

intreXis[®]

Power Supplies with the X



Datasheet

intreXis Boardnet Converter Platform
IC248_5, 75 W Single-Output
24 Vin – 110 Vin

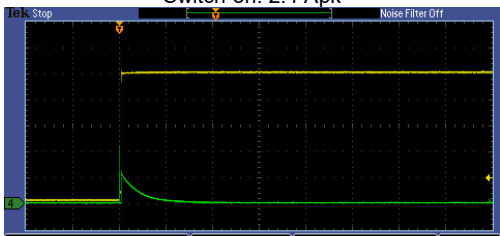
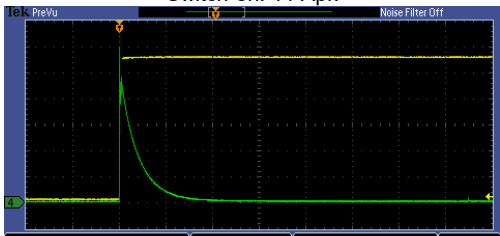
- Xtra high efficiency: > 93 % @ 110 Vin, 75 W
- Xtra wide input voltage range: 14.4 – 154 VDC
- Xtra wide temperature range: -50 – 85 °C

This datasheet covers the details of the IC248_5 power supply with single output voltage and output power of 75 W. This DC/DC converter is designed according to EN 50155:2017 and IEC 60571:2012 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 code: IC248_5

INPUT CHARACTERISTICS

Continuous Input Voltage Range	16.8 – 137.5 VDC
Temporary Input Voltage Range according to EN 50155:2017, 5.1.1.3	14.4 – 154 VDC for 1.0 sec
Input Undervoltage Lockout	V _{in_OFF} = 13.2 VDC ±2 % V _{in_ON} = 15.5 VDC ±2 %
Input Voltage Reverse Polarity Protection	Active reverse polarity protection: I _{in_reverse} < 500 µA @ V _{in} = -154 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 over the entire operating temperature range	An active inrush limitation circuit limits the input inrush current with a 10 Ω-resistor at switch-on of the input voltage (The charging current into EMI suppression capacitors is disregarded in the first microseconds after switch-on) Inrush Current @ 24 V_{in}, full load Switch-on: 2.4 Apk  CH1 yellow: Input voltage 5 V/Div, CH4 green: Input current 2 A/Div, Timebase: 10 ms/Div Inrush Current @ 110 V_{in}, full load Switch-on: 11 Apk  CH1 yellow: Input voltage 20 V/Div, CH4 green: Input current 2 A/Div, Timebase: 10 ms/Div Inrush Current Integral: I_{inrush}²t < 1.0 A²s @ V_{in} = 16.8 – 137.5 VDC

Input Capacitance	350 μ F			
Input Current typ. @ full Load	24 Vin	36 Vin	72 Vin	110 Vin
	3.52 A	2.31 A	1.14 A	0.73 A
Input Power typ. @ no Load over the input voltage range	0.70 – 0.81 W			
Internal Input Fuse	Fuse included, therefore no external fuse or circuit breaker required. If you, nevertheless, install an external circuit breaker for any other reason, please select it according to the recommendation below. $I^2t_{\text{-fuse}} = 171 \text{ A}^2\text{s}$			
External Circuit Breaker recommendation Important: Circuit Breaker must be rated for the maximum DC-input voltage	24 Vin	36 Vin	72 Vin	110 Vin
	8 A, type B	5 A, type B	3 A, type B	2 A, type B
Interruptions of Input Voltage Supply (Hold-up time)	Class S2 (10 ms) according to EN 50155:2017 The converter continues to operate as intended during and after the interruption, with no degradation of performance or loss of function over the entire input voltage range (Performance criterion A).			
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 @ $V_{in} = 16.8\text{--}137.5\text{ V}$, 14.4–154 for 1.0 sec (no derating over the entire temperature range)	75 W
Minimum Load	No minimum load required.
Setpoint Accuracy	< 1.0 %
Load Regulation @ off-load to full load over the entire temperature range	< 0.2 %
Line Regulation @ full load over the entire temperature range	< 0.1 %
Output Ripple & Noise @ 20 MHz bandwidth, including spikes	< 50 mVpp @ -25 – +85 °C < 100 mVpp @ -50 – -25 °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)	3.3 – 4.2 A
Short-Circuit current	< 4.5 A
Overvoltage Protection (OVP) (output voltage is limited, if main regulation loop fails)	< 31 VDC
	SELV-compliant according to EN 60950-1:2006+A2:2013, IEC 60950-1:2005+A1:2009+A2:2013 CSV
Paralleling of Outputs	Paralleling can be optionally included. Please contact intreXis for advice
Active Decoupling Diode for redundant Systems	Decoupling diode on the output for redundant systems with two or more power supply sources driving a load can be optionally included. Please contact intreXis for advice
Maximum load-capacitance	Unlimited, tested up to 14 mF

