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White Paper

Why move the power supply out of the control panel?

Automation Trends

Increased desire to relocate power sources to the field

Increasingly, industries are moving their power supplies into the field. Decentralized automation components like Murrelektronik's Emparro67 switch-mode power supplies offer significant advantages when they are moved from the cabinet to the field including significantly faster installation, comprehensive IO-Link diagnostic options and the ability to use smaller control cabinets with lower cooling requirements.

In the past, industrial components were almost exclusively installed in large, centrally located control cabinets. This has not always proven to be the best solution. Over the past decade as the desire for more flexibility and higher efficiency has grown, more and more manufacturers have recognized that there is enormous potential in the optimizing, modularization and decentralization of key components.

By dividing machines and systems into smaller units, many control cabinet components can be placed closer to the process. The introduction of decentralized units also means that they can be assembled, tested and operated as modular subsystems which simplifies processes like commissioning and maintenance.

This idea makes it relatively inexpensive to add on, retrofit, move or update systems without having to change the overall application concept. Previously, switch-mode power supplies were found almost exclusively in the control cabinet, now they can be shifted to the machine environment. The closer the power supply is to the point-of-load, i.e. the consumer, the lower the line losses.

Murrelektronik – Your Decentralization Expert

For decades, Murrelektronik's experts have been dealing with the question of how electrical machine installation can be designed and implemented as economically and efficiently as possible. Decentralization, i.e. the relocation of systems from a central point directly to the process in the machine or plant, has proven to be a particularly valuable part in this process.

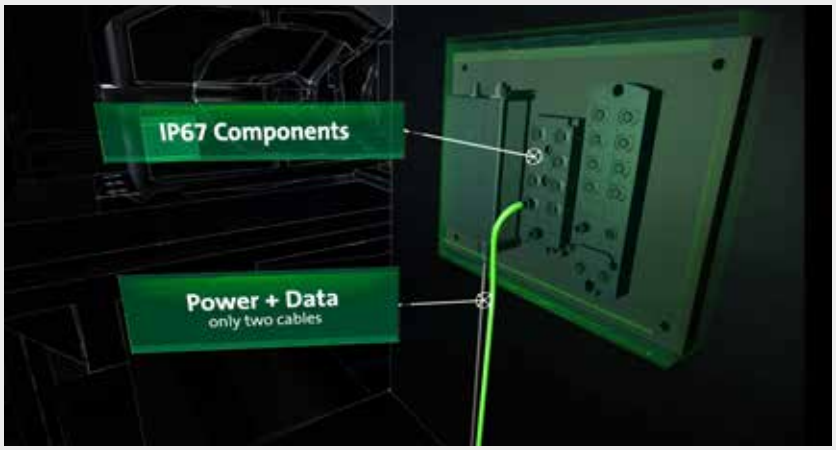
Mission "Zero Cabinet" from Murrelektronik

With decentralization, control cabinet components can be kept to a minimum. In return, systems can be mounted directly in the field, which significantly reduces installation, maintenance and diagnostic costs.

For many years, Murrelektronik customers have been using IP67 rated (water- and dust-proof) IO systems in the field in a wide variety of applications. As an industry leader, Murrelektronik has brought those same advantages to the world of industrial power supplies. The Emparro67 series power supplies offer important advantages to the user:

- The mains voltage is converted directly at the load into DC-voltage. This minimizes energy losses.
- Field mounting allows control cabinets to be smaller and have a lower cooling requirement.
- Installation time can be reduced by up to 70% as compared to conventional power supplies thanks to M12 and Mini (7/8”) ports.
- An IO-Link interface enables collection of extensive diagnostic data as well as lifetime monitoring and predictive maintenance.

Control cabinet with classic installation technology



Modern machine installation: The control cabinet with minimum space requirement, components are installed decentrally on standardized modules

