO_2$** | 200±20ppb |
| **Gas composition $H_2S$** | 10±5ppb |
| **Gas composition $NO_2$** | 200±20ppb |
| **Gas composition $Cl_2$** | 10±5ppb |
| **Temperature** | 55±2°C (131±3.6°F) |
| **Relative humidity** | 75±5% |
| **Test duration** | 21days |

### 6.2 Salt mist

The power supplies with conformally coated PC boards have been type tested according to IEC 60068-2-11 - Test Ka: Salt mist. During the inspection after the exposure, no signs of corrosion have been detected.

| | |
|---|---|
| **Salt type** | Sodium chloride |
| **Purity** | 99.5% |
| **Temperature** | 35°C (95°F) |
| **Collection rate** | 1,6ml/h |
| **Test duration** | 96h |

## 7. Reliability and Service lifetime

| | | | |
|---|---|---|---|
| **Service lifetime** | *min.* | 97 000hrs | 100$V_{AC}$, 100% $P_{out_nom}$, 40°$C_{amb}$, 24/7 |
| | *min.* | 165 000hrs | 120$V_{AC}$, 100% $P_{out_nom}$, 40°$C_{amb}$, 24/7 |
| | *min.* | 243 000hrs | 240$V_{AC}$, 100% $P_{out_nom}$, 40°$C_{amb}$, 24/7 |
| | *min.* | 238 000hrs | 100$V_{AC}$, 75% $P_{out_nom}$, 40°$C_{amb}$, 24/7 |
| | *min.* | 279 000hrs | 120$V_{AC}$, 75% $P_{out_nom}$, 40°$C_{amb}$, 24/7 |
| | *min.* | 324 000hrs | 240$V_{AC}$, 75% $P_{out_nom}$, 40°$C_{amb}$, 24/7 |
| | *min.* | 275 000hrs | 100$V_{AC}$, 100% $P_{out_nom}$, 25°$C_{amb}$, 24/7 |
| | *min.* | 466 000hrs | 120$V_{AC}$, 100% $P_{out_nom}$, 25°$C_{amb}$, 24/7 |
| | *min.* | 689 000hrs | 240$V_{AC}$, 100% $P_{out_nom}$, 25°$C_{amb}$, 24/7 |
| **Early life MTBF** Telcordia SR-332 Issue 4 | *min.* | 1.74M hrs | 55°$C_{amb}$, 50% $P_{out_nom}$ |
| | *min.* | 2.56M hrs | 40°$C_{amb}$, 50% $P_{out_nom}$ |
| | *min.* | 2.74M hrs | 25°$C_{amb}$, 50% $P_{out_nom}$ |
| | *min.* | 0.83M hrs | 55°$C_{amb}$, 100% $P_{out_nom}$ |
| | *min.* | 1.41M hrs | 40°$C_{amb}$, 100% $P_{out_nom}$ |
| | *min.* | 1.64M hrs | 25°$C_{amb}$, 100% $P_{out_nom}$ |
| **Service life MTBF** Telcordia SR-332 Issue 4 | *min.* | 3.57M hrs | 55°$C_{amb}$, 50% $P_{out_nom}$ |
| | *min.* | 10.25M hrs | 40°$C_{amb}$, 50% $P_{out_nom}$ |
| | *min.* | 13.73M hrs | 25°$C_{amb}$, 50% $P_{out_nom}$ |
| | *min.* | 1.09M hrs | 55°$C_{amb}$, 100% $P_{out_nom}$ |
| | *min.* | 2.33M hrs | 40°$C_{amb}$, 100% $P_{out_nom}$ |
| | *min.* | 3.01M hrs | 25°$C_{amb}$, 100% $P_{out_nom}$ |

ⓘ The maximum service lifetime guaranteed by the eCap manufacturer is 131 400hrs (15 years). All values above are theoretically calculated.

