

intreXis[®]
POWER SUPPLIES

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Datasheet

intreXis Boardnet Converter Platform
IC198, 480 W Single-Output
36 Vin

This datasheet covers the details of the IC198 power supply with single output voltage and output power of 300 W-continuous and 480 W for 10 seconds. This DC/DC converter is designed according to EN 50155:2017 for railway applications and is ideal for other demanding environments which require the highest performance and reliability.

Output voltage: 24 V. Other voltages on request.
Ordering codes: IC198

FEATURES

- Input voltage range: 21.6 – 50.4 VDC.
This converter covers the EN 50155:2017 railway battery-voltage 28 V, 36 V.
- Wide temperature range: -40 – +70 °C.
This converter covers the EN 50155:2017 operating temperature range class OT4: -40 – +70 °C.
- Full power (no derating) over the entire temperature range.
- Very high efficiency:
Up to 97.4 % @ 36 Vin at full load.
- Continuous-overload and short-circuit proof.
- Fully compliant with EN 50155:2017 and EN 45545-2:2013+A1:2015
- Non-isolated power supply.
- Inrush current limitation avoids false tripping of external circuit breakers.
- Modular design.
- Field proven technology.
- Standard model ex stock.
- On request connectors of your choice; individual case style; additional functions as Power Fail signal, etc.



INPUT CHARACTERISTICS

Continuous Input Voltage Range	25.2 – 45.0 VDC
Temporary Input Voltage Range according to EN 50155:2017, 5.1.1.3	21.6 – 50.4 VDC for 1.0 sec
Input Undervoltage Lockout	V _{in_OFF} = 19.7 VDC ±2 % V _{in_ON} = 22.9 VDC ±2 %.
Input Voltage Reverse Polarity Protection	Active reverse polarity protection: I _{in_reverse} < 500 µA @ V _{in} = -45 VDC (with reverse polarity of V _{in} , the converter remains off without being damaged. Only a small reverse current I _{in_reverse} flows. With correct polarity of V _{in} , the converter works correctly)
Inrush Current @ T = 25 °C	An active inrush limitation circuit limits the input inrush current after turn-on of the input voltage. The charging current into EMI suppression capacitors is disregarded during the first microseconds after switch-on. Inrush Current Energy over the entire input voltage range: I _{inrush} ² t < 11 A ² s @ V _{in} = 21.6 – 50.4 VDC Inrush Current Peak = 36 A typ. @ 36 V _{in} Inrush Current Peak = 45 A typ. @ 45 V _{in}
Input Capacitance	3100 µF
Input Current typ. @ 300 W Load	36 V_{in}
	8.6 A
Input Power typ. @ no Load over the input voltage range	1.66 – 5.13 W
Internal Input Fuse	No internal fuse is provided
External Circuit Breaker recommendation Important: Circuit Breaker must be rated for the maximum DC-input voltage	36 V_{in}
	32 A, type B
Startup time (Time input voltage ON to output voltage ON)	< 200 ms for all input voltages

OUTPUT CHARACTERISTICS

Output Voltage Nominal	+24.0 VDC
Max. Continuous Output Power @ Vin = 25.2–45.0 V (no derating over the entire temperature range)	300 W
Max. Output Power @ Vin = 21.6–50.4 V for 0.1 sec	480 W
Max. Peak Output Power @ Vin = 25.2–45.0 V for 10 sec	480 W
Minimum Load	No minimum load required.
Setpoint Accuracy	< 1.5 %
Load Regulation @ off-load to full load over the entire temperature range	< 0.5 %
Line Regulation @ full load over the entire temperature range	< 0.1 %
Output Ripple & Noise @ 20 MHz bandwidth, including spikes	< 20 mVpp @ 25 °C < 100 mVpp @ -40 – +70 °C
Overload and Short-Circuit	The converter is continuous overload and short-circuit proof. Output overloaded: The output voltage is reduced and the output current limited (constant current). Output short-circuited: Constant current.
Current Limit (varies due to component tolerances)	23 – 35 A
Short-Circuit current	< 18.0 A
Paralleling of Outputs	Output cannot be paralleled without additional precautions.
Internal Decoupling Diode	No decoupling diode.