EFFICIENCY

Conditions	24 Vin	36 Vin	72 Vin	110 Vin
Efficiency typ. @ 100 % Load	88.7 %	90.1 %	91.3 %	93.2 %
Efficiency typ. @ 66 % Load	89.2 %	90.0 %	91.0 %	92.2 %
Efficiency typ. @ 33 % Load	87.5 %	87.5 %	89.1 %	90.8 %

SIGNALS AND INTERFACES

DC-OK Signal	Optically isolated solid-state relay (between connector X20/pin 3-4, see block diagram)
DC-OK relay & LED switch on threshold	$V_{out} > +22.0 \text{ VDC} \pm 2 \%$
DC-OK relay & LED switch off threshold	$V_{out} < +21.6 \text{ VDC} \pm 2 \%$
DC-OK max. relay current, when on	50 mA max.
DC-OK max. relay voltage-drop, when on	$< 1.7 \text{ VDC} @ 50 \text{ mA}$ (between connector X20/pin 3-4, see block diagram)
DC-OK max. relay voltage, when off (max voltage which can be applied externally)	$\pm 154 \text{ VDC}$ (between connector X20/pin 3-4, see block diagram)
LED	Green LED on output side indicates that output voltage is ok.

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 ± 2 kV line to ground ± 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	± 6 kV contact discharge ± 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	± 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	-50 °C – +85 °C Class OT4: -40 – +70 °C and class ST1,ST2: +15 °C according to EN 50155:2017 extended down to -50 °C
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 45545-2:2020 compliant with all Hazard Levels HL1-HL3