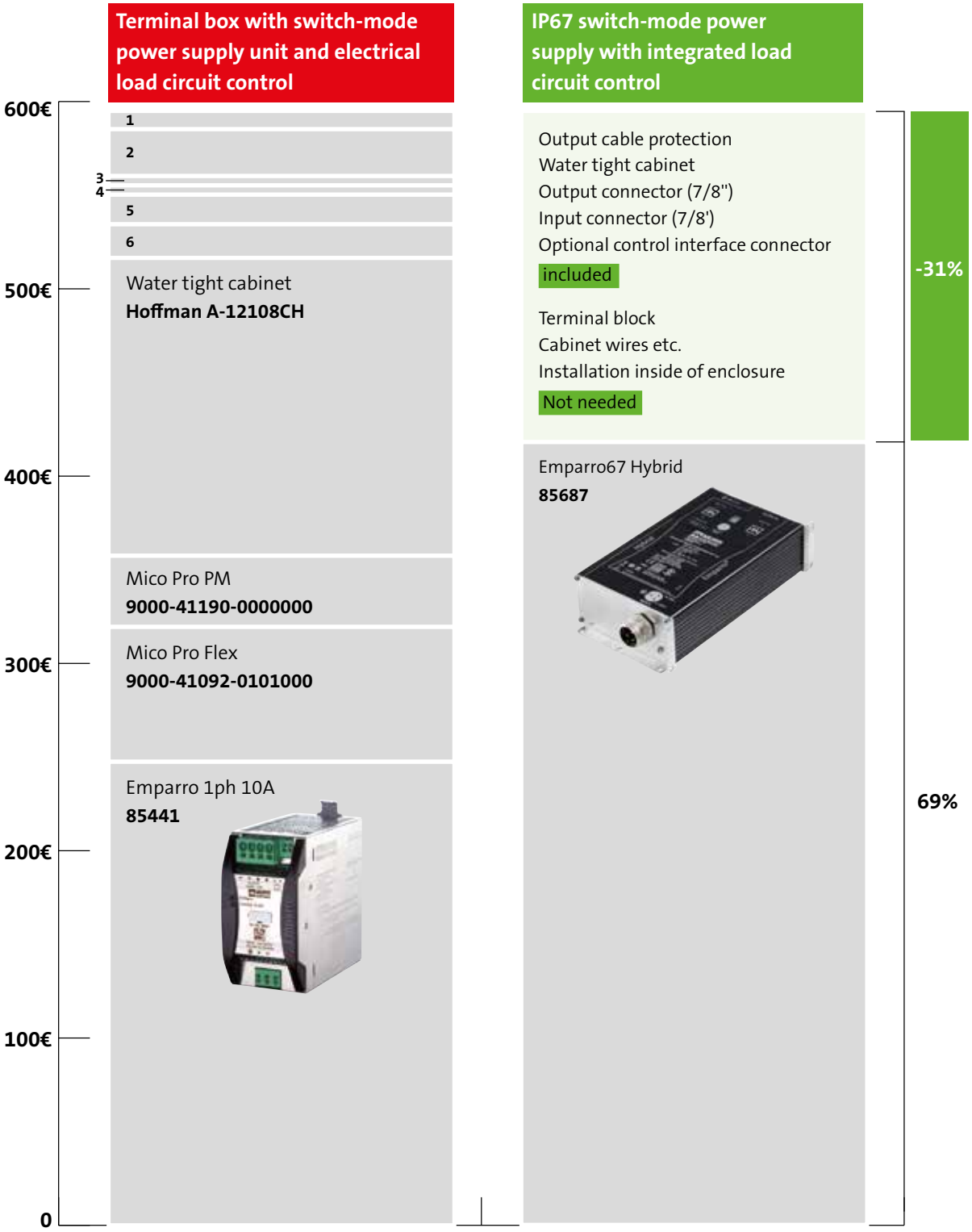
Control cabinet or outsource to the field?

In industrial applications, most of the functions, such as control, load circuit monitoring or power supply, are located in a central place, usually a large control cabinet. To make the application more flexible and to relocate individual functions modularly to the point-of-load, there are different ways of outsourcing into the field.

One option is a small terminal box to house the IP20 switch-mode power supplies. In this option the corresponding components are mounted in a small terminal box and placed as close as possible to the load.

Another much more efficient option is to use the power supply itself to provide short-circuit and overload protection. Here, an IP67 switch-mode power supply is mounted in the field. Additionally money on housings and mounting material can be saved.