EFFICIENCY

Conditions	36 Vin
Efficiency typ. @ 480 W	96.7 %
Efficiency typ. @ 360 W	97.2 %
Efficiency typ. @ 240 W	97.4 %
Efficiency typ. @ 120 W	97.1 %
Efficiency typ. @ 60 W	95.3 %

ELECTROMAGNETIC COMPATIBILITY (EMC)

Test	Standard	Test severity levels	Performance Criteria
Surges	EN 50155:2017 EN 50121-3-2:2016/ A1:2019 IEC60571:2012 IEC 62236-3-2:2018	1.2/50 μ s 42 Ω , 0.5 μ F DC power supply port \pm 2 kV line to ground \pm 1 kV line to line	Criterion B required, but compliant with more strict criterion A
Electrostatic discharge	EN 50155:2017 EN 50121-3-2:2016/ A1:2019 IEC60571:2012 IEC 62236-3-2:2018	\pm 6 kV contact discharge \pm 8 kV air discharge	Criterion B required, but compliant with more strict criterion A
Fast transients	EN 50155:2017 EN 50121-3-2:2016/ A1:2019 IEC60571:2012 IEC 62236-3-2:2018	\pm 2 kV 5/50 ns tr/th 5 kHz repetition frequency	Criterion A
Radio-frequency common mode	EN 50155:2017 EN 50121-3-2:2016/ A1:2019 IEC60571:2012 IEC 62236-3-2:2018	150 kHz – 80 MHz 10 Vrms (carrier voltage) 80 % AM, 1 kHz Source impedance 150 Ω	Criterion A
Radio-frequency electromagnetic field	EN 50155:2017 EN 50121-3-2:2016/ A1:2019 IEC60571:2012 IEC 62236-3-2:2018	80 MHz – 1000 MHz 20 Vrms/m 80 % AM, 1 kHz unmodulated carrier; 1400 MHz – 2000 MHz 10 Vrms/m 80 % AM, 1 kHz unmodulated carrier; 2000 MHz – 2700 MHz 5 Vrms/m 80 % AM, 1 kHz unmodulated carrier; 5100 MHz – 6000 MHz 3 Vrms/m 80 % AM, 1 kHz unmodulated carrier	Criterion A
Conducted emissions	EN 50155:2017 EN 50121-3-2:2016/ A1:2019 IEC60571:2012 IEC 62236-3-2:2018	150 kHz – 500 kHz: 99 dB μ V quasi-peak 500 kHz – 30 MHz: 93 dB μ V quasi-peak	
Radiated emissions	EN 50155:2017 EN 50121-3-2:2016/ A1:2019 IEC60571:2012 IEC 62236-3-2:2018	30 MHz – 230 MHz: 40 dB μ V/m quasi-peak at 10 m 230 MHz – 1000 MHz: 47 dB μ V/m quasi-peak at 10 m	

ENVIRONMENTAL CHARACTERISTICS

Operating Temperature	-40 °C – +70 °C Class OT4: -40 – +70 °C according to EN 50155:2017
Cooling	Natural convection
Storage Temperature Range	-50 °C – +100 °C
Altitude Class	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 50155:2017: -25 °C to +15 °C / 95 %RH, ±3 °C/s +10 °C to 40 °C / 60 %RH, ±3 °C/s
Protective Coating	Class PC2 according to EN 50155:2017 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. The coating is compliant with class 2, according to IPC-A-610G: 2017.
Prohibited Substances	No substances defined as Prohibited according to the RoHS, REACH, UNIFE (RISL), or Prohibited for the Project, are present. No substances defined as Declarable according to RoHS, REACH, UNIFE (RISL), or Declarable for the Project, are present.
Fire behaviour	EN 45545-2:2013+A1:2015 compliant with all Hazard Levels HL1-HL3

