intreXis®

Power Supplies with the X


IC352_1: example of customized version

IC352_2: version without front-plate

IC352_3: compatible with IC320,IC323

# Datasheet

## intreXis USB-C Railway Charger
## IC352_x, 2x15 W Dual-Output
## 12 Vin – 24 Vin

- Xtra two USB-C Sockets for simultaneously charging of latest generation mobile devices.
- Xtra full charging current, according to USB Type C and Power Delivery (PD) @ 2x 5 V/ 3 A, ensures short charging time.
- Xtra ready for new EU rules valid from 2024.
  Supporting older devices: Standard BC 1.2 and Apple Divider-Mode 2.
- Xtra dedicated for railway passenger compartments and driver desk.
  Voltage regulation in USB front-end device.
- Xtra easy to change USB front-end device in case of vandalism.
- Xtra one IC26X DC/DC converter can drive multiple USB front-end devices.

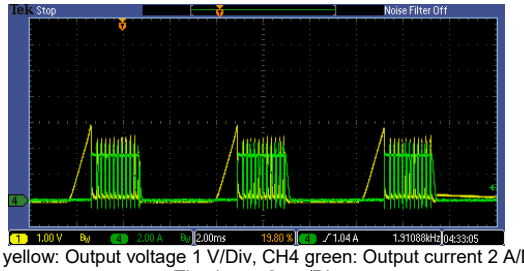
This datasheet covers the details of the IC352_x USB-C chargers with dual output voltage and output power of 2x15 W. These DC/DC converters are designed according to EN 50155:2021 and IEC 60571:2012 for railway applications and are ideal for other demanding environments which require the highest performance and reliability.

Output voltage: 5.1 V
Ordering codes: IC352_1, IC352_2, IC352_3, IC352_4.
The differences between the variants are explained in this datasheet.

# INPUT CHARACTERISTICS

| | | |
|---|---|---|
| Continuous Input Voltage Range | 10.0 – 25.2 VDC<br><br>To be powered from DC-DC Converter with regulated output, as example IC273_3, IC248_5, IC263_5 etc. depending on the number of USB chargers connected to the same bus.<br><br>Not designed to be connected directly to boardnet battery. | |
| Input Undervoltage Lockout | Vin_OFF = 7.6 VDC ±2 %<br>Vin_ON = 9.6 VDC ±2 % | |
| Input Voltage Reverse Polarity Protection | Nosels on connector ensure protection against polarity reversal | |
| Input Capacitance | 20 µF | |
| Input Current typ. @ full Load | **12 Vin** | **24 Vin** |
| | 2.67 A | 1.36 A |
| Input Power typ. @ no Load<br>over the input voltage range | 0.11 – 0.15 W | |
| Internal Input Fuse | No internal fuse is provided | |
| Startup time<br>(Time input voltage ON to output voltage ON) | < 200 ms for all input voltages | |
| Wiring | Tested with 25 m (each pole) input wires,<br>0.5 $mm^2$, Vin = 24VDC, 2x15 W-load | |

# OUTPUT CHARACTERISTICS

| | |
|---|---|
| Output Voltage Nominal | 2x +5.10 VDC |
| Max. Continuous Output Power<br>@ Vin = 10.0–25.2 V<br>(no derating over the entire temperature range) | 2x up to 15 W<br>(charging current depends on device to be charged, USB cables, state of the charge) |
| Minimum Load | No minimum load required |
| Setpoint Accuracy | < 1.7 % |
| Load Regulation<br>@ off-load to full load over the entire temperature range | < 2.5 % |
| Line Regulation<br>@ full load over the entire temperature range | < 0.3 % |
| Output Ripple & Noise<br>@ 20 MHz bandwidth, including spikes | < 100 mVpp @ -25 – +55 °C |
| Overload and Short-Circuit | The converter is continuous overload and short-circuit proof.<br>**Output overloaded:**<br>Up to 3.4 A, constant current.<br>If higher overloads, the converter switches off and retries periodically (hiccup)<br>  <br>CH1 yellow: Output voltage 1 V/Div, CH4 green: Output current 2 A/Div, Timebase: 2 ms/Div<br>**Output short-circuited:**<br>The converter switches off and tries periodically to switch on again, every 26 ms for 4 ms typ:<br>  <br>CH1 yellow: Output voltage 1 V/Div, CH4 green: Output current 2 A/Div, Timebase: 2 ms/Div<br>If the short-circuit is removed, the converter switches on at the next switch-on attempt (hiccup). |
| Current Limit, each output<br>(varies due to component tolerances) | 3.16 – 3.64 A |
| Short-Circuit current | < 2.0 Arms |

