SEW EURODRIVE

White Paper

DECENTRALISED CONTROL

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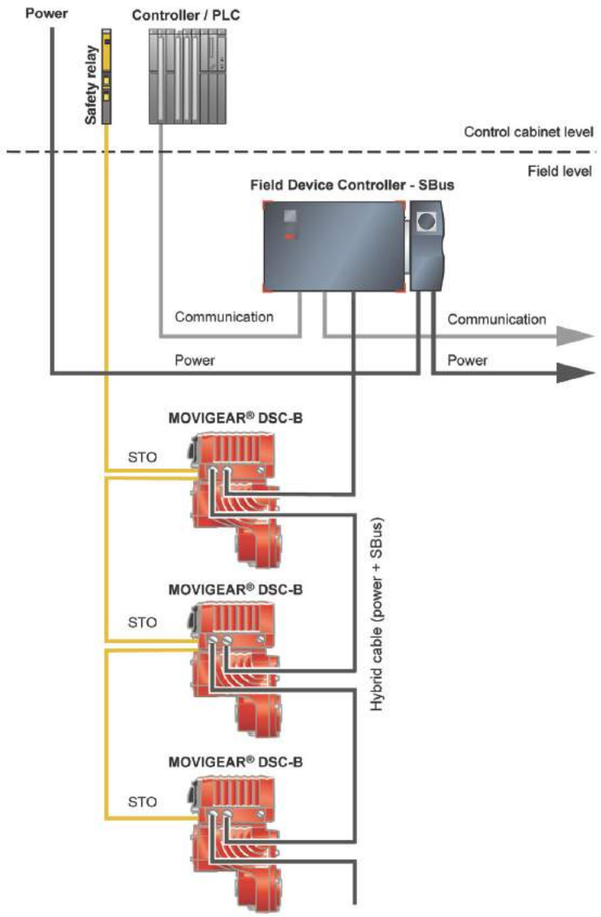

WHAT IS DECENTRALISED CONTROL?

Q. How is control decentralised?
A. In a decentralised control system, motor control functions are removed from a central control cabinet and distributed out on a machine, so that control devices are located closer to the machine's motors.

Q. Is there more than one way to decentralise control?
A. There are many levels of decentralisation, from a motor starter or drive located at the motor to a fully decentralised system with a variable frequency drive, overload protection, motor disconnect switch, I/O and bus module, all combined in a single package that is installed on or near the motor. This package is often called a field distributor.

Q. What are the advantages of decentralised control?
A. There are many benefits that can be gained by decentralising motor control. Chief among these are significant cost savings in engineering time and materials, including less wiring and smaller control panels, reduced installation times through drive and motor pre-commissioning, improved machine performance, less maintenance and fast replacement of electronic components without wiring.

Q. How long has decentralised control technology been available?
A. Decentralised control was first implemented in Europe beginning in the early 1990s. The automotive industry was the first to adopt it because it simplified production line changes and reduced engineering and maintenance costs. Now it's being considered in many different applications like material handling and logistics.

APPLICATIONS

Q. Is decentralised control the right solution for every application?
A. As a rule of thumb, decentralised control is best for applications involving ten or more motors. These include the large conveyor systems used in material handling applications such as logistics or packaging or automotive assembly. Typically, those systems cover large amounts of floor space and require extensive wiring with a centralised control scheme.

Q. What are some typical applications?
A. Applications that require multiple motors and take up a large amount of floor space are best suited for decentralised control systems. These include any conveying process, rotary and lift tables, as well as automotive assembly, food and beverage processing, packaging, warehouses, logistics and other materials handling applications.

SAVING MONEY

Q. How much money can be saved by using a decentralised control system?
A. In our field tests, total savings of up to 30 percent were achieved compared to a centralised control system. The savings were due to less engineering time, fewer components and less wiring, smaller panels, smaller PLCs, and faster installation, debugging and commissioning.

Q. Can you give an example of a typical application and how much savings can be achieved by using decentralised control?
A. Consider a bottling line that uses 200 meters of conveyor and 50 off 0.75 kW motors. In wiring alone, for example, a decentralised control system would reduce the amount of power cable from 3000 meters to 700 meters. Field installation time would decline also because there are fewer components. In comparison to the total cost for building and installing a centralised control system for this bottling line, including panel construction, cable, cable tray, components, drives and labour, and decentralised control, the price difference is approximately 40% in favour of decentralised system. You can see there are huge potential savings for both OEMs and their customers.

Q. Why are control panels smaller?
A. Panel building costs are particularly significant in centralised systems because of the large number of components required, including overload protection, drives and bus gateways, as well as the larger panel size needed to accommodate these components. As more electronic components are added, the more heat is generated. Expensive fans and heat sinks are required to dissipate the heat, adding to the cost of building a control system. They also add to the energy costs for operating the system.

In contrast, in a decentralised system, the motor disconnect switch, overload and bus capability are built into the drive, which is mounted near the motor. Local I/O can also be connected without adding the hardware normally associated with doing this, such as terminal blocks, junction boxes and remote I/O modules. Costs are lower because there are fewer components to purchase and panel size is smaller.

Q. How is wiring reduced?
A. Complex wiring systems that run from the control cabinet to the motors are vastly reduced in a decentralised motor control system. With fewer wires, there is less potential for cross-talking noise and EMC interference, a major source of machine downtime. That means less wire to install and less rewiring when production lines must be changed or equipment needs to be upgraded to add sensors or other control devices.

Q. Are maintenance costs also lower with decentralised control?
A. Maintenance of a decentralised control system is significantly less. Commissioning is less complex, there's less wiring to change or repair, and it's easier to troubleshoot and replace a failed component rather than an entire system if problems arise.