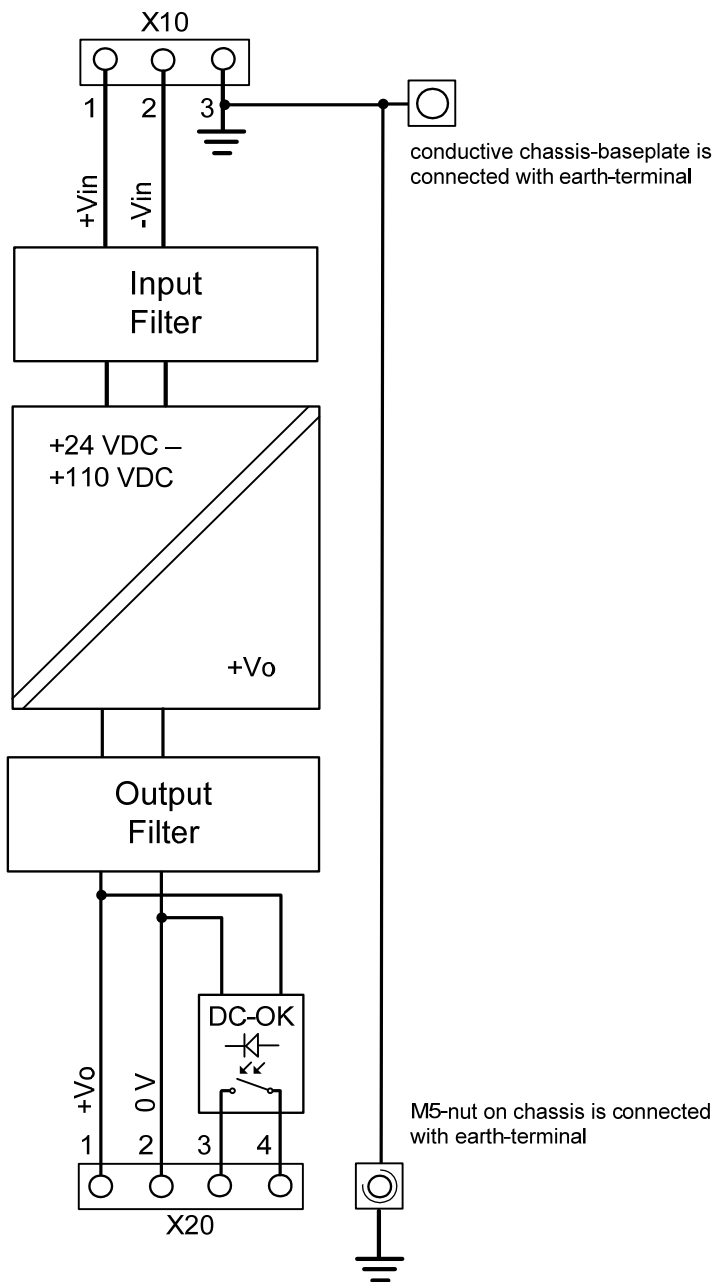
GENERAL CHARACTERISTICS

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
	11 656 000 h	8 135 000 h	1 744 000 h	882 000 h
MTBF Calculation method: SN 29500 (IEC 61709)	2 098 000 h @ +50 °C			
Marking	Label with following information: - part number, input voltage range, output voltage, output power - unique serial number for identification and traceability (printed in text format and as barcode) - revision index			
Connector identification	Printings on chassis to identify connectors and pin-functions.			

SAFETY AND INSULATION

Safety Standards	EN 60950-1:2006+A2:2013, IEC 60950-1:2005+A1:2009+A2:2013 CSV, EN 62368-1:2014+A11:2017 IEC 62368-1:2018
Insulation Coordination	According to EN 50124-1:2017
Input, Output, Chassis	The input is galvanically isolated to the output. Input, output and signals are galvanically isolated to the chassis.
Input to Output	Isolation Voltage: 3300 Vrms at 2000 m altitude, 60 s 2500 Vrms at 5000 m altitude, 60 s Clearance: 5.5 mm Creepage: 5.5 mm For the type test, the Y-capacitors must be removed according to EN 61287-1:2014. Please refer to the intreXis whitepaper "Insulation Test" for detailed information. For the routine test according to EN 50124-1:2017 of Input to Output and Input to Chassis, intreXis AG recommends the following procedure: connect Output to Chassis, apply a test-voltage of 2125 VDC or 1500 VAC with trigger threshold ≥ 10 mA, 10 s between Input and Chassis. For this test, the Y-capacitors must not be removed. Please refer to the intreXis whitepaper "Insulation Test" for detailed information.
Input to Chassis	Isolation Voltage: 2000 Vrms, 60 s Clearance: 2.5 mm Creepage: 2.5 mm For the routine test, see above.
Output to Chassis	Isolation Voltage: 1000 Vrms, 60 s Clearance: 1.6 mm Creepage: 1.6 mm
DC-OK Signal to Output DC-OK Signal to Input DC-OK Signal to Chassis	Isolation Voltage: 2000 Vrms, 60 s Clearance: 2.5 mm Creepage: 2.5 mm
Insulation Resistance	Input – Chassis: > 550 MΩ Input – Output: > 550 MΩ Output – Chassis: > 550 MΩ DC-OK Signal to Output: > 550 MΩ DC-OK Signal to Input: > 550 MΩ DC-OK Signal to Chassis: > 550 MΩ Test-voltage: 500 VDC