# EFFICIENCY

| Conditions | 12 Vin | 24 Vin |
|---|---|---|
| Efficiency typ. @ 100 % Load | 93.6 % | 92.0 % |
| Efficiency typ. @ 66 % Load | 94.8 % | 93.0 % |
| Efficiency typ. @ 33 % Load | 95.0 % | 92.0 % |

# SIGNALS AND INTERFACES

The IC352_x charger handles the signals necessary to detect the attached device and enable the charging at full current. It implements the following protocols over USB Type-C connectors:

- USB Type-C Rev. 1.2 and Power Delivery (PD) @ 2x 5V / up to 3 A (charging current depends on device to be charged, USB cables, state of the charge)

- Supports USB Dedicated Charging Port for backward compatibility (according to Battery Charging standard BC 1.2 and Divider Mode 2)

Tested with Apple, Samsung, Huawei, Honor.

# ELECTROMAGNETIC COMPATIBILITY (EMC)

| Test | Standard | Test severity levels | Performance Criteria |
|---|---|---|---|
| Electrostatic discharge | EN 50155:2021<br>EN 50121-3-2:2016/ A1:2019<br>IEC60571:2012<br>IEC 62236-3-2:2018 | ±6 kV contact discharge<br>±8 kV air discharge | Criterion B required, but compliant with more strict criterion A |
| Fast transients | EN 50155:2021<br>EN 50121-3-2:2016/ A1:2019<br>IEC60571:2012<br>IEC 62236-3-2:2018 | ±2 kV<br>5/50 ns tr/th<br>5 kHz repetition frequency | Criterion A |
| Radio-frequency common mode | EN 50155:2021<br>EN 50121-3-2:2016/ A1:2019<br>IEC60571:2012<br>IEC 62236-3-2:2018 | 150 kHz – 80 MHz<br>10 Vrms (carrier voltage)<br>80 % AM, 1 kHz<br>Source impedance 150 Ω | Criterion A |
| Radio-frequency electromagnetic field | EN 50155:2021<br>EN 50121-3-2:2016/ A1:2019<br>IEC60571:2012<br>IEC 62236-3-2:2018 | 80 MHz – 1000 MHz<br>20 Vrms/m<br>80 % AM, 1 kHz<br>unmodulated carrier;<br>1400 MHz – 2000 MHz<br>10 Vrms/m<br>80 % AM, 1 kHz<br>unmodulated carrier;<br>2000 MHz – 2700 MHz<br>5 Vrms/m<br>80 % AM, 1 kHz<br>unmodulated carrier;<br>5100 MHz – 6000 MHz<br>3 Vrms/m<br>80 % AM, 1 kHz<br>unmodulated carrier | Criterion A |
| Conducted emissions | EN 50155:2021<br>EN 50121-3-2:2016/ A1:2019<br>IEC60571:2012<br>IEC 62236-3-2:2018 | 150 kHz – 500 kHz: 99 dBµV quasi-peak<br>500 kHz – 30 MHz: 93 dBµV quasi-peak | |
| Radiated emissions | EN 50155:2021<br>EN 50121-3-2:2016/ A1:2019<br>IEC60571:2012<br>IEC 62236-3-2:2018 | 30 MHz – 230 MHz: 40 dBµV/m<br>quasi-peak at 10 m<br>230 MHz – 1000 MHz: 47 dBµV/m<br>quasi-peak at 10 m | |

# ENVIRONMENTAL CHARACTERISTICS

| | |
|---|---|
| Operating Temperature | -25 °C – +70 °C<br>Class OT1: -25 – +55 °C and class ST1,ST2: +15 °C<br>according to EN 50155:2021 |
| Cooling | Natural convection |
| Storage Temperature Range | -50 °C – +100 °C |
| Altitude Class | Class Ax (>1400 m) according to EN 50125-1:2014:<br>5000 m above sea level max. |
| Pollution Degree | PD2 according to EN 50124-1:2017 |
| Shock and Vibration | According to EN 61373:2010, category 1, class B |
| Rapid Temperature Variation | Class H2 according to EN 50155:2021:<br>-25 °C to +15 °C / 95 %RH, ±3 K/s<br>+10 °C to +40 °C / 60 %RH, ±3 K/s |
| Protective Coating | Class PC2 according to EN 50155:2021<br>The board is protected on both sides with a protective transparent fluorescent-pigment coating to prevent deterioration or damage due to moisture and atmospheric contaminants.<br>The coating is compliant with class 2,<br>according to IPC-A-610H |
| Prohibited Substances | No substances defined as Prohibited according to the RoHS, REACH, UNIFE (RISL), or Prohibited for the Project, are present.<br>No substances defined as Declarable according to RoHS, REACH, UNIFE (RISL), or Declarable for the Project, are present. |
| Fire behaviour | EN 45545-2:2020<br>compliant with all Hazard Levels HL1-HL3 |