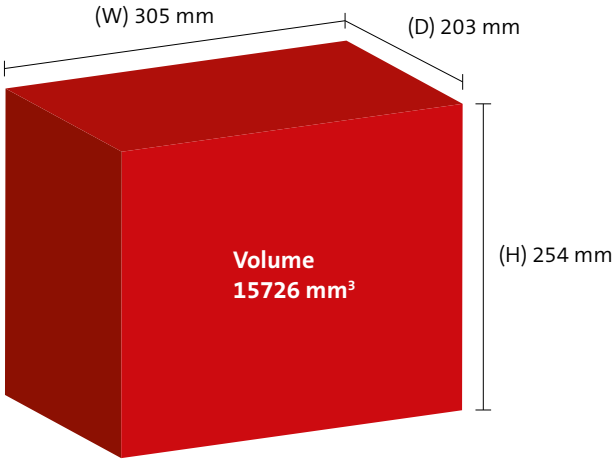
Cost Comparison: Terminal Box vs. Decentralized Power Supply



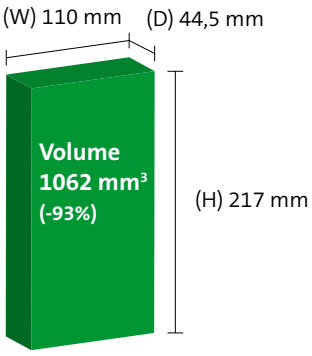
1 Optional control interface connector **(7000-13521-9020020)** | **2** Installation inside of enclosure **(30 minutes @ 50€/h)**
3 Cabinet wires, Din-Rail, screws etc. | **4** Terminal block | **5** Input connector (7/8') **(Binder 09-2447-320-03)**
6 Output connector (7/8") **(7000-78361-9770020)**

With increasing pressure to lower costs on installations, the approximately 30% savings that can be achieved can be a significant competitive advantage. In addition, space plays an important role when using a power supply. It has an influence on the size of the application as well as the thermal behavior and thus on the service life and maintenance costs.

Space Needed: Terminal Box



Space Needed: Decentralized Power Supply



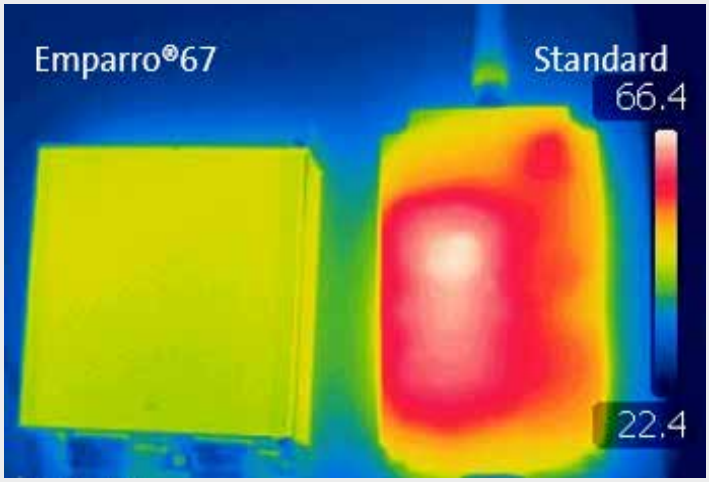
Thanks to the compact design, the use of IP67 switch mode power supplies saves approx. 93% over a terminal box.

Meet cooling and communication requirements

Heat concept

The power components installed in a control cabinet cause loss during operation which must be dissipated in the form of heat. Increased cabinet temperatures can lead to power losses and premature component aging. Therefore, you have to include heat dissipation when designing control cabinets.

With decentralized power supplies, heat dissipation is not a problem. The main problem of trapped heat is removed from the equation along with the cabinet and derating is usually not necessary. Since the power supply is located outside a housing, the heat is more easily dissipated. At the same time, a smaller, and less expensive, control cabinet can be used for the PLC, drives and other components. Another plus is a lower cooling requirement as well as longer service life and lower operating costs (e.g. electricity costs for air conditioning units). Decentralized power supplies with their wide temperature range offer maximum availability especially in summer, when hot temperatures in non-air-conditioned applications can often lead to forced power supply shutdowns.



Comparison: Emparro67 heat emmision vs. standard power supply

Communication and Diagnostics

The Emparro67 Hybrid power supply enables extensive and transparent communication for connection to the control system thanks to its IO-Link interface. This power supply can communicate as an IO-Link device with a higher-level IO-Link master for diagnostic and maintenance purposes. It has functions for preventive maintenance and provides device status information via various diagnostics. For example, when the PSU reaches the end of its lifetime, it sends an alarm. So it can be replaced during the next maintenance cycle. Unplanned and expensive downtimes can be avoided.