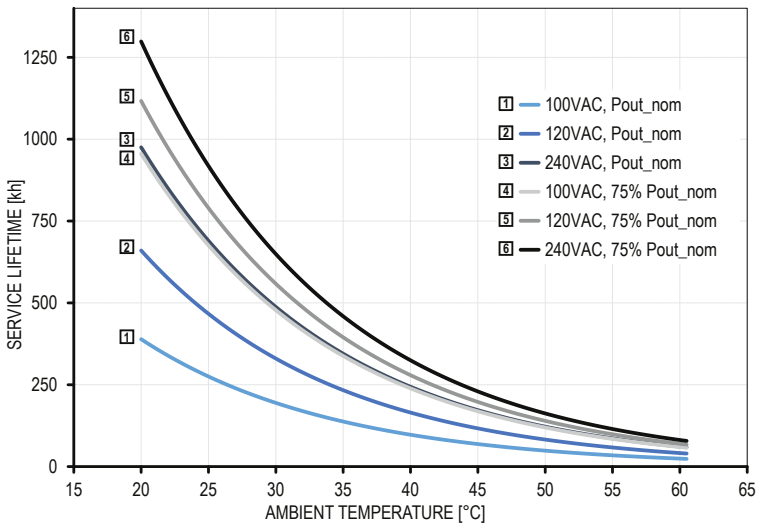



**Fig. 15:** Power supply expected service lifetime in dependence of ambient temperature

## 8. Dimensions & Mechanical data

| | | | |
|---|---|---|---|
| **Enclosure material** | | Aluminum | |
| **Cover material** | | Aluminum | |
| **Inflammability class**<br>UL 94 | | V0 | incl. connection terminals |
| **Width** | | 38mm (1.50in) | |
| **Height** | | 125mm (4.92in) | |
| **Depth** | | 110mm (4.33in) | w/o DIN rail |
| **Built-in width** | *min.* | 38mm (1.50in) | |
| **Built-in height** | *min.* | 185mm (7.28in) | |
| **Weight** | *max.* | 460g (1.01lb) | |
| **Lever arm** | *max.* | 45mm (1.77in) | into the direction of Y axis |
| **Torsional moment on DIN rail** | *max.* | 0.2Nm (1.8lb in) | |
| **Enclosure openings** | *max.* | 7mm (0.28in) | |
| **DIN rail types**<br>IEC 60715 | | TH 35-7.5, TH 35-15 | |