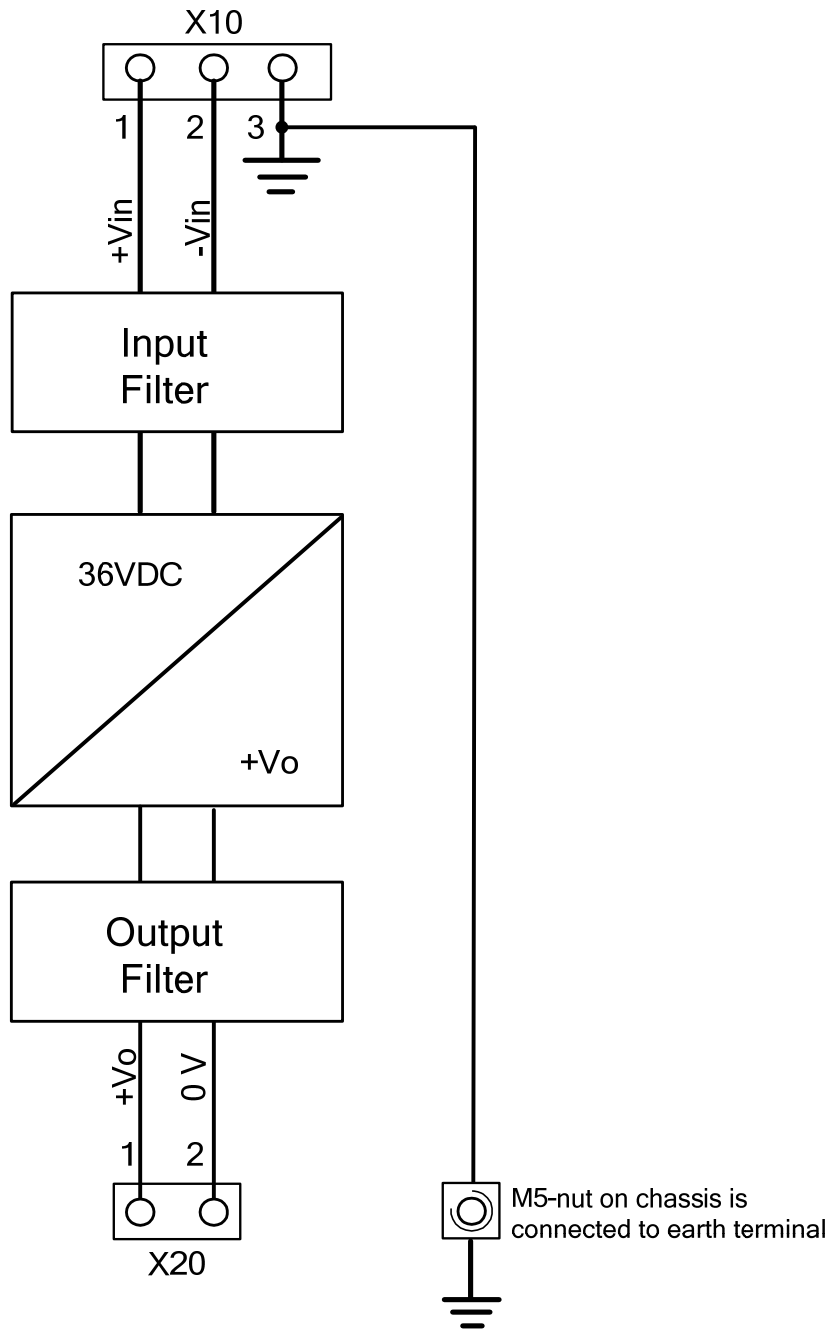
GENERAL CHARACTERISTICS

General Standard	EN 50155:2017 Railway applications - Rolling stock - Electronic equipment IEC 60571:2012 Railway applications - Electronic equipment used on rolling stock			
Useful Life Class	Class L4 (20 years) according to EN 50155:2017			
MTBF Calculation method: MIL-HDBK-217-F2 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
	8 150 000 h	6 154 000 h	1 323 000 h	800 000 h
Marking	Label with following information: - part number, input voltage range, output voltage - serial number for identification and traceability (printed in text format and as barcode) - revision index			
Connector identification	Printings on chassis to identify connectors and polarity.			

