# DC-DC CONVERTER **ACR120/Ks,Ksl,Ksl-O**

**RAILWAY CONVERTER**

## FOR CHASSIS MOUNTING



## HIGHLIGHTS

+ Output Power up to 150 Watts
+ Efficiency up to 93 %
+ Wide Input Range
+ Wide Temperature Range
+ Hold-up-time > 10 ms
+ RoHS compliance
+ According to EN5155

## INPUT

| | |
|---|---|
| Input Voltage Nominal | 24, and 110 VDC |
| Input Voltage Operating | 16,8 – 30,0 VDC and 77,0 – 137,5 VDC |
| Input Voltage Range | 14,4 – 34,0 VDC and 66,0 – 154,0 VDC (t ≤ 1,0 sec.) (Class C1) |
| No Load Input Current | See table page 2 |

## OUTPUT

| | |
|---|---|
| Output Voltage | 12 V / 24 V / 48 V (other voltages on request) |
| Initial Set Accuracy | <2 % (no load) |
| Minimum Load | No minimum load |
| Short circuit | Continuous short circuit proof |
| Line Regulation | <0,5 % |
| Load Regulation | <2 % (0 % - 100 % load) |
| Ripple & Noise | <2 % pk-pk, 20 MHz bandwidth |
| Start Time | <200 ms at 24 Vin and 900 ms at 110 Vin |
| Max. Output Capacitance | 2000 uF x $I_{out\ nom}$, 3000 uF for 48 V version |
| Temperature Coefficient | <0.01 % / °C |

## FEATURES

| | |
|---|---|
| Active Reverse Polarity Protection | Max. 160 V at 110 Vin, max. 30 V at 24 Vin |
| Active Inrush Current Limitation | Max. 6 A at 110 Vin, max. 24 A at 24 Vin (at t >100 µs) <0,1 $A^2s$ |
| Hold-up-time | >10 ms (at Pout ≤ 120 W, 110 Vin (Class S2)<br>>10 ms (at Pout ≤ 100 W, 24 Vin (Class S2) |
| Enable | See page 7 |
| Tracking | See page 7 |
| Adjust | See page 7 |

## PROTECTION

| | |
|---|---|
| Over Voltage Protection (OVP) | 110-130% $V_{out\ nom}$. |
| Over Current Protection (OCP) | See table page 2 |
| Over Temperature Protection (OTP) | Shutdown at +105-110 °C PCB-temp. with about 5 °C hysteresis and auto recovery.<br>+110-115 °C for Ksl-O |

* +70 °C continuously, +85 °C max. 10 minutes at full load (baseplate temp. must not exceed +90°C
** In built-in condition the devices may show different EMC properties.

## GENERAL

| | |
|---|---|
| Product Standard | EN 50155:2021 |
| Isolation | 2200 VDC Input to Output<br>2200 VDC Input to Case (PE)<br>750 VDC Output to Case (PE) |
| Pollution Degree | PD2 according to EN 50124-1:2017 |
| Switching Frequency | Typ. 120 kHz |
| Dimensions [mm] | 113,5 x 35 x 46 see page 5 |
| Weight | Approx. 320 g, approx. 170 g for Ksl-O |
| MTBF | 21,8 Mio h, field data |
| Fire & Smoke | EN45545-2:2020:A1:2023 |

## ENVIRONMENTAL

| | |
|---|---|
| Operating Ambient Temp. | -40 °C to +85 °C* (Class OT4 + ST1, ST2) |
| Storage Temperature | -55 °C to +100 °C |
| Rapid Temperature Variation | Class H1 |
| Altitude | Up to 2000 m |
| Vibration / Shock / Bump | EN 61373:2010, Cat. 1B |

## EMC

| | |
|---|---|
| EMC Standard | EN 50121-3-2:2016 + A1:2019 |
| Conducted Emissions | EN 55011:2025, Class A** |
| ESD Immunity | EN 61000-4-2:2009, level 3 (6 kV/8kV), Crit. A |
| Burst | EN 61000-4-4:2012, level 3 (2 kV), Crit. A |
| Surge | EN 50121-3-2:2016 + A1:2019 Crit. B, EN 61000-4-5:2014+A1:2017 Crit. B |
| Conducted Immunity | EN 61000-4-6:2014, level 3 (10V), Crit. A |
| Radiated Immunity | EN 61000-4-3:2020, 20V/m, Crit. A |
| Safety | IEC 62368-1:2020+A11:2020 |