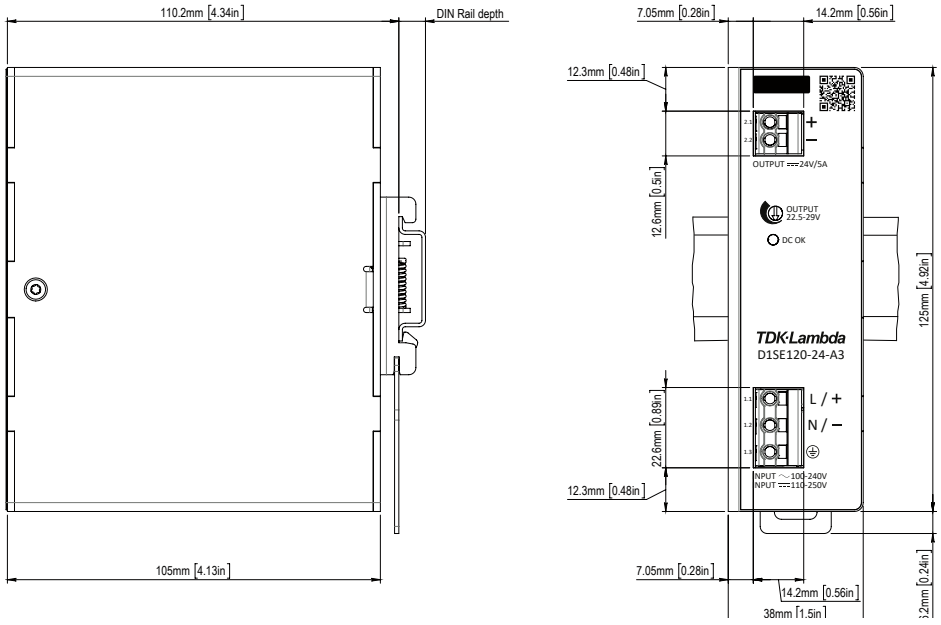



**Fig. 16:** Dimension drawing of D1SE120-24-A3

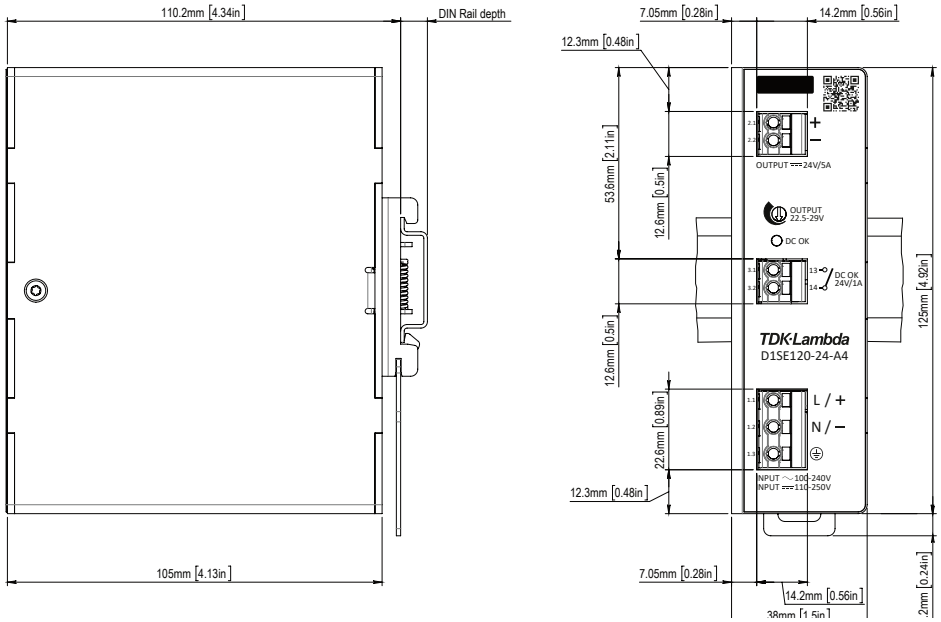



**Fig. 17:** Dimension drawing of D1SE120-24-A4/-A5

Unless otherwise stated, all values are specified in normal mounting position, at full load, nominal input and output voltages, 25°C (77°F) ambient temperature and a run-in time of 5 minutes.

## 9. Installation clearances

| | | | | |
|---|---|---|---|---|
| **Vertically (Z axis)** | | | | |
| Top side | 1 | *min.* | 40mm (1.57in) | |
| Bottom side | 2 | *min.* | 20mm (0.79in) | installation above heat sources not permitted |
| **Horizontally (X axis)** | | | | |
| Left side / Right side | 3a 4a | *min.* | 10mm (0.39in) | to heat sources (same power rating) |
| Left side / Right side | 3b 4b | *min.* | 0mm (0in) | to passive components |

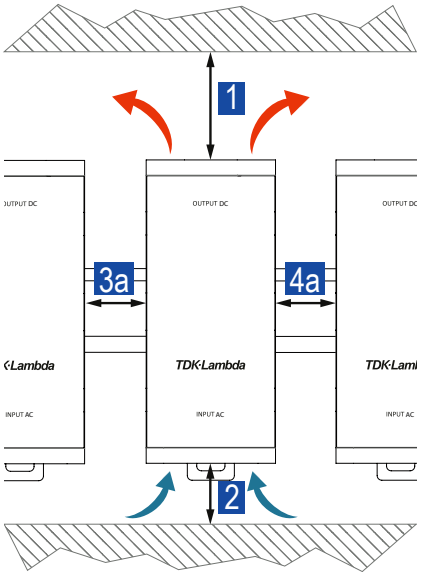



**Fig. 18:** Installation clearances to heat sources

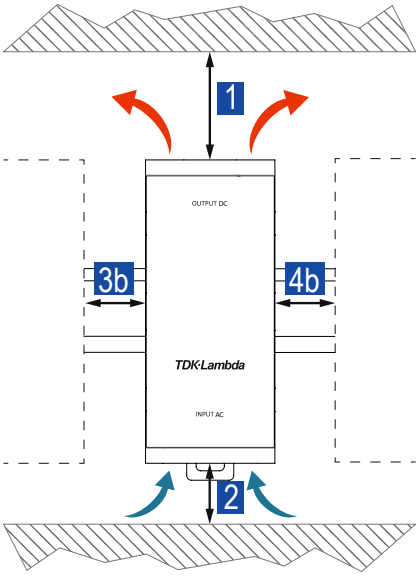



**Fig. 19:** Installation clearances to passive components

## 10. Wiring & Connection

| | Input | Output | Signaling |
|---|---|---|---|
| **Terminal type** | Push-in | Push-in | Push-in |
| **Recommended screw driver** | SL 0.5x3mm (SL $^{1}/_{64}$ x $^{1}/_{8}$in) | SL 0.5x3mm (SL $^{1}/_{64}$ x $^{1}/_{8}$in) | SL 0.5x3mm (SL $^{1}/_{64}$ x $^{1}/_{8}$in) |
| **Solid wire** | 0.2-4.0mm² (26-12AWG) | 0.2-4.0mm² (26-12AWG) | 0.2-4.0mm² (26-12AWG) |
| **Flexible wire** | 0.2-2.5mm² (26-12AWG) | 0.2-2.5mm² (26-12AWG) | 0.2-2.5mm² (26-12AWG) |
| **Insulated ferrules*** | 0.2-1.5mm² | 0.2-1.5mm² | 0.2-1.5mm² |
| **Uninsulated ferrules*** | 0.2-2.5mm² (26-14AWG) | 0.2-2.5mm² (26-14AWG) | 0.2-2.5mm² (26-14AWG) |
| **Stripping length** | 9-10mm (0.35 - 0.39in) | 9-10mm (0.35 - 0.39in) | 9-10mm (0.35 - 0.39in) |

*The ferrules must be selected to match the stripping length.

