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White Paper

POWER MODULES VS. COMPLETE POWER SUPPLY UNITS

Rev00

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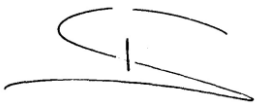
			

1 Introduction

Time to market, costs, size constraints, design risk and ease of use are among the most common factors when choosing between power modules and a complete power supply unit.
By adding some input and output capacitors, electronics designers are supposed to develop their power supplies quickly, confident that design requirements will be met easily.
In particular, some power modules are available in compliance with the specifications of European Standard EN50155 for Railway Applications.

Is it really that easy to develop a power supply for railway applications, using a power module?
This article provides an overview of the relevant factors that must be carefully considered when choosing between power modules and a complete power supply solution.

2 Power modules

A power module is a converter that includes a PWM controller, switching FETs, a transformer, passive components and diodes brought together into a single unit.
The input supply voltage range varies and usually does not cover the complete range of battery voltages.
Splitting the input voltage range is necessary when some design constraints cannot be met (unit size, loss and heat). In this way, the converter's operation is optimised over a reduced range of conditions.

Table 1 – Examples of modules for the railway market.

	Output power	Input voltage range
Module 1	50 W	18-75 V, 9-36 V
Module 2	150 W	42-110 V, 66-160 V
Module 3	50 W	18-36 V, 36-75 V
Module 4	150 W	18-75 V, 43-160 V
Module 5	50 W	9-36 V
Module 6	50 W	18-75 V
Module 7	50 W	42-110 V
Module 8	50 W	66-160 V

Most modules on the market can only be used within a limited input voltage range. For different battery voltages, different modules are necessary.
They are not able to cover the widest range specified by EN50155, that is, 14.4-154 VDC.

3 Complete power supply units

A complete power supply includes all components, connectors, EMI-filter, signals and LEDs.
At a glance, the complete solution is more expensive than power modules, but it does not require any additional components and provides clearly defined performance, under the specifications of the relevant European standards.
Obviously, the power modules are compliant with the same standards. But is that enough to ensure that the complete power supply (module-based) will be compliant? Design time is expensive and only a great experience in this field ensures an efficient solution.

With all of its know-how and experience in the railway market, intreXis can offer the best solution for your power needs.

Table 2 – Examples of complete power supply units by intreXis.

IC27x_2 50 W	**IC37x_2 100 W**
	
Output power: 50 W Input voltage range: 14.4-154.0 V	Output power: 100 W Input voltage range: 14.4-154.0 V

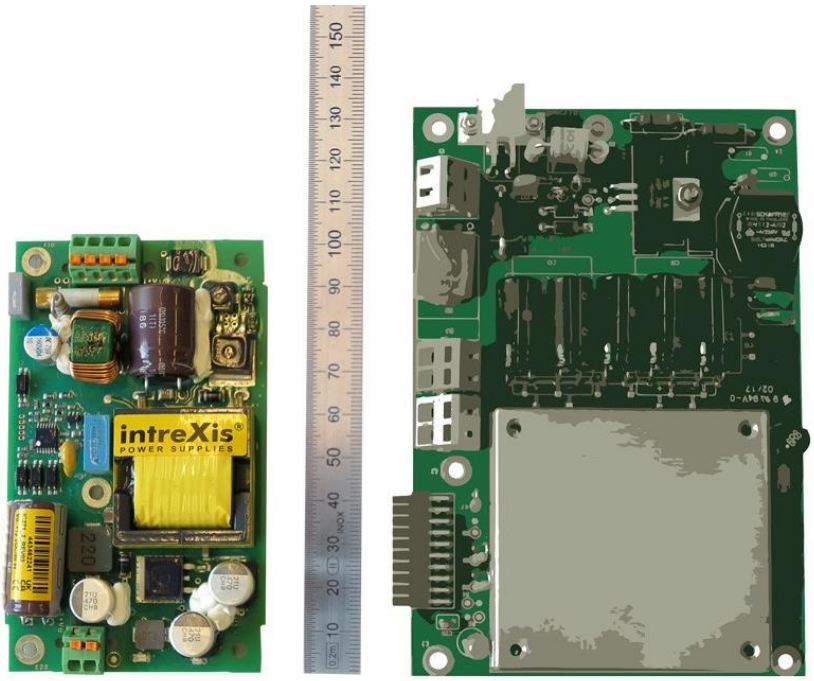
4 Comparison

To keep readers informed, we have given some relevant, key aspects which may not be evident at first glance.

Design time
It is usually possible to put together a working circuit using modules, thereby saving design time. Nonetheless, design time should include testing, designing mechanical parts for the chassis, working with various partners, EMI-tests, etc. as well as the resulting costs.
A failure at the EMI laboratory generates very high costs and require special skills to be rectified.
As a manufacturer of power supplies, intreXis applies its know-how to all products, in order to provide the most efficient and reliable power solution.

Performances
Modules require additional external parts, such as capacitors, EMI filters, etc.
Choosing proper components has an impact not only on costs, but also on the performance of the power supply. For example, the ESR of output capacitors is critical for the voltage ripple.
Heat dissipation is another important difference between power supplies based on modules and complete power solutions. While dissipation techniques may differ from one module to the next, a module is usually a uniform source of heat inside the power supply, which negatively affects the lifetime of surrounding electronics.
A good thermal practice is to bring heat away from the PCB, for example, using a conductive chassis, which is possible with careful, discrete design.

Size and weight
The size and weight of a module-based power supply will become larger by adding the necessary external components and a chassis. Furthermore, it is not possible to optimise the design, because the module is black-boxed and its internal nodes are not accessible.
As an example, according to EN50155, class S2 requires the power supply to deliver power during a 10 ms interruption of the input voltage. In the case of modules, the only way to achieve this is to add large capacitance at the input, which affects size, weight and costs. On the other hand, discrete design allows some additional capacitance to be placed where it is more convenient. For example, the capacitance needed to achieve class S2 is much smaller if added after a boost stage.



Reliability
Robust design requires experience and control of all of the procedures during a product's development, from the specifications to the end product.
Thanks to its long experience in the field along with its use of state-of-the-art technologies and procedures, intreXis delivers extremely reliable power supplies.

Standards
Extensive know-how and ongoing updates are needed to develop products that are ready for the railway industry and compliant with the latest European standards, such as EN45545 "Fire protection on railway vehicles".
Only an expert team with skills in various fields (electronic design, electric and mechanical CAD, production, testing, planning, etc.) can guarantee this key advantage.

5 Conclusions

intreXis DC-DC converters with extra high efficiency of >93% can be used without additional heat sinks.
If the application calls for it, it is possible to couple the case or components thermally to bring most of the heat to the outside of the unit.
All converters are 100% compliant with all relevant standards and are all fully tested.
We provide a risk-free solution: no EMC concerns, no design time on the part of customers, and very competitive prices.