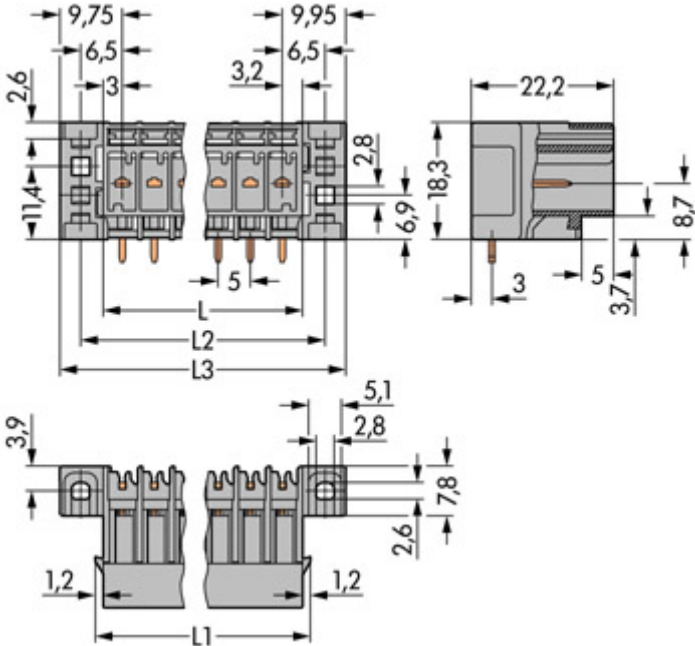
SAFETY AND INSULATION

Safety Standards	EN 60950-1:2006+A2:2013, IEC 60950-1:2005+A1:2009+A2:2013 CSV, EN 62368-1:2014
Insulation Coordination	According to EN 50124-1:2017
Input, Output, Chassis	The input is not isolated to the output. Input and output are galvanically isolated to the chassis.
Input to Chassis	Isolation Voltage: 1000 Vrms, 60 s
Output to Chassis	Isolation Voltage: 1000 Vrms, 60 s
Insulation Resistance	Input-Chassis: >550 MΩ Output-Chassis: >550 MΩ Test-voltage: 500 VDC

BLOCK DIAGRAM



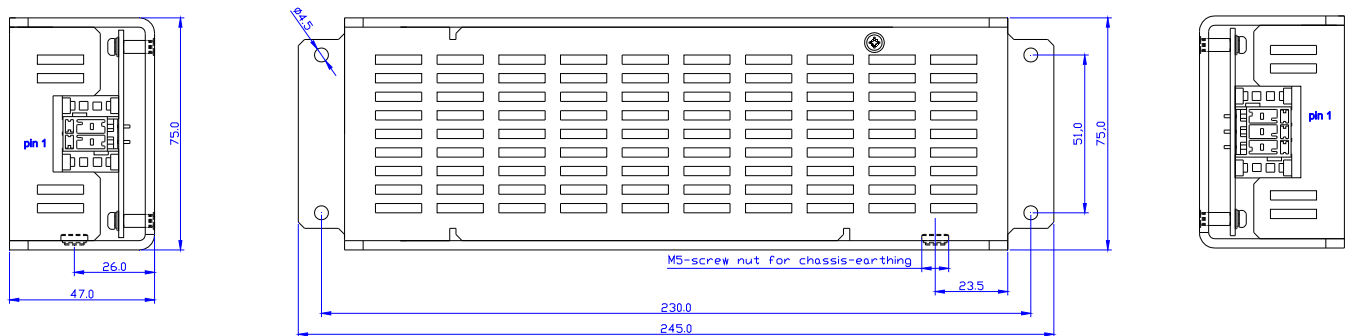
CONNECTOR TYPES

<p>Input connector X10</p>	<p>Wago 769-663/003-000 Pitch: 5.0mm, Number of pins: 3, horizontal</p> <p>Mating part: Wago 769-103/021-000</p>
<p>Output connector X20</p>	<p>Wago 769-662/003-000 Pitch: 5.0mm, Number of pins: 2, horizontal</p>  <p>Mating part: Wago 769-102/021-000</p>

MECHANICAL CHARACTERISTICS

Chassis	Aluminium: EN AW 5052 - AL5052 - AlMg2.5 or EN AW 5754 - AL5754 - AlMg3 black anodized
Overall dimensions	According to the drawing (millimeters, unless otherwise specified)
Weight	700 g
IP code	IP20
Mounting	Mounting in any position is allowed

Mechanical drawings:



Output connector X20:

1. +Vo
2. 0 V

Input connector X10:

1. +Vin
2. -Vin
3. Earth

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

TEST COMPLIANCE SUMMARY (CERTIFICATE OF CONFORMITY)

Performed Test	Standard	Test conditions	Performance level	Reference document
Visual inspection	EN 50155:2017 IEC60571:2012	Aspect, dimensions, weight, markings	According to design specification	Test report
Performance test	EN 50155:2017 IEC60571:2012	Supply voltage: 25.2 – 45.0 VDC	Criterion A	Test report
Power supply test Supply overvoltages	EN 50155:2017 IEC60571:2012	Supply voltage: 21.6–50.4 VDC 1s	Criterion B required, but tested with more strict criterion A	Test report
Insulation test	EN 50155:2017 IEC60571:2012	Input – Chassis 500 VDC Output – Chassis 500 VDC Repeated after Voltage withstand test Voltage withstand test: Input – Chassis 1500 Vrms 60 s Output – Chassis 1000 Vrms 60 s	Resistance > 20 MΩ (measured >550 MΩ, exceeding the requirement) No disruptive discharge	Test report
Low temperature start-up test Cold start test	EN 50155:2017 IEC60571:2012	T = -40 °C	Criterion A (exceeds the requirements)	Test report
Dry heat test	EN 50155:2017 IEC60571:2012	T = +70 °C (cycle A)	Criterion A	Test report
Cyclic damp heat test	EN 50155:2017 IEC60571:2012	T = +55 °C and +25 °C (2 cycles)	Criterion A	Test report
EMC test	EN 50155:2017 EN 50121-3-2:2016/ A1:2019 IEC60571:2012 IEC 62236-3-2:2018	See section 'Electromagnetic Compatibility (EMC)'		compliant
Vibration and shock test	EN 50155:2017 IEC60571:2012	EN 61373:2010, Category 1, class B		compliant

Additional tests:

Performed Test	Standard	Test conditions	Performance level	Reference document
Fire behaviour	EN 45545-2:2013+ A1:2015	PCB: R25 (EN 60695-2-11, T16: No ignition at T=850 °C)	PASSED (HL1-HL2-HL3)	Fire_Certificate_IC198

Furthermore, the product is compliant with the requirements of:

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


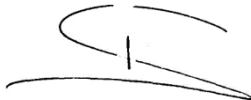
Neuhausen am Rheinfall, 31.01.2019

Thomas Schiegg
intreXis AG






EU DECLARATION OF CONFORMITY (DoC)

Product Models	IC198	
Name and address of the manufacturer	intreXis AG Tobelraastrasse 4 CH-8212 Neuhausen am Rheinfall Switzerland	
This declaration of conformity is issued under the sole responsibility of the manufacturer.		
<p>IC198</p> 		
The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:	Low Voltage Directive: RoHS Directive: EMC Directive:	2014/35/EU 2011/65/EU 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: RoHS Directive: EMC Directive: Railway Applications:	EN 60950-1:2006+A2:2013 EN 62368-1:2014+A11:2017 EN 63000:2018 EN 50121-3-2:2016/ A1:2019 EN 50155:2017
Signed for and on behalf of:	intreXis AG Tobelraastrasse 4 CH-8212 Neuhausen am Rheinfall Switzerland	
Place, Date of issue	Neuhausen am Rheinfall, 29.03.2020	
Name, Function, Signature	Thomas Schiegg, Managing Director: 	

INSTALLATION AND OPERATION

<p>Safety</p>	<div style="display: flex; align-items: center;">  <div> <p>Warning / Caution !</p> <p>The power supplies should be installed and put into operation only by qualified personnel.</p> </div> </div> <p>Before installing or removing the unit, disconnect the power from the system.</p>
<p>Servicing</p>	<p>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.</p>
<p>Spare Parts</p>	<p>List and drawings of spare parts are not provided, since the failed units have to be returned to intreXis for analysis and repair.</p>
<p>Disposal</p>	<p>Disused units must be collected separately and disposed at a suitable recycling facility.</p>
<p>Connecting the Cables</p>	<p>Ensure that proper wires are used according to the input current specifications. Prepare the cables according to the specifications of the particular connector used.</p>
<p>Operation of the Unit</p>	<p>Once the input power is applied, the output voltage is enabled.</p>