In compliance to IEC/EN/UL 62368-1 (Ed.3) ferrules are required if flexible wires are used.

In compliance with IEC/EN/UL 61010-1, 61010-2-201 appropriate copper wires must be used that withstand operating temperatures of at least 75°C (167°F) in ambients NOT exceeding 40°C (104°F), and 90°C (194°F) in ambients exceeding 40°C (104°F).

## 11. Signaling & Control

**DC OK**

| | | | |
|---|---|---|---|
| Type | | Relay contact | |
| Characteristic | | N/O | |
| Closing | | $U_{out}$ > 90% $U_{set}$ | duration max. 13ms |
| Opening | | $U_{out}$ < 80% $U_{set}$ | duration max. 5ms |
| Resistive load | *nom.* | 1A | 24V$_{DC}$ |
| | *max.* | 0.5A | 60V$_{DC}$ |
| Trigger hysteresis | *typ.* | 0.6V | |

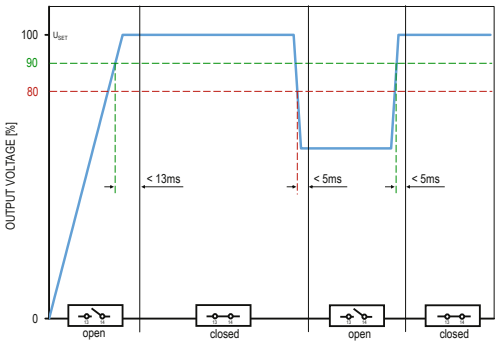



**Fig. 20:** DC-OK relay status in dependence of output voltage

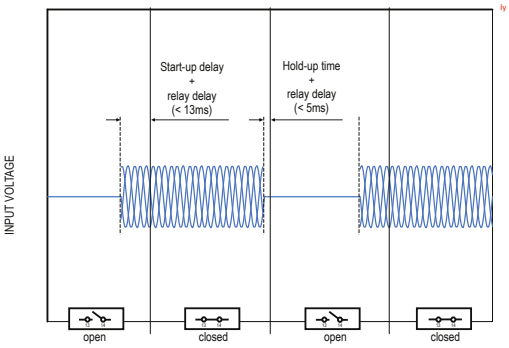



**Fig. 21:** DC-OK relay status in dependence of input voltage

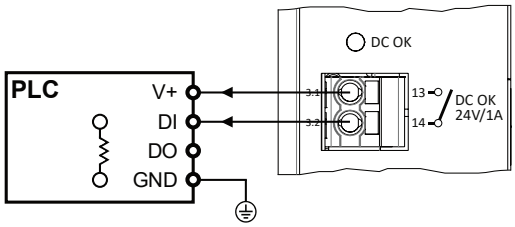



**Fig. 22:** Generic connection diagram of the DC OK relay contact

## 12. Block diagram

| | | | |
|---|---|---|---|
| **Active PFC** | 1 | 77 .. 161kHz | Dependent on $U_{in}$ and $I_{out}$ |
| **Power stage** | 2 | 156 .. 34kHz | Dependent on $U_{out}$ and $I_{out}$ |

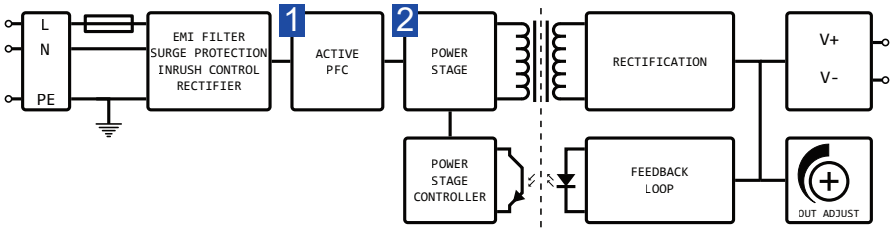



**Fig. 23:** Block diagram of -A3 models

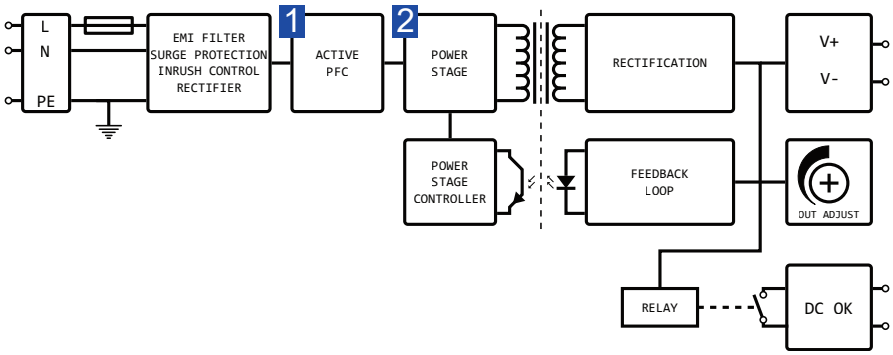



**Fig. 24:** Block diagram of -A4/-A5 models

Unless otherwise stated, all values are specified in normal mounting position, at full load, nominal input and output voltages, 25°C (77°F) ambient temperature and a run-in time of 5 minutes.