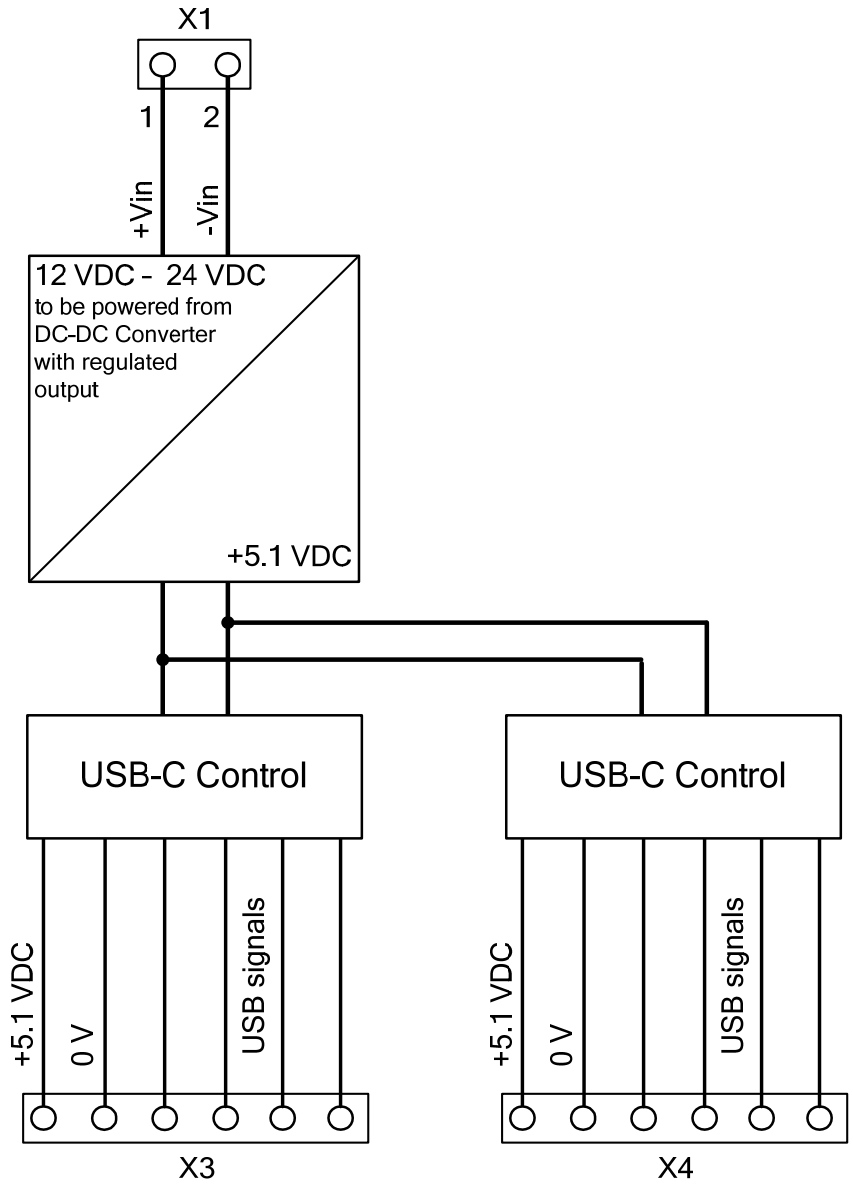
# GENERAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| General Standard | EN 50155:2021<br>Railway applications - Rolling stock - Electronic equipment<br>IEC 60571:2012<br>Railway applications - Electronic equipment used on rolling stock | | | |
| Useful Life Class | Class L4 (20 years) according to EN 50155:2021 | | | |
| MTBF<br>Calculation method: MIL-HDBK-217-F2<br>Using demonstrated Failure Rates of components | **Ground Benign (GB), +25 °C** | **Ground Benign (GB), +40 °C** | **Ground Fixed (GF), +40°C** | **Ground Mobile (GM), +40 °C** |
| | 52 336 000 h | 34 415 000 h | 6 909 000 h | 3 751 000 h |
| MTBF<br>Calculation method: SN 29500 (IEC 61709) | 5 604 000 h @ +40 °C | | | |
| Marking | Label with following information:<br>- part number, output voltage, output power<br>- unique serial number for identification and traceability (printed in text format and as barcode)<br>- revision index | | | |
| Connector identification | Printings on PCB to identify input connector and pin-number. | | | |