# TECHNICAL DATA

For $T_{amb}$= 25°C, $V_{in\ nom}$, $I_{out\ nom}$ unless otherwise specified

## QUICK-FINDER

| Order No. | Typ | Vout | Vin | Connector | IP Rating | Notes |
|---|---|---|---|---|---|---|
| 72 31 12 0229 7 | ACR120/Ks | 12 | 24 | vertical | 20 | Housing, with pin cover |
| 72 31 24 0229 3 | ACR120/Ks | 24 | 24 | vertical | 20 | Housing, with pin cover |
| 72 31 24 0243 3 | ACR120/Ksl-O | 24 | 24 | horizontal | 00 | Open frame |
| 77 31 12 0522 4 | ACR120/Ks | 12 | 110 | vertical | 00 | Housing |
| 77 31 12 0529 5 | ACR120/Ks | 12 | 24 | vertical | 20 | Housing, with pin cover |
| 77 31 24 0522 9 | ACR120/Ks | 24 | 110 | vertical | 00 | Housing |
| 77 31 24 0529 1 | ACR120/Ks | 24 | 110 | vertical | 20 | Housing, with pin cover |
| 77 31 24 0528 6 | ACR120/Ksl | 24 | 110 | horizontal | 00 | Housing |
| 77 31 24 0543 1 | ACR120/Ksl-O | 24 | 110 | horizontal | 00 | Open frame |
| 77 31 48 0529 2 | ACR120/Ks | 48 | 110 | vertical | 20 | Housing, with pin cover |

## SPECIFICATION Input 14,4 - 34 VDC

| | TYPE | | ACR120/Ks (with pin cover) |
|---|---|---|---|
| | ORDER NUMBER | | 72 31 12 0229 7 |
| | CHARACTERISTIC | Unit | |
| INPUT | Input Voltage Nominal | V | **24** |
| | Input Voltage Range | V | 14,4…34 |
| | Under Voltage Turn-on | V | 15…16,5 |
| | Under Voltage Turn-off | V | 13…14,3 |
| | Input Current @ Full Load | A | 5,0 |
| | Input Current @ No Load | A | 0,04 |
| | Input Current Disabled Mode | mA | 7 |
| | Recommended External Fuse | A | 10 T |
| OUTPUT | Output Voltage Nominal | V | **12** |
| | Output Current Nominal | A | 9 |
| | Output Power | W | 108 |
| | Efficiency @ Full Load (typical) | % | 91 |
| | Output Current limit | A | 10…12,5 |
| | Short Circuit Current (typical) | A | 19<br>(pulse approx. 1Hz)* |
| | Transient Response<br>25 % / 75 % Load Step<br>Recovery Time < 1 ms | mV | ±240 |

* Pulsating current time duration 50 ms

# TECHNICAL DATA

For $T_{amb}$= 25°C, $V_{in\ nom}$, $I_{out\ nom}$ unless otherwise specified

## SPECIFICATION Input 14,4 - 34 VDC

| | TYPE | | ACR120/Ks (with pin cover) | ACR120/Ksl-O |
|---|---|---|---|---|
| | **ORDER NUMBER** | | **72 31 24 0229 3** | **72 31 24 0243 3** |
| | **CHARACTERISTIC** | **Unit** | | |
| **INPUT** | **Input Voltage Nominal** | V | **24** | **24** |
| | **Input Voltage Range** | V | 14,4…34 | 14,4…34 |
| | **Under Voltage Turn-on** | V | 15…16,5 | 15…16,5 |
| | **Under Voltage Turn-off** | V | 13…14,3 | 13…14,3 |
| | **Input Current @ Full Load** | A | 5,5 | 4,4 |
| | **Input Current @ No Load** | A | 0,04 | 0,04 |
| | **Input Current Disabled Mode** | mA | 7 | 7 |
| | **Recommended External Fuse** | A | 10 T | 8 T |
| **OUTPUT** | **Output Voltage Nominal** | V | **24** | **24** |
| | **Output Current Nominal** | A | 5 | 4 |
| | **Output Power** | W | 120 | 96 |
| | **Efficiency @ Full Load (typical)** | % | 91 | 91 |
| | **Output Current limit** | A | 6,5…8,5 | 5,2…7 |
| | **Short Circuit Current (typical)** | A | 11 (pulse approx. 1Hz)* | 7 (pulse approx. 1Hz)* |
| | **Transient Response 25 % / 75 % Load Step Recovery Time < 1 ms** | mV | ±480 | ±480 |