## 13. Device protection

| | | | |
|---|---|---|---|
| **Ingress protection degree**<br>IEC 60529 | | IP 20 | |
| **NEMA classification**<br>NEMA 250-2018 | | NEMA 1 | |
| **Output overcurrent protection (OCP)** | *min.* | 6.5A, auto-recovery | |
| **Output overtemperature protection (OTP)** | | Yes, auto-recovery | |
| **Output overvoltage protection (OVP)** | *max.* | 32$V_{DC}$, auto-recovery | |
| **Undervoltage protection threshold (UVP)** | *max.* | 75$V_{AC}$ | |
| **Integrated input fuse** | | 4A at L pin | not DC capable, not user replaceable |
| **Recommended DC fuse**<br>UL 248-1, UL 248-4 | | 4A | |
| **Recommended MCB types**<br>IEC 60898-1, UL 1077 | | B or C characteristic, 6/8/10A | |
| **Transient protection** | | MOV | |

When installed in an end-product, the maximum branch circuit rating must not exceed 20A (IEC UL 62368-1 Ed.3). If the upstream supply provides a higher ampacity than 20A, an external protection device is required.

## 14. Electrical Safety

| | | | |
|---|---|---|---|
| **Class of protection**<br>IEC 61140 | | I | PE connection required |
| **Electrical energy source classification**<br>IEC 62368-1 | | ES1 | |
| **Safety Extra Low Voltage**<br>IEC 61010-2-201, IEC 60950-1 | | SELV | |
| **Protective Extra Low Voltage**<br>IEC 60204-1 | | PELV | Output must be earthed in the end application |
| **Protective ground resistance** | *max.* | 45mΩ | |
| **Ground leakage current**<br>IEC 60990 | *max.*<br>*max.* | 0.45mA<br>0.55mA | TN/TT mains, 240VAC, 50Hz<br>TN/TT mains, 240VAC, 60Hz |
| **Touch current**<br>IEC 60990 | *max.*<br>*max.* | 100µA<br>120µA | TN/TT mains, 240VAC, 50Hz<br>TN/TT mains, 240VAC, 60Hz |
| **Overvoltage category**<br>IEC 61010-1, IEC 62368-1 (Ed.3) | | II | <3000mASL (<9842ftASL) |

### 14.1 Overvoltage category design

| Underlying IEC standard | 61010-1 | 62368-1[1] | 60950-1 | 61558-2-16[2] | 62477-1 | 61204-7 | 60664-1 |
|---|---|---|---|---|---|---|---|
| Mains transient voltage | II | II | III | II | III | III | III |
| Creepage & Clearance | III | II | III | II | III | III | III |

[1] Edition 3

[2] not applicable along with IEC 61204-7

### 14.2 Insulation strength

| | | Type test (60s)<br>IEC 62368-1<br>IEC 61010-1 | Routine test (3s)<br>IEC 61010-1 | Field test (3s) |
|---|---|---|---|---|
| Input / Output | A | 5000VDC | 4000VDC | 4000VDC |
| Input / PE | B | 3100VDC | 3100VDC | 3100VDC |
| Input / DC OK | C | 3000VAC | | 4000VDC |
| Output / PE | D | | 750VDC | 750VDC |
| Output / DC OK | E | 860VAC | | 750VDC |

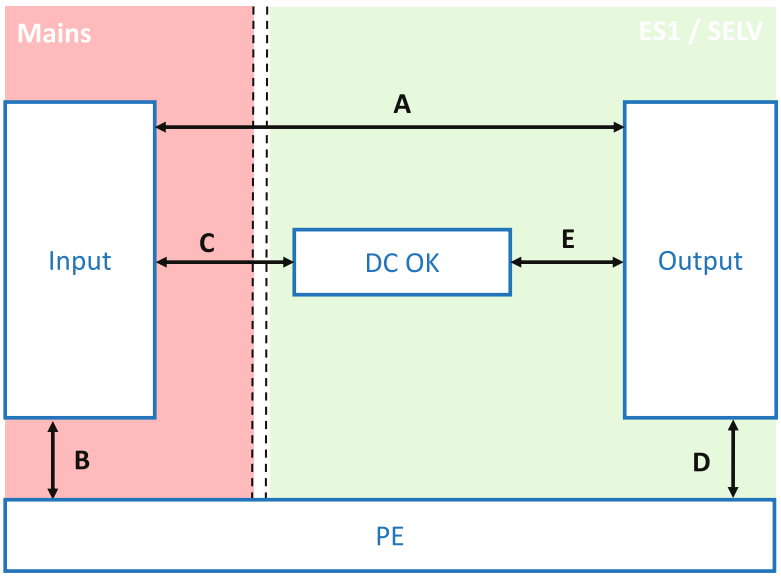



**Fig. 25:** Schematic of the insulation paths

### 14.3 HIPOT test

Apart from routine and type test, the end user might need to check the insulation strength during the final inspection and testing to guarantee the electrical safety of the end application. Therefore, a high-voltage test (HIPOT test) can be performed in the field. The following conditions must be observed:

- As every HIPOT test causes stress on the power supplies safety insulation, avoid frequent HIPOT testing or excessive test voltages
- The test voltages and durations, as indicated under „14.2 Insulation strength“ on page 18, must not be exceeded
- The test voltages rise and fall time should be between 2 and 4 seconds

ⓘ According to EN 60204-1 (Safety of machinery - Electrical equipment of machines), an individual HIPOT test of the power supply isn't required. During the HIPOT test of the end application, the power supply can be disconnected and only installed once the test has been completed.

## 15. Electromagnetic immunity

Investigated under generic standards IEC/EN 61000-6-2 (2019) - Immunity for industrial environments.

| | | | |
|---|---|---|---|
| **Electrostatic contact discharge**<br>IEC/EN 61000-4-2 | 4kV | Criterion A | 330Ω / 150pF |
| **Electrostatic air discharge**<br>IEC/EN 61000-4-2 | 8kV | Criterion A | 330Ω / 150pF |
| **Electromagnetic RF field**[1]<br>IEC/EN 61000-4-3 | 10V/m<br>3V/m | Criterion A<br>Criterion A | 80MHz .. 1GHz<br>1.4GHz .. 6GHz |
| **Fast transients (burst)**<br>IEC/EN 61000-4-4 | | | |
| Input[2] | 2kV | Criterion A | 5kHz or 100kHz |
| Output | 1kV | Criterion A | 5kHz or 100kHz |
| Signal contact[2] | | | |
| **Surge voltages**<br>IEC/EN 61000-4-5 | | | |
| Input symmetrical (L-L)[2] | 2kV | Criterion A | 2Ω+18µF, for Φ = 0°,90°,180°,270° |
| Input asymmetrical (L-PE)[2] | 4kV | Criterion A | 12Ω+9µF, for Φ = 0°,90°,180°,270° |
| Output symmetrical (L-L) | 2kV | Criterion A | 2Ω+18µF |
| Output asymmetrical (L-PE) | 4kV | Criterion A | 12Ω+9µF |
| Signal line asymmetrical (Signal-PE) | | | 12Ω+9µF |
| **Conducted disturbances Input, signal line, PE**[3]<br>IEC/EN 61000-4-6 | 10V | Criterion A | 150kHz .. 80MHz |
| **Power frequency magnetic field**<br>IEC/EN 61000-4-8 | 30A/m | Criterion A | 50Hz, 60s each axis (x, y, z) |
| **Voltage dips/sags and interruptions** | | | |
| IEC/EN 61000-4-11, 61000-4-34 | 500ms<br>200ms<br>20ms<br>5000ms | Criterion A<br>Criterion A<br>Criterion A<br>Criterion C | 400VAC at 70%, 50Hz<br>400VAC at 40%, 50Hz<br>400VAC at 0%, 50Hz<br>400VAC at 0%, 50Hz |
| SEMI F47-0706 | 1000ms<br>500ms<br>200ms<br>20ms | Criterion A<br>Criterion A<br>Criterion A<br>Criterion A | 400VAC at 80%, 50Hz<br>400VAC at 70%, 50Hz<br>400VAC at 50%, 50Hz<br>400VAC at 0%, 50Hz |

[1] Except for the ITU broadcast frequency bands 87 .. 107MHz, 174 .. 230MHz and 470 .. 790MHz, where the level shall be 3V/m.

[2] Exceeds the requirements of the European Low Voltage Directive 2014/35/EU

[3] Except for the ITU broadcast frequency bands 47 .. 68MHz, where the level shall be 3V.

ⓘ **Performance level definitions:**

**Criterion A:**
The device continues operation as intended during and after the test. The specified performance level accepts a change of ±10% on nominal output voltage and current. There is neither a violation of the performance level, nor a loss of function if the device is used as intended.

**Criterion B:**
The device continues operation as intended after the test. The specified performance level accepts a change of ±10% on nominal output voltage and current. There is neither a violation of the performance level, nor a loss of function if the device is used as intended. During the test a violation of the performance level is allowed.