# SAFETY AND INSULATION

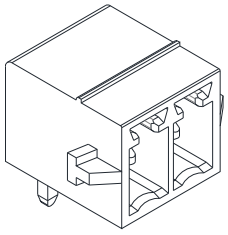
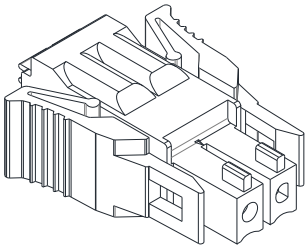
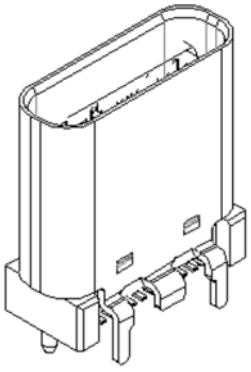
| | |
|---|---|
| Safety Standards | EN 60950-1:2006+A2:2013,<br>IEC 60950-1:2005+A1:2009+A2:2013 CSV,<br>EN 62368-1:2014+A11:2017<br>IEC 62368-1:2018 |
| Insulation Coordination | According to EN 50124-1:2017 |
| Input to Output | The input is not galvanically isolated to the output. |
| Output to Chassis | Not applicable |

# BLOCK DIAGRAM

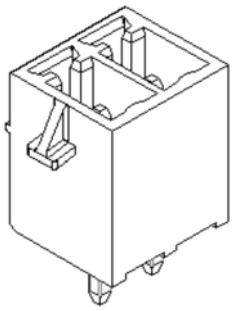
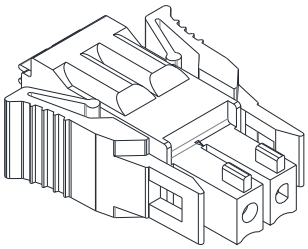
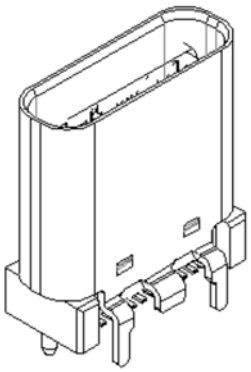


# CONNECTOR TYPES

## IC352_1, IC352_3, IC352_4 (horizontal input-connector on top)

| | |
|---|---|
| **Input connector X1** | Phoenix MC 1,5/ 2-G-3,5-RN or equivalent<br>Pitch: 3.5 mm<br>Number of pins: 2<br>  <br>Mating part: Phoenix FMC 1,5/ 2-ST-3,5-RF, Ordering code: 1952021<br>  |
| **Output connectors X3,X4** | GCT USB4115-03<br>Pitch: according to USB C<br>Number of pins: 24<br>Durability: 10 000 cycles min. of insertion/extraction<br>  <br>Mating part: USB C plugs |

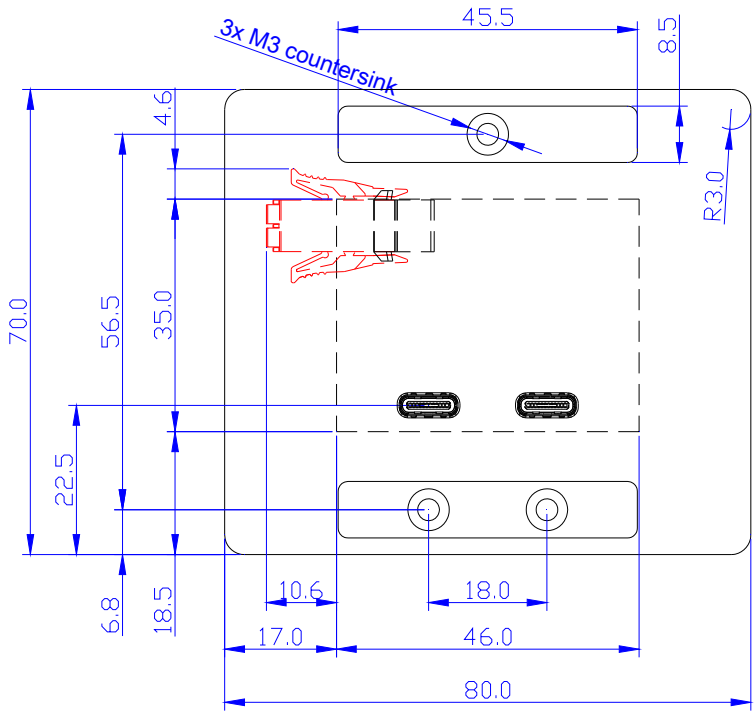
# IC352_2 (vertical input-connector on bottom)

| | |
|---|---|
| **Input connector X1** | Phoenix MCV 1,5/ 2-G-3,5-RN or equivalent<br>Pitch: 3.5 mm<br>Number of pins: 2<br>  <br>Mating part: Phoenix FMC 1,5/ 2-ST-3,5-RF, Ordering code: 1952021<br>  |
| **Output connectors X3,X4** | GCT USB4115-03<br>Pitch: according to USB C<br>Number of pins: 24<br>Durability: 10 000 cycles min. of insertion/extraction<br>  <br>Mating part: USB C plugs |