* Pulsating current time duration 50 ms

## SPECIFICATION Input 66 - 154 VDC

| | TYPE | | ACR120/Ks | ACR120/Ks (with pin cover) |
|---|---|---|---|---|
| | **ORDER NUMBER** | | **77 31 12 0522 4** | **77 31 12 0529 5** |
| | **CHARACTERISTIC** | **Unit** | | |
| **INPUT** | **Input Voltage Nominal** | V | **110** | |
| | **Input Voltage Range** | V | 66…154 | |
| | **Under Voltage Turn-on** | V | 67,0…76,0 | |
| | **Under Voltage Turn-off** | V | 58,0…66,0 | |
| | **Input Current @ Full Load** | A | 1,45 | |
| | **Input Current @ No Load** | A | 0,04 | |
| | **Input Current Disabled Mode** | mA | 4 | |
| | **Recommended External Fuse** | A | 3,15 T | |
| **OUTPUT** | **Output Voltage Nominal** | V | **12** | **12** |
| | **Output Current Nominal** | A | 12 | 12 |
| | **Output Power** | W | 144 | 144 |
| | **Efficiency @ Full Load (typical)** | % | 92 | 92 |
| | **Output Current limit** | A | 13…17 | 13…17 |
| | **Short Circuit Current (typical)** | A | 30 (pulse approx.. 1Hz)* | 30 (pulse approx.. 1Hz)* |
| | **Transient Response 25 % / 75 % Load Step Recovery Time < 1 ms** | mV | ±240 | ±240 |

* Pulsating current time duration 50 ms

## SPECIFICATION Input 66 - 154 VDC

| | TYPE | | ACR120/Ks | ACR120/Ks (with pin cover) | ACR120/Ksl | ACR120/Ksl-O |
|---|---|---|---|---|---|---|
| | **ORDER NUMBER** | | **77 31 24 0522 9** | **77 31 24 0529 1** | **77 31 24 0528 6** | **77 31 24 0543 1** |
| | **CHARACTERISTIC** | **Unit** | | | | |
| **INPUT** | **Input Voltage Nominal** | V | **110** | | | |
| | **Input Voltage Range** | V | 66…154 | | | |
| | **Under Voltage Turn-on** | V | 67,0…76,0 | | | |
| | **Under Voltage Turn-off** | V | 58,0…66,0 | | | |
| | **Input Current @ Full Load** | A | 1,45 | | | |
| | **Input Current @ No Load** | A | 0,04 | | | |
| | **Input Current Disabled Mode** | mA | 4 | | | |
| | **Recommended External Fuse** | A | 3,15 T | | | |
| **OUTPUT** | **Output Voltage Nominal** | V | **24** | **24** | **24** | **24** |
| | **Output Current Nominal** | A | 6,25 | 6,25 | 6,25 | 4 |
| | **Output Power** | W | 150 | 150 | 150 | 96 |
| | **Efficiency @ Full Load (typical)** | % | 93 | 93 | 93 | 93 |
| | **Output Current limit** | A | 7,2…9,0 | 7,2…9,0 | 7,2…9,0 | 7,2…9,0 |
| | **Short Circuit Current (typical)** | A | 16 (pulse approx. 1Hz)* | 16 (pulse approx. 1Hz)* | 16 (pulse approx. 1Hz)* | 16 (pulse approx. 1Hz)* |
| | **Transient Response 25 % / 75 % Load Step Recovery Time < 1 ms** | mV | ±480 | ±480 | ±480 | ±480 |