**Criterion C:**
A temporary loss of function is allowed, provided the function is auto-recoverable, or can be restored by the operation of the controls.

## 16. Electromagnetic emission

Investigated under generic standards IEC/EN 61000-6-3 (2021) - Emission standard for residential, commercial and light-industrial environments.

| | | |
|---|---|---|
| **Conducted noise emission input**<br>EN 55011, CISPR 11 | Class B | 150kHz .. 30MHz |
| **Radiated noise emission input**<br>EN 55011, CISPR 11 | Class B | 30MHz .. 1GHz |
| **Harmonic currents input**<br>IEC/EN 61000-3-2 | Class A | 0kHz .. 2kHz |
| **Total harmonic distortion (THD) input**<br>IEC/EN 61000-3-2 | 16.6% | Order 1..40 |
| **Voltage changes, voltage fluctuations and flicker input**<br>IEC/EN 61000-3-3 | PASS | 50Hz |

## 17. Certifications & Approvals

| | | |
|---|---|---|
| c UL us LISTED | UL 61010-1<br>CAN/CSA-C22.2 No. 61010-1 | Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements |
| | UL 61010-2-201<br>CAN/CSA-C22.2 No. 61010-2-201 | Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-201: Particular requirements for control equipment<br>UL file: E356563 |
| IECEE CB SCHEME | IEC EN 61010-1 | Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements |
| | IEC EN 61010-2-201 | Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-201: Particular requirements for control equipment |
| | IEC EN 62368-1 (Ed.3) | Audio/video, information and communication technology equipment - Part 1: Safety requirements |
| c UL us | UL 62368-1 (Ed. 3) | Audio/video, information and communication technology equipment - Part 1: Safety requirements<br>UL file: E511889 |
| | IS 13252-1 | Information technology equipment - Safety - Part 1: General requirements<br>Reg. ID: R-41185469 |

## 18. Designed to meet

The safety design of the product complies additionally with the following standards.

| | |
|---|---|
| IEC 60950-1 | Information technology equipment - Safety - Part 1: General requirements |
| IEC EN 62477-1 | Safety requirements for power electronic converter systems and equipment - Part 1: General |
| IEC EN 61204-7 | Low-voltage switch mode power supplies - Part 7: Safety requirements |
| IEC EN 61558-2-16 | Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1100 V - Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units |
| EN 60204-1 | Safety of machinery - Electrical equipment of machines - Part 1: General requirements |
| IEC EN 60068-2-60 | Test Ke: Flowing mixed gas corrosion test |
| IEC 60068-2-11 | Test Ka: Salt mist |

## 19. Compliance & Registration

Conformity with health, safety, and environmental protection standards for products sold within the European Economic Area (EEA).

UKCA (UK Conformity Assessed) is the product marking that is used for certain goods being placed on the United Kingdom market.

The Waste Electrical and Electronic Equipment Directive (WEEE Directive) is the European Community Directive 2012/19/EU on collection, recycling and recovery targets for all types of electrical goods.

The Restriction of Hazardous Substances Directive 2011/65/EU (RoHS 2) regulates the use of certain hazardous substances in electrical and electronic equipment.

Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) is a European Union regulation that addresses the production and use of chemical substances, and their potential impacts on both human health and the environment.

## 20. Application notes

### 20.1 Parallel operation

In order to increase the output power, or to build up a 1+1 redundant system, it is possible to connect the power supplies in parallel. However, it should be noted that the power supplies themselves do not offer a parallel mode, or an integrated decoupling function. Therefore a decoupling module with an integrated load-sharing function is required. The products in the TDK-Lambda DRM series are recommended for this purpose (see "Add-ons and accessories" on page 3). The following measures must be taken into account:

- Only power supplies of the same series and power rating must be paralleled
- Load wiring shall be identical in terms of length and cross section
- The output voltage of the power supplies must be set to the same value
- The output voltage of each power supply should be checked and maintained in regular intervals
- All power supplies must be operated under the same ambient conditions
- The power supplies must not be operated under any condition which requires a power derating (e.g. altitudes above 3000mASL (9842ftASL), temperatures above 55°C$_{amb}$ (131°F$_{amb}$), mounting orientations others than the normal mounting position, etc.)
- The increased installation distances must be taken into account when installing the power supplies side by side (see "Installation clearances" on page 15)

In parallel operations the values of output load regulation, inrush currents, EMI, harmonic and leakage currents will increase.