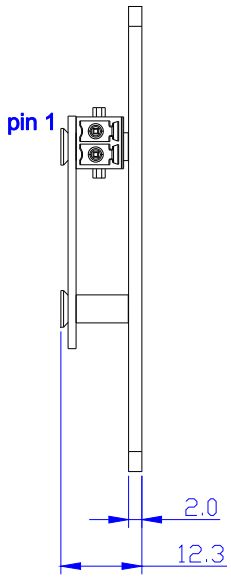
# MECHANICAL CHARACTERISTICS

| | |
|---|---|
| Front-plate | IC352_1: Stainless Steel<br><br>IC352_2: not implemented (only PCB)<br><br>IC352_3, IC352_4:<br>Aluminium: EN AW 5052 - AL5052 - AlMg2.5 or<br>EN AW 5754 - AL5754 - AlMg3<br>Black anodized |
| Overall dimensions | According to the drawing<br>(millimetres, unless otherwise specified) |
| Weight | IC352_1: 100 g<br>IC352_2: 16 g<br>IC352_3: 38 g<br>IC352_4: 34 g |
| IP code | IP00 in general<br>IP30 on front panel |
| Mounting | Mounting in any position is allowed |

Mechanical drawings:
**IC352_1:**




Output connectors X3,X4:
USB C

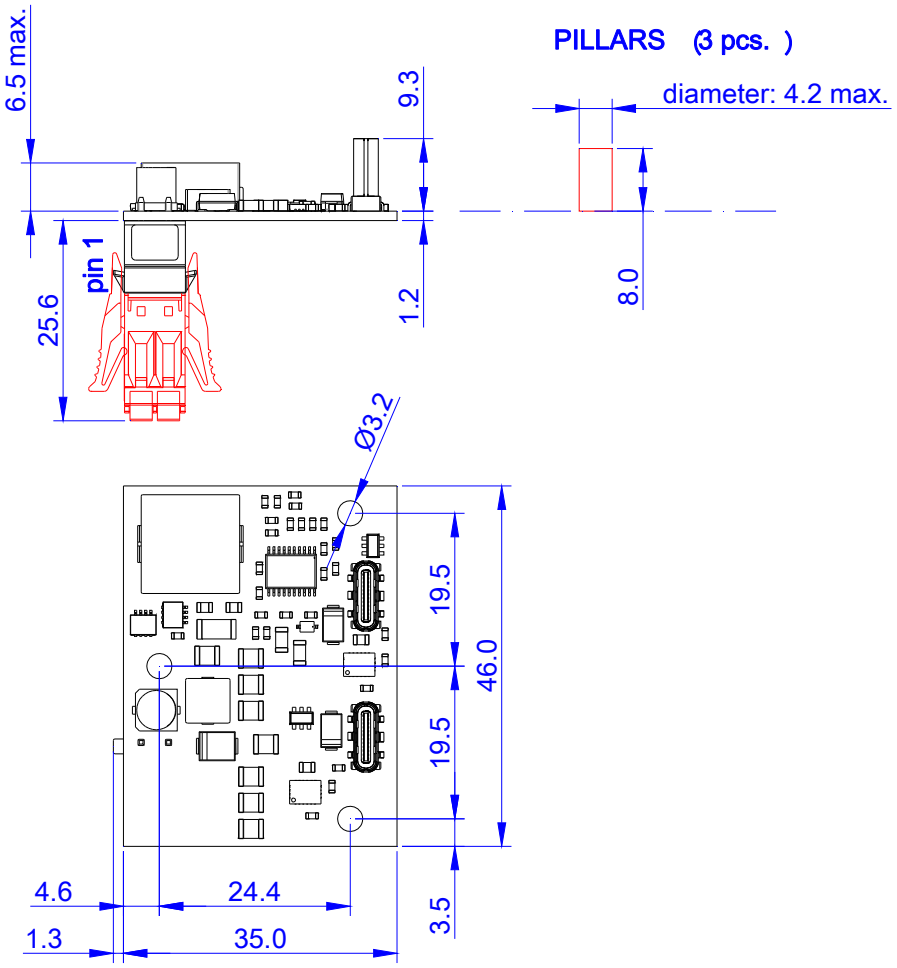



Input connector X1:
1. +Vin
2. -Vin

Parts colored in red are mating connectors, that are not provided and are shown for illustration

The unit must be secured using three M3 screws, flat-head (not supplied) in the mounting holes.