* Pulsating current time duration 50 ms

## SPECIFICATION Input 66 – 154 VDC

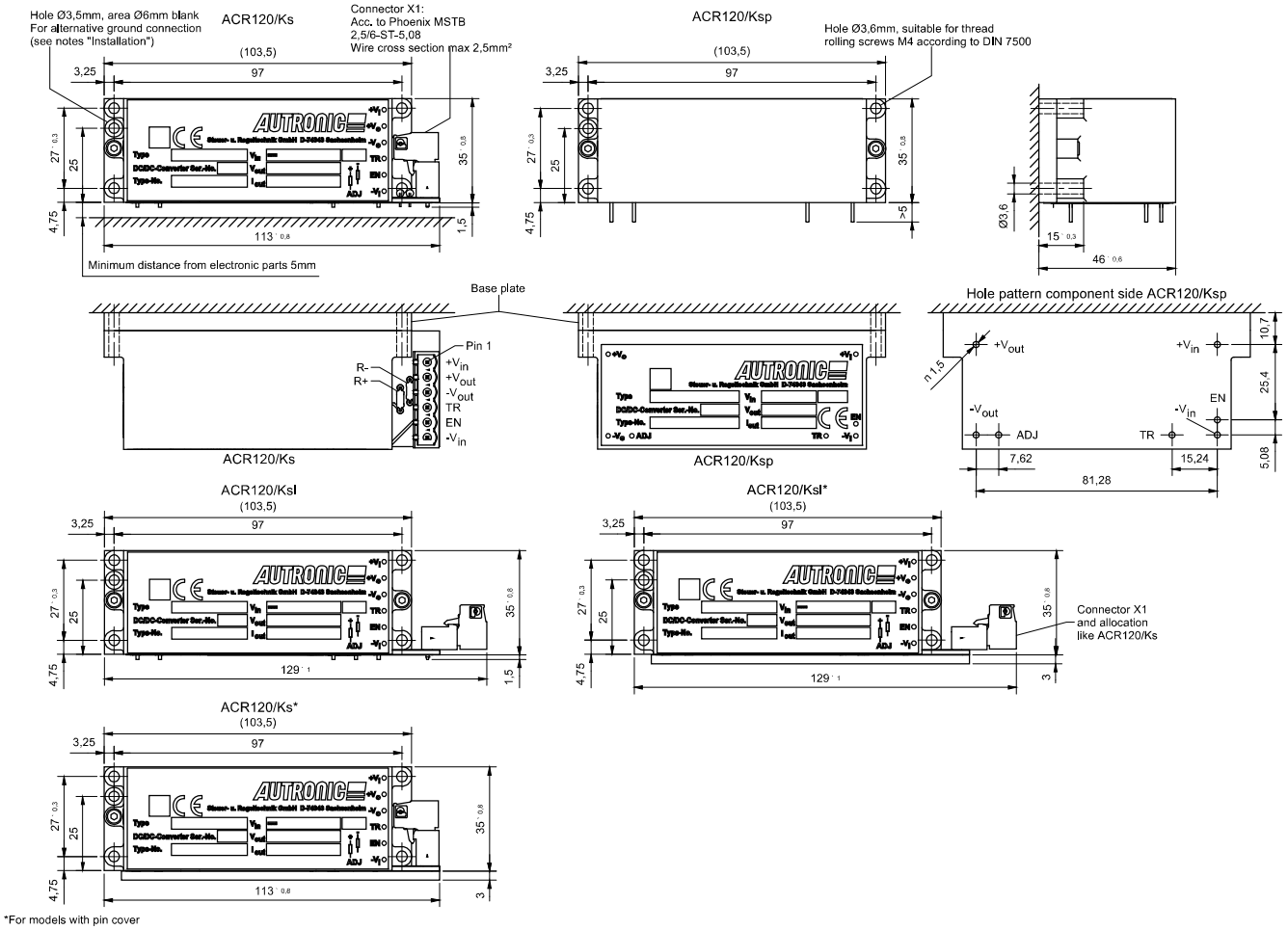
| | TYPE | | ACR120/Ks (with pin cover) |
|---|---|---|---|
| | **ORDER NUMBER** | | **77 31 48 0529 2** |
| | **CHARACTERISTIC** | **Unit** | |
| **INPUT** | **Input Voltage Nominal** | V | **110** |
| | **Input Voltage Range** | V | 66…154 |
| | **Under Voltage Turn-on** | V | 67,0…76,0 |
| | **Under Voltage Turn-off** | V | 58,0…66,0 |
| | **Input Current @ Full Load** | A | 1,48 |
| | **Input Current @ No Load** | A | 0,02 |
| | **Input Current Disabled Mode** | mA | 4 |
| | **Recommended External Fuse** | A | 3,15 T |
| **OUTPUT** | **Output Voltage Nominal** | V | **48** |
| | **Output Current Nominal** | A | 3,13 |
| | **Output Power** | W | 150 |
| | **Efficiency @ Full Load (typical)** | % | 92 |
| | **Output Current limit** | A | 3,3…4,2 |
| | **Short Circuit Current (typical)** | A | 10 (pulse approx. 1Hz)* |
| | **Transient Response 25 % / 75 % Load Step Recovery Time < 5 ms** | mV | ±800 |