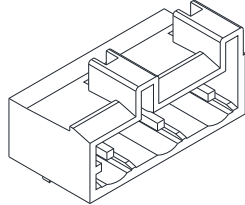
BLOCK DIAGRAM



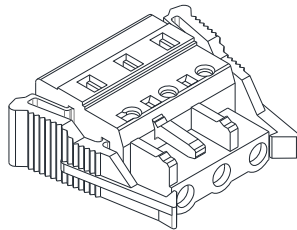
CONNECTOR TYPES

**Input connector
X10**

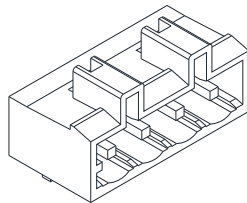
Wago 721-833/001-000
Pitch: 7.5 mm
Number of pins: 3



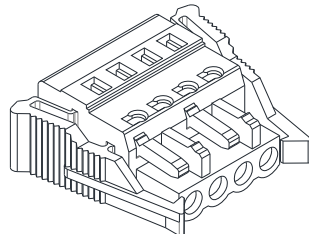
Mating part: Wago 721-203/037-000

**Output connector
X20**

Wago 721-464/001-000
Pitch: 5.0 mm
Number of pins: 4



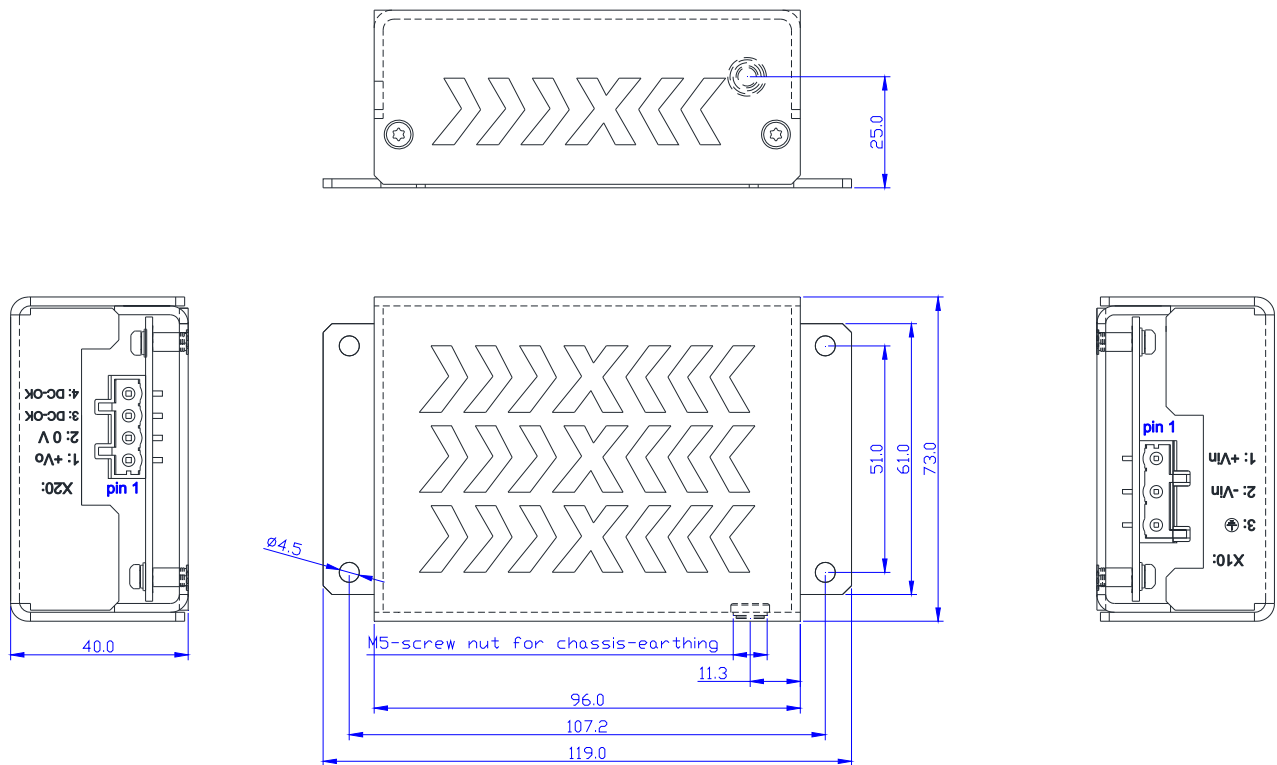
Mating part: Wago 721-104/037-000



MECHANICAL CHARACTERISTICS

Chassis	Aluminium: EN AW 5052 - AL5052 - AlMg2.5 or EN AW 5754 - AL5754 - AlMg3 Baseplate: blank Cover: black anodized
Overall dimensions	According to the drawing (millimeters, unless otherwise specified)
Weight	270 g
IP code	IP20
Mounting	Mounting in any position is allowed

Mechanical drawings:



Output connector X20:

1. +Vo
2. 0 V
3. DC-OK
4. DC-OK

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	Ambient temperature. Nominal supply voltage: 24 VDC and 110 VDC Supply voltage range: 16.8 – 137.5 VDC (static)	Criterion A	Test report
Power supply test Supply overvoltages	EN 50155:2017 IEC60571:2012	Supply voltage: 14.4 – 154 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 Input – Output 500 VDC Output – Chassis 500 VDC DC-OK Signal – Output DC-OK Signal – Input DC-OK Signal – Chassis Repeated after Voltage withstand test Voltage withstand test: Input – Chassis 2000 Vrms 60 s Input – Output 3300 Vrms 60 s Output – Chassis 1000 Vrms 60 s DC-OK Signal – Output 2000 Vrms 60 s DC-OK Signal – Input 2000 Vrms 60 s DC-OK Signal – Chassis 2000 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 = -50 °C	Criterion A (exceeds the requirements, extended range down to -50 °C for extremely cold environments)	Test report
Dry heat test	EN 50155:2017 IEC60571:2012	T = +70 °C (cycle A) T = +85 °C (cycles B and C)	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)'		TestreportEMC R-EM-354-0921-07A