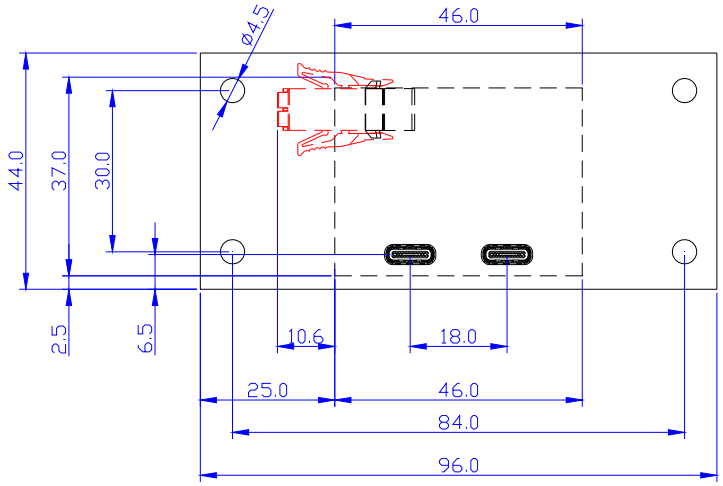
**IC352_2:**

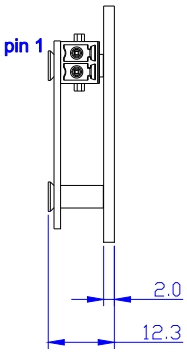



Parts colored in red are mating connectors, that are not provided and are shown for illustration

The unit must be mounted onto a front-plate (recommended thickness: 2.0 mm). Mounting pillars (not provided) must ensure a distance from PCB to front-plate of 8.0 mm. The max. diameter of the pillars is 4.2 mm, otherwise electrical creepage is violated.
Three screws M3x6 mm (not provided) have to be assembled to fix the PCB onto the pillars. If metallic screws are used, they must be flat-head type, otherwise electrical creepage is violated.

**IC352_3:**



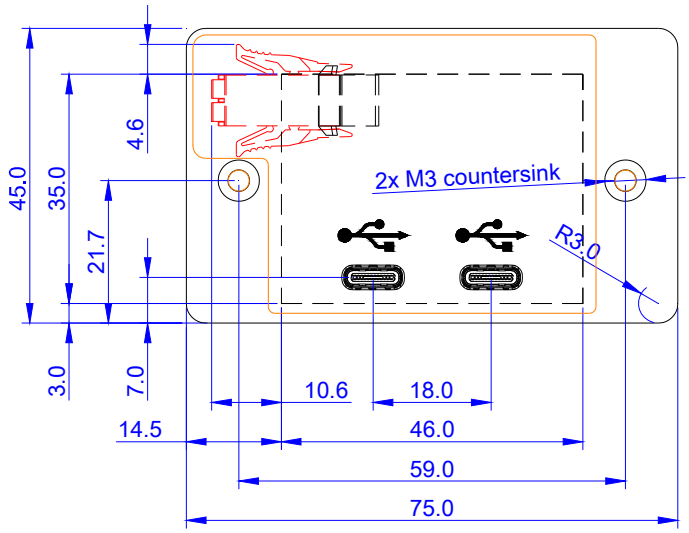

Output connectors X3,X4:
USB C

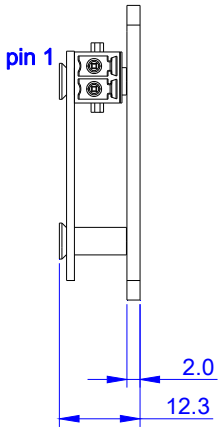
Input connector X1:
1. +Vin
2. -Vin

Parts colored in red are mating connectors, that are not provided and are shown for illustration

The unit must be secured using four M4 screws or bolts (not supplied) in the mounting holes.

**IC352_4:**



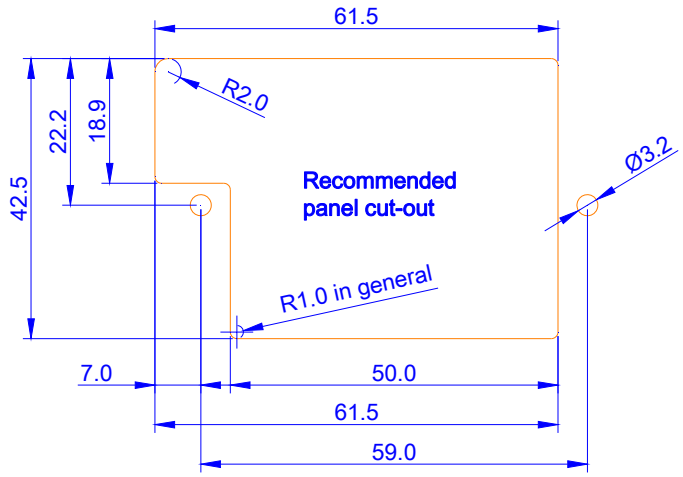




Output connectors X3,X4:
USB C

Input connector X1:
1. +Vin
2. –Vin

Parts colored in red are mating connectors, that are not provided and are shown for illustration

The unit must be secured using two M3 screws, flat-head (not supplied) in the mounting holes.
The recommended panel cut-out is specified below.