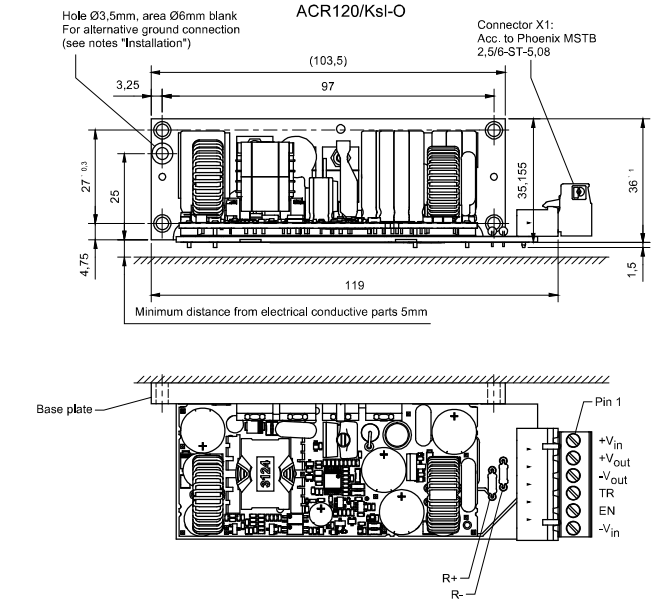
* Pulsating current time duration 10 ms

## MECHANICAL DETAILS

1. Dimensions are in mm
2. Unless otherwise specified, general tolerances +/-0,5 are for values in brackets (XX)
   Values not in brackets are according to ISO-2768-1m

Coating Class: PC2, Lackwerke Peters ELPEGUARD SL 1307-FLZ/2
Protection Degree: PD2




Resin compound: Polyurethan blue, UL94-V0, EN45545-2:2020-02 – HL1 - HL2 (R22) HL1 – HL2 – HL3 (R23)
Production acc. to IPC-A-610 (exception bonding, coating may show differences to requirements)