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 45545-2:2020	PCB: R25 (EN 60695-2-11, T16: No ignition at T=850 °C)	PASSED (HL1-HL2-HL3)	Fire_Certificate_IC24X

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, 03.09.2021

Thomas Schiegg
intreXis AG





EU DECLARATION OF CONFORMITY (DoC)

Product Models	IC248_5	
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.		
IC248_5 		
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, (EU) 2015/863 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, 03.09.2021	
Name, Function, Signature	Thomas Schiegg, Managing Director: 	



UK DECLARATION OF CONFORMITY (DoC)

Product Models	IC248_5	
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.		
IC248_5 		
The object of the declaration described above is in conformity with the relevant UK legislation:	UK SI 2016 No. 1101: UK SI 2012 No. 3032: UK SI 2016 No. 1091:	Electrical Equipment (Safety) Regulations 2016 The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 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: RoHS Directive: EMC Directive: Railway Applications:	BS EN 60950-1:2006+A2:2013 BS EN 62368-1:2014+A11:2017 BS EN 63000:2018 BS EN 50121-3-2:2016/A1:2019 BS 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, 13.10.2021	
Name, Function, Signature	Thomas Schiegg, Managing Director: 	

INSTALLATION AND OPERATION

Safety	Warning / Caution! The power supplies should be installed and put into operation only by qualified personnel. Before installing or removing the unit, disconnect the power from the system. For 72 V and 110 V input applications, in addition to the main protective earthing terminal (X10/pin3), a separate protective earthing terminal must be permanently connected to the conductive chassis-baseplate or to the M5-nut provided on the chassis.
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. 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 enabled.