# TEST COMPLIANCE SUMMARY (CERTIFICATE OF CONFORMITY)

| Performed Test | Standard | Test conditions | Performance level | Reference document |
|---|---|---|---|---|
| Visual inspection | EN 50155:2021<br>IEC60571:2012 | Aspect, dimensions, weight, markings | According to design specification | Test report |
| Performance test | EN 50155:2021<br>IEC60571:2012 | Ambient temperature.<br>Nominal supply voltage:<br>12 VDC and 24 VDC<br><br>Supply voltage range:<br>10.0 – 25.2 VDC (static) | Criterion A | Test report |
| DC Power supply test<br><br>Supply overvoltages | EN 50155:2021<br><br>IEC60571:2012 | Supply voltage: 10.0 – 25.2 VDC | Criterion B required, but tested with more strict criterion A | Test report |
| Low temperature test | EN 50155:2021<br>IEC60571:2012 | T = -25 °C | Criterion A | Test report |
| Dry heat test | EN 50155:2021<br>IEC60571:2012 | T = +55 °C (cycle A) | Criterion A | Test report |
| Low temperature storage test | EN 50155:2021<br>IEC60571:2012 | T = -50 °C | Criterion A<br>after recovery period | Test report |
| Insulation test | EN 50155:2021<br>IEC60571:2012 | Not applicable | Resistance > 20 MΩ (measured >550 MΩ, exceeding the requirement)<br><br>No disruptive discharge | |
| Cyclic damp heat test | EN 50155:2021<br>IEC60571:2012 | T = +55 °C and +25 °C<br>(2 cycles) | Criterion A | Test report |
| Electromagnetic compatibility test | EN 50155:2021<br>EN 50121-3-2:2016/ A1:2019<br>IEC60571:2012<br>IEC 62236-3-2:2018 | See section 'Electromagnetic Compatibility (EMC)' | | TestreportEMC_ R-EM-354-0222-02A |
| Shock and vibration test | EN 50155:2021<br>IEC60571:2012 | EN 61373:2010, Category 1, class B | | Compliant |

Additional tests:

| Performed Test | Standard | Test conditions | Performance level | Reference document |
|---|---|---|---|---|
| Fire behaviour | EN 45545-2:2020 | PCB: R25<br>(EN 60695-2-11, T16:<br>No ignition at T=850 °C) | PASSED<br>(HL1-HL2-HL3) | Fire_Certificate_IC352 |

Furthermore, the product is compliant with the requirements of:

- EC 1907/2006 (December,18th 2006) REACH regulation: Registration, Evaluation, Authorisation and Restriction of Chemicals.