Further information, such as power-on processes, internal fuse tripping or current values can be read in real time via the IO-Link interface and evaluated using appropriate software. This makes power supplies with the IO-Link an important component for Industry 4.0.

Highly visible status LEDs are installed on the power supply to **inform the user of status and other diagnostic messages**. If, on the other hand, you use an IP20 power supply in a housing, access to optical diagnostic information is difficult. To get the same information from an IP20 power supply, you either have to open the control cabinet or use a stack light.

While LEDs allow you to see, at a glance, the operating status of a power supply, it makes more sense to be able to monitor load circuits by channel. Emparro67 Hybrid has an **integrated 24V DC load circuit monitoring (short circuit and overload protection or "MICO function") on two channels**. This allows sensors, actuators and the fieldbus module supply to be monitored electronically. It also increases machine availability, as current paths are switched off channel by channel in the event of a fault. The status of each channel is shown via a status LED on the device so responses can be made as needed.

The channel granularity also reduces downtime. For example, if the actuator supply is interrupted due to a short circuit, overload or cable break, a connected

fieldbus module can continue to be supplied via the other channel. Error messages and diagnostic information are then transmitted via IO-Link or the digital alarm contact. This allows service visits to be planned immediately and eliminates the need for multiple trips to rectify different faults. Downtimes are reduced and the return on system investment is increased.

In addition to the monitoring function, Emparro67 Hybrid also enables channels to be switched on and off in a targeted manner. With this integrated switching function, a variety of applications can be implemented cost-effectively and efficiently, since you do not need a separate switching element.

Emparro67 Hybrid User Interface

Special features for machine manufacturers and end customers

Applications with a field based power supply offer some special features and options, the most important of which are summarized below.

The 10 top features of a decentralized power supply

1	Terminal boxes are not needed with an IP67 power supply
2	Power supplies can be placed in the field, next to the consumer, saving space and money
3	The ability to use cables with a smaller cross section reduces material costs
4	Plug-and-play installations simplify cabling and eliminate wiring errors
5	Switch-mode power supplies in the field are easy to install and significant-ly reduce installation costs
6	IP67 switch-mode power supplies offer the end customer additional diagnostics and maintenance benefits
7	Using a decentralized power supply concept makes future machine expansions easier
8	IP67 switch-mode power supplies reduce the space required in control cabinets as well as the cooling requirements
9	IO-Link communication gives users a comprehensive look at the current status of the machine or system.
10	Integrated load circuit monitoring ensures maximum machine availability and selectivity

Industry Example: Early Adopters

Many industry leaders rely on decentralized switch-mode power supplies. The early adopters recognized the advantages of moving the power supply to the field. In the automotive industry, IP67 power supplies are mounted directly on machines and systems. Decentralized power supplies are most frequently used in large systems like assembly plants or body shops. This allows smaller cables to be used and keeps line loss to a minimum saving energy and money. The basic machine structure, with its pre-wired and tested sub-modules, which is common in the automotive industry, can be easily implemented with IP67 power supplies. Subsystems can be independently tested and are only connected to the main machine during commissioning.

One focus of the automotive industry, the maximum availability of its production facilities, is implemented in a special way by IP67 switch-mode power supplies. By connecting the switch-mode power supplies in parallel, one power supply can replace another in the event in case of a failure. This reduces machine downtimes. Additionally it is very easy to add modules, like for example a robot cell. It enables a huge potential for the future, which offers even more value.

The **logistics industry** is confronted with ever-increasing plant expansion. There, too, you can see the advantages achieved by reducing line losses and the placing switch-mode power supplies as close as possible to the load.

In logistics applications, decentralized switch-mode power supplies can be used to directly supply roller drives with power. Future expansions can be easily implemented, since the roller drives and the associated power supply can be modularly expanded. Also, these fully potted power supplies, with up to 50g shock resistance, are an ideal choice for meeting the shock and vibration requirements of a logistics application.

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About Murrelektronik

Murrelektronik is an internationally operating family business in automation technology with more than 3000 employees. The goal and task of Murrelektronik is to optimize machine and system installations and thereby increase the competitiveness of its customers. Decentralization is the key success factor: the control level in machines and systems is optimally connected to the sensor-actuator level using proven concepts and new technologies. A close customer relationship is essential to develop individual solutions for an optimal machine installation. High product availability completes off Murrelektronik's range of services and customer experience.