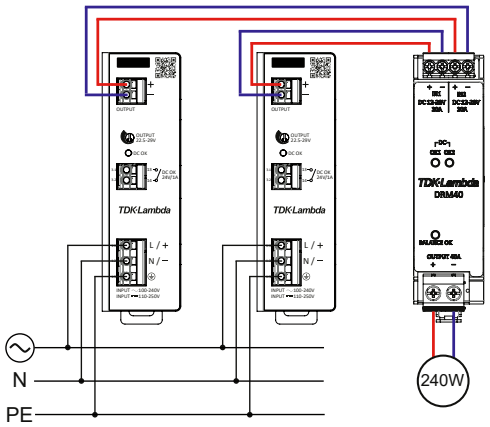



**Fig. 26:** Connection scheme of power supplies in parallel for the purpose of output power increase

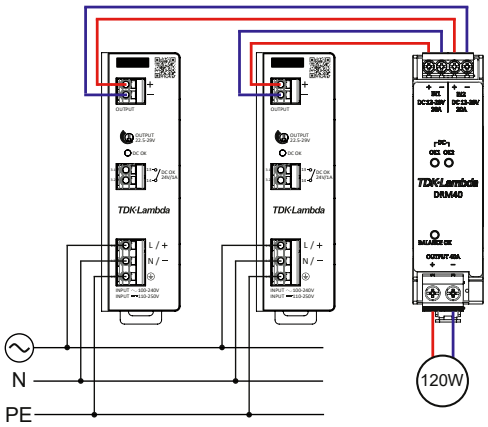



**Fig. 27:** Connection scheme of power supplies in parallel for the purpose of a 1+1 redundancy

## 20.2 Series operation

For the purpose of higher load voltages, power supplies can be connected in series. The following measures must be taken into account:

- The output voltage sum must not exceed 250$V_{DC}$
- If the output voltage sum exceeds 60$V_{DC}$, a safeguard against unintended touching must be considered
- Only power supplies of the same series and power rating must be connected in series
- All power supplies in series must be operated under the same ambient conditions
- The power supplies must not be operated under any condition which requires a power derating (e.g. altitudes above 3000mASL (9842ftASL), temperatures above 55°$C_{amb}$ (131°$F_{amb}$), mounting orientations others than the normal mounting position, etc.)
- The increased installation clearances must be considered (refer to chapter "Installation clearances" on page 15)

In series operations the values of output load regulation, inrush currents, EMI, harmonic and leakage currents will increase.

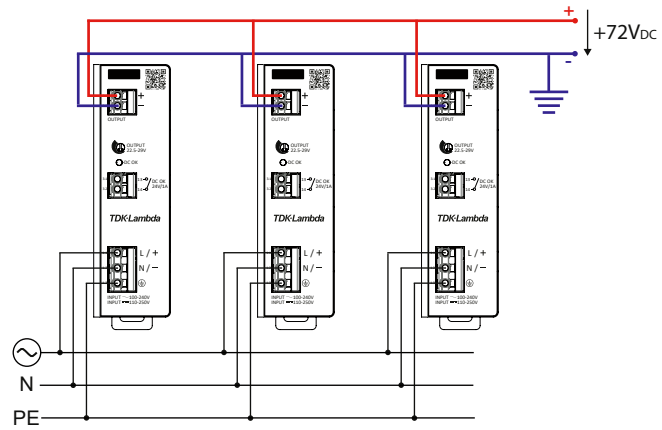



**Fig. 28:** Connection scheme for series operation with positive voltage level

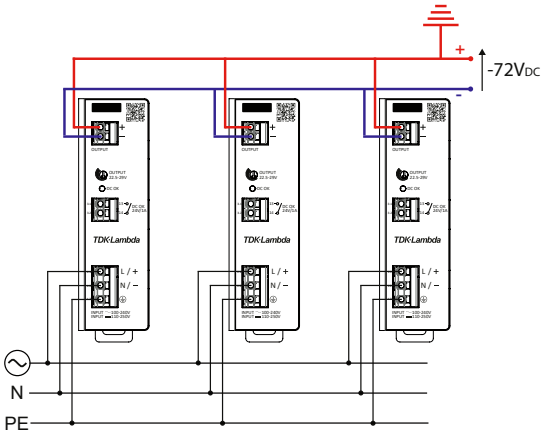



**Fig. 29:** Connection scheme for series operation with negative voltage level

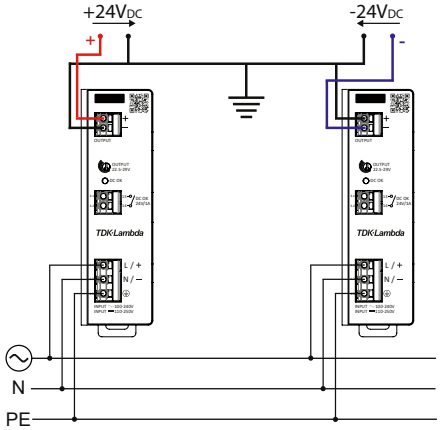



**Fig. 30:** Connection scheme for series operation with centre tap

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