New Ideas About 24 VDC Field Power Supplies Can Reduce Costs, Simplify Connectivity for Distributed I/O Devices on Industrial Machinery

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While the use of distributed I/O control is increasing on industrial machinery,

the technology of supplying field power to machine controls has lagged a little behind the technology curve.

Typical 24 VDC supplies used for field power are designed to be used in a protective enclosure. It's now possible to consider a power supply design in its own environmentally-sealed, machine-mountable package compliant with IP65, IP66, IP67 and NEMA 4X ratings. A design that includes a heat sink housing can withstand physical abuse, dust, water and oils while efficiently dissipating heat. This allows full power operation in ambient temperatures from -40 to +60°C.

Increasing Use of Distributed Field Power

As industrial machinery is increasingly controlled remotely by industrial networks such as DeviceNet, Profibus, Interbus, ASI, and others, the demand for "distributed field power" for machine device control and communication is increasing. Devices using field power operate at different voltages, including 5, 12, 15 and 24 volts. Power consumption by individual devices tends to fall below 300 watts.

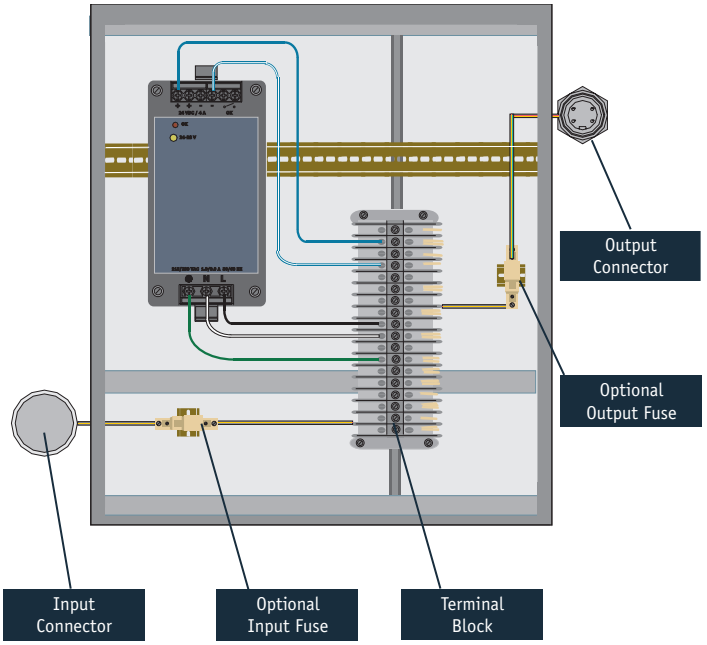
Although no hard and fast standards have been adopted industry-wide, field power at 24 VDC in the <100 watt range is increasingly becoming the de facto standard of machine input/output devices. It is sufficient to power most sensors, relays, hydraulic and pneumatic actuators, valves, and communications devices such as Ethernet hubs and distribution blocks. It can also be distributed as direct current over modest distances and presents minimal shock, burn, or fire ignition hazard.

A power supply's size, proximity and protection from the operating environment are emerging as significant engineering and cost issues as machines employ more intelligent I/O devices. This is especially true in manufacturing environments where water, dust, oils and other potential contaminants pose a threat to the power supply.

In the past, it wasn't a problem to house the power supply in an external enclosure and cable power to the machine's modest set of control devices. Machine designers and systems integrators are now faced with the cost and space constraint challenges posed by the traditional enclosure-housed power supply.

A Look at Enclosing a Traditional Field Power Supply

To understand the design rationale for a sealed machine-mountable power supply, it's helpful to look at a typical power supply setup. A 24 VDC power supply is typically DIN rail-mounted inside an enclosure that has a special environmental rating such as IP67 or NEMA 4X. Therefore, a traditional power supply is not designed with any special resistance to water or other contaminants. Dissipation of excess heat from power transistors, transformer windings and other on-board thermal sources is accomplished through ventilation of the power supply into the enclosure. Together, these factors make a typical power supply enclosure fairly large. Size historically wasn't a problem when a machine had plenty of space in its' working envelope, or if I/O cabling to and from an off-machine enclosure wasn't too complex and costly.