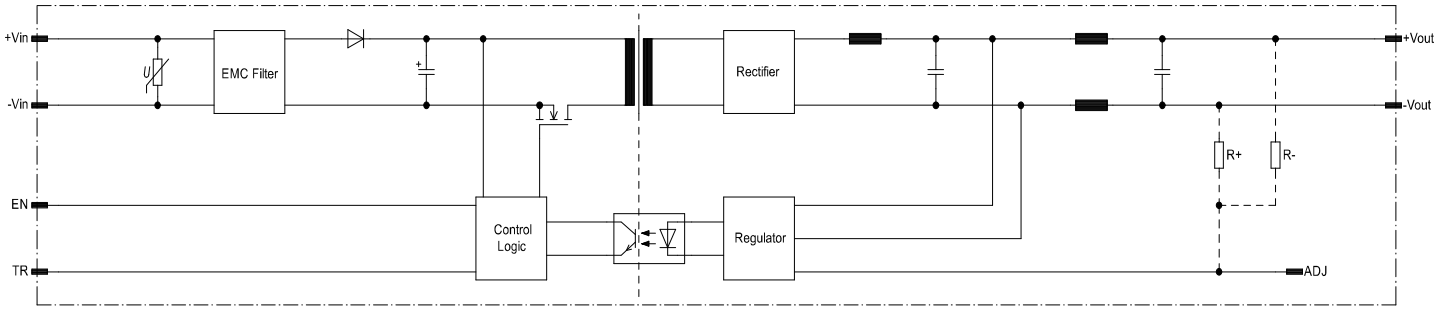
## PINNING

| Pin | | Function |
|---|---|---|
| X10-1 | $-V_{out}$ | $+V_{in}$ |
| X10-2 | $+V_{out}$ | $+V_{out}$ |
| X10-3 | TR | $-V_{out}$ |
| X10-4 | $+V_{in}$ | TR |
| X10-5 | $-V_{in}$ | EN |
| X10-6 | PE | $-V_{in}$ |

## NOTES

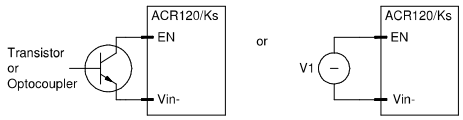
Installation instructions:
The converters must be installed according to the guidelines currently in force, like other open electronic component assemblies. Attention must be paid to sufficient ventilation, carry off heat, fastening and protection against accidental contact. Plug in not under voltage. The mounting surface must be flat and able to remove the thermal energy of the baseplate (baseplate temperature must not exceed +90°C). The converter has to be mounted, and the baseplate has to be grounded by using thread rolling screws M4 according to DIN 7500. An alternative connection to protective earth can be realized by a special mounting hole, which is free of anodizing surface.
Fault protection: For input protection a time-lag fuse corresponding to IEC 60127-2 must be installed. For recommended rating of the fuse refer to specification table above. Pay attention on sufficient current source in case of short circuit. In some applications two fuses would be necessary, one in each input line.

## BLOCK DIAGRAMM



## ENABLE SIGNAL

The module may be disabled by pulling EN low with respect to the –Input.
This may be done with an open collector transistor, relay, optocoupler or an external control voltage (V1).




Open collector:
Leakage current ≤ 100 µA
Min. $V_{CEO}$ ≥ 20 V

V1:
3…5 V (Enable active)
0…0,8 V (Enable inactive)

Pin sourcing current is 1mA max. at $V_{EN}$ = 0 V. Pin sinking current is 1mA max. at $V_{EV}$ = 5 V. When not in use, leave Enable pin not-connected.

## ADJUST

The output voltage of the converter can be adjusted via fixed resistors, which can be added on the PCB, R+ or R- (see page 5).

| Values for resistor R+[kOhm] | | | | | Values for resistor R- [kOhm] | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | up 2% | up 4% | up 6% | up >7% | down 2% | down 4% | down 6% | down 8% | down <10% |
| ACR120 24/12 72 31 12 xxxx x | 728 | 289 | 144 | < 102 | 733 | 277 | 140 | 45 | < 1 |
| ACR120 24/24 72 31 24 xxxx x | 575 | 195 | 70 | < 35 | 815 | 305 | 166 | 43 | < 1 |
| ACR120 110/12 77 31 12 xxxx x | 728 | 289 | 144 | < 102 | 733 | 277 | 140 | 45 | < 1 |
| ACR120 110/24 77 31 24 xxxx x | 574 | 195 | 70 | < 35 | 815 | 305 | 166 | 43 | < 1 |
| ACR120 110/48 77 31 48 xxxx x | 400 | 160 | 75 | < 50 | 1500 | 670 | 400 | 270 | < 90 |

When not in use, leave Adjust pin not-connected

## TRACKING

If the TR pins of two or more converters are connected together, the output voltages in case of short-circuit or overload go synchronously down. This is necessary for parallel connection of up to 3 identical converters. For several types a minimum load is required for parallel connection. External adjustment of the output voltages could be necessary. Detailed information and recommendations on demand.

When not in use, leave Tracking pin not-connected.

| Revision | Date | Author | Modification |
|---|---|---|---|
| a05 | 2020-05-13 | Eigner | Change for new Product Standard EN50155:2017 |
| a06 | 2023-03-07 | Eigner | New version 110V/48V12V added, several updates |
| a07 | 2026-04-20 | Eigner | Minor corrections |
| a08 | 2026-07-21 | Eigner | Date of standards updated, Quick-Finder added |