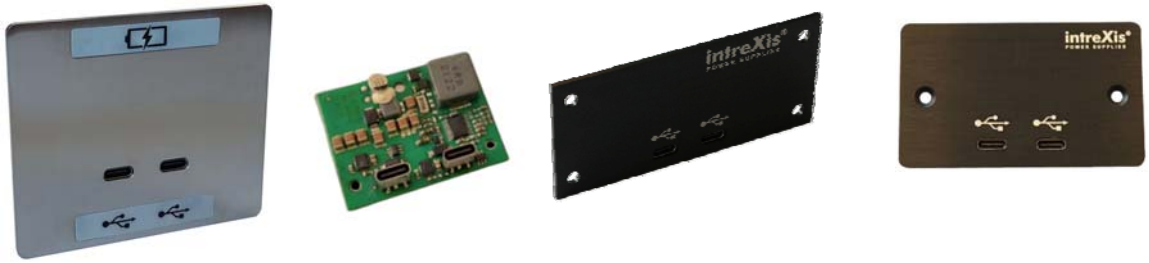
- UNIFE Railway Industry Substance List

Neuhausen am Rheinfall, 31.01.2022

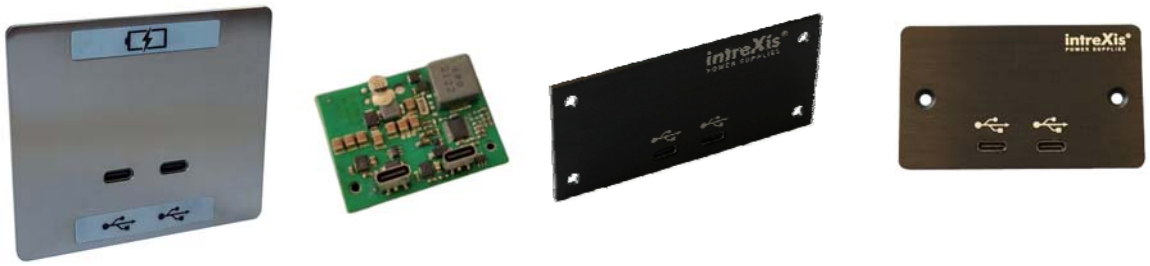
Thomas Schiegg
intreXis AG

# EU DECLARATION OF CONFORMITY (DoC)

CE

| | | |
|---|---|---|
| Product Models | IC352_1, IC352_2, IC352_3, IC352_4 | |
| Name and address of the manufacturer | intreXis AG<br>Tobelraastrasse 4<br>CH-8212 Neuhausen am Rheinfall<br>Switzerland | |
| This declaration of conformity is issued under the sole responsibility of the manufacturer. | | |
| IC352_1 IC352_2 IC352_3 IC352_4<br>  | | |
| The object of the declaration described above is in conformity with the relevant Union harmonisation legislation: | Low Voltage Directive:<br>RoHS Directive:<br>EMC Directive: | 2014/35/EU<br>2011/65/EU, (EU) 2015/863<br>2014/30/EU |
| References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared: | Low Voltage Directive:<br>RoHS Directive:<br>EMC Directive:<br>Railway Applications: | EN 62368-1:2020/A11:2020<br>EN 63000:2018<br>EN 50121-3-2:2016/ A1:2019<br>EN 50155:2021 |
| Signed for and on behalf of: | intreXis AG<br>Tobelraastrasse 4<br>CH-8212 Neuhausen am Rheinfall<br>Switzerland | |
| Place, Date of issue | Neuhausen am Rheinfall, 31.01.2022 | |
| Name, Function, Signature | Thomas Schiegg, Managing Director:<br>  | |

# UK DECLARATION OF CONFORMITY (DoC)

| | | |
|---|---|---|
| Product Models | IC352_1, IC352_2, IC352_3, IC352_4 | |
| Name and address of the manufacturer | intreXis AG<br>Tobelraastrasse 4<br>CH-8212 Neuhausen am Rheinfall<br>Switzerland | |
| This declaration of conformity is issued under the sole responsibility of the manufacturer. | | |
| IC352_1 IC352_2 IC352_3 IC352_4<br>  | | |
| The object of the declaration described above is in conformity with the relevant UK legislation: | UK SI 2016 No. 1101:<br>UK SI 2012 No. 3032:<br>UK SI 2016 No. 1091: | Electrical Equipment (Safety) Regulations 2016<br>The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012<br>Electromagnetic Compatibility Regulations 2016 |
| References to the relevant standards used or references to the other technical specifications in relation to which conformity is declared: | Low Voltage Directive:<br>RoHS Directive:<br>EMC Directive:<br>Railway Applications: | BS EN 62368-1:2020/A11:2020<br>BS EN IEC 63000:2018<br>BS EN 50121-3-2:2016/A1:2019<br>BS EN 50155:2021 |
| Signed for and on behalf of: | intreXis AG<br>Tobelraastrasse 4<br>CH-8212 Neuhausen am Rheinfall<br>Switzerland | |
| Place, Date of issue | Neuhausen am Rheinfall, 31.01.2022 | |
| Name, Function, Signature | Thomas Schiegg, Managing Director:<br>  | |

# INSTALLATION AND OPERATION

| | |
|---|---|
| Safety |  Warning / Caution!<br><br>The power supplies should be installed and put into operation only by qualified personnel.<br><br>Before installing or removing the unit, disconnect the power from the system. |
| Servicing | In case of failures, malfunctions or defects, the converter must be returned to intreXis for analysis and repair. In particular, the converter should be sent to intreXis for analysis if any damage has occurred to the unit (e.g. the unit dropped). Any attempts to open and repair the unit could void the warranty and could expose the operator to hazardous voltages. |
| Spare Parts | List and drawings of spare parts are not provided, since the failed units have to be returned to intreXis for analysis and repair. |
| Disposal | Disused units must be collected separately and disposed at a suitable recycling facility. |
| Connecting the Cables | Ensure that proper wires are used according to the input current specifications.<br>Prepare the cables according to the specifications of the particular connector used. |
| Operation of the Unit | Once the input power is applied, the output voltage is ready. Once a device is attached to an USB connector, the output voltage at the connector is enabled and charging starts. |