A Review of Key Enclosure Ratings

Industrial enclosures can come with a variety of ratings that typically specify protection against particulates, water and other contaminants. Here are a few relevant definitions from the National Electrical Manufacturers Association (NEMA) and the International Electrotechnical Commission (IEC).

NEMA Type 4X – Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, hose-directed water, and corrosion; and that will be undamaged by the external formation of ice on the enclosure.

NEMA Type 12 and **12K** enclosures are constructed (with knockouts) for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, circulating dust, lint, fibers, and flyings, and against dripping and light splashing of liquids (oil and coolant seepage).

IEC Enclosure Classifications begin with the letters "IP", which stand for "Ingress Protection." Two numbers follow; the first refers to protection against solid objects and dust, and the second refers to protection against water. Three IEC protection classes are especially relevant to industrial power supplies:

IEC IP65 – Totally protected against dust, protected against low pressure jets of water from all directions, limited ingress permitted

IEC IP66 – Totally protected against dust, protected against heavy streaming water, limited ingress permitted (e.g. ship deck)

IEC IP67 – Totally protected against dust, protected against the effect of short term immersion between 15 cm and 1 m

However, adding more I/O devices to individual machines to take full advantage of automation network capabilities changes the situation significantly. Both space constraints and cost can create headaches when the demand for field power increases in automated environments.

The cost of enclosures can easily equal or exceed the cost of the power supplies they protect. Enclosure size is also an increasingly important issue on complex machines where space is at a premium. If the enclosure cannot be mounted directly on the machine, routing cabling to and from a large number of devices can become a complex issue with reliability, maintenance and operator safety issues entering the mix.

It's hard to reduce the size of a conventional enclosure when considering environmental sealing integrity and thermal management. The latter is a special concern for power supplies that operate at full rated power. For example, even a 100-watt power supply operating at full capacity and 90% efficiency will radiate 38 BTU per hour into its enclosure. Without a large enclosure and active ventilation, interior temperatures can quickly rise to destructive conditions.

Self-Enclosing and Downsizing a 24 VDC Power Supply

Rather than trying to reconfigure the enclosure, newer design innovations permit the power supply to be a compact, stand-alone, self-protected unit that could mount directly on machines. In addition to eliminating the expense and bulk of a non-ventilated enclosure, direct machine mounting would significantly reduce the amount of cabling between the power supply and consuming devices on the machine.

Thermal management is accomplished by a metal housing and internal design features that result in very efficient passive convection cooling (i.e. no fans).

A Side-by-Side Comparison of Installed Costs for Traditional Enclosure/Power Supply vs. Sealed Field Power Supplies

While the self-encapsulated design of the sealed power supply is intuitively superior to current technologies, the true value is revealed in a cost analysis that compares it to a traditional field power supply mounted in an enclosure. A traditional enclosed power supply requires assembly of multiple parts plus miscellaneous hardware and labor costs. The costs of researching, specifying and ordering the parts add additional expense.

About Sola/Hevi-Duty, a Leader in Industrial Power Supply Technology

Sola/Hevi-Duty specializes in identifying and providing industrial power quality solutions. Sola/Hevi-Duty's products include uninterruptible power systems, power conditioners, voltage regulators, shielded transformers, transient voltage surge suppressors and power supplies. The company has a history of product innovations and excellence in customer support dating back to the early 1900's.

Our new SCP-X sealed 24 VDC field power supply lowers the cost of delivering field power to machines by eliminating separate power supply enclosures and simplifying power supply wiring.

The addition of widely-used DIN Mini Connections adds to the flexibility and possible applications for a field power supply. The 1 0 115 VAC input side uses a three-pin EN1775301-803 (formerly DIN 43650) male Mini connector, and the DC output side provides 24 Vdc power through a four-pin EN1775301-803 (formerly DIN 43650) female Mini connector.

A wide variety of adapters are available to easily connect the unit to virtually any connection style. Unlimited devices can be operated from a single power supply as long as continuous power consumption does not exceed 94W (3.8A).

For a detailed explanation of our new SCP-X power supply including complete specifications, please visit http://www.solaheviduty.com/news/SCPX.htm.

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