PROGRAMMING

Q. Is it difficult to program a decentralised control system?
A. Programming should be simpler, which makes this another source of significant cost savings. In contrast to a centralised control system, which requires a large PLC to accommodate the complex programming needed to govern the entire machine, in a decentralised control system each field distributor carries only the code necessary for a specific set of activities. Since it is possible for all control functions to reside in the drive or field distributor, the PLC can be smaller, which means it is also less expensive. The PLC's primary function becomes system monitoring over fieldbus or Ethernet.

Q. Does decentralised control require a different programming language than ladder logic?
A. If your supplier's system is compatible with the IEC 61131 standard, you have a wide choice of programming languages, including function block diagram (FBD), sequential function chart (SFC), structured text (ST), instruction list (IL) and ladder diagram (LD). Most drives today come with pre-programmed application routines, which reduces programming and debugging time and makes commissioning much faster and simpler.

FIELDBUSES

Q. Do you need to use a fieldbus with decentralised control?
A. Not always. It depends on the unit selected for the application. Many fieldbuses are available with decentralised control.

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Fieldbus allows for a more extensive and complex exchange of important data which can include control data, speed, ramp, unit status and other information. The use of fieldbus networks for monitoring and control is widespread in Europe and in the automotive industry around the world, and is now being adopted by many other industries, particularly for material handling applications.

Q. Will I have a choice of fieldbuses?
A. It varies depending on the manufacturer, but many suppliers offer a wide range of common fieldbus options, including Modbus Ethernet TCP/IP, Profibus and Profinet, EtherNet/IP, DeviceNet and ASi Interface.

Q. Can binary control be used in a decentralised system?
A. Binary control using discrete I/O as an alternative to a fieldbus is also possible.

Q. Will I need a PLC for decentralised control?
A. When using a fieldbus it is necessary to use a PLC. The size of the PLC and program can be reduced if the decentralised unit has programming capability that allows control routines to be carried out in the drive. This decreases the program size of the PLC and the scan times of the system.

MOTORS AND DRIVES

Q. I've heard that drives used in a decentralised control system should be oversized to withstand 150 percent of the normal motor operating current?
A. That's not true. The drives in a decentralised control system should be sized exactly the same as in any control system. If you have a 0.75 kW motor, you need a 0.75 kW drive. In most cases, you need to size the motor and drive for the application. The only time you might need to oversize the motor and drive is in a high cycling operation where a high starting torque is required, but this type of application is very rare.

Q. Will I need an external motor disconnect?
A. Most decentralised systems are available with an integrated motor disconnect switch further reducing the amount of external components required.

Q. Should I use a variable frequency drive or a starter for my system?
A. It depends on your application. A starter, even a soft starter, will not modulate starts and stops as well as a variable frequency drive. There is very little price differential between starters and drives today.

Q. Can you govern multiple motors with one drive?
A. An SEW decentralised control system like MOVIFIT® enables one drive to control up to three MOVIMOT® motors. The three MOVIMOT® motors are addressed as one node on the fieldbus, but each is individually controlled by the MOVIFIT® controller. With 62 potential nodes, an SEW system can control up to 186 motors. Other systems require a drive and a fieldbus node for each motor. This means the maximum number of motors that can be controlled on those systems is 62.

Q. How is motor brake control handled?
A. Motor brake control is integrated into SEW systems. With other systems, you will need to add a separate brake relay. A brake resistor can also be used to dissipate regenerative energy created when a motor is decelerated.

RELIABILITY

Q. The equipment in my factory has to stand up to a lot of abuse. Are decentralised control systems designed for that kind of environment?
A. Look for components that are specifically designed to withstand industrial environments, not just a drive placed in a metal enclosure. SEW, for example, uses an aluminium alloy that resists corrosion rather than standard aluminium for its housings. The housing needs to be rugged so that it can stand up to the abuse typically received by equipment in a factory, including contact with moving equipment like forklifts or maintenance people standing on it, as well as corrosion, dust, oil and moisture. System components also need to be compact enough so that they don't stick too far out into the aisles between machines.

Q. What type of IP rating should I have for my decentralised control system?
A. A minimum IP 65 rating is needed for an industrial environment. In a wash-down environment, an IP 69K rating is recommended.

Q. What does the IP 69K rating mean?
A. The IP 69K or hygienic version of decentralised control systems is designed to resist corrosion on the outside and stay dry on the inside. Sharp edges that tend to collect contaminants and moisture are eliminated and coatings will not scratch or wash off under high-pressure water sprays.

COMMISSIONING

Q. How do I commission the variable frequency drives in my system, and how much time should I expect that to take?

A. With an SEW-EURODRIVE system using optional dip switches, commissioning is as simple as setting the fieldbus address of the device. Drives can also be programmed using software. Because the control code is divided among a system's drives, commissioning typically takes much less time, even when programmed with software, compared to a centralised system with complex programming.

Q. Do I need to use software to commission my system?
A. The answer is yes for most suppliers, but SEW provides a dip switch option that simplifies commissioning when both SEW motors and drives are used. Simply set the dip switches for control and fieldbus address.

MAINTENANCE

Q. How is maintenance different?
Troubleshooting is easier and less labour intensive since technicians no longer need to be stationed at both the control panel and the machine to identify and correct problems. There are also fewer wires and external components, so diagnostics are less complex. Failures are also easier to troubleshoot because many manufacturers locate an LED display on the front of a unit.

Look for a modular system design that allows failed components to be replaced easily without sending the complete unit back to the supplier for analysis or repair. It is much more cost efficient to keep spare components on hand rather than complete spare units. Also ask for pre-wired plug connectors, which reduce maintenance time and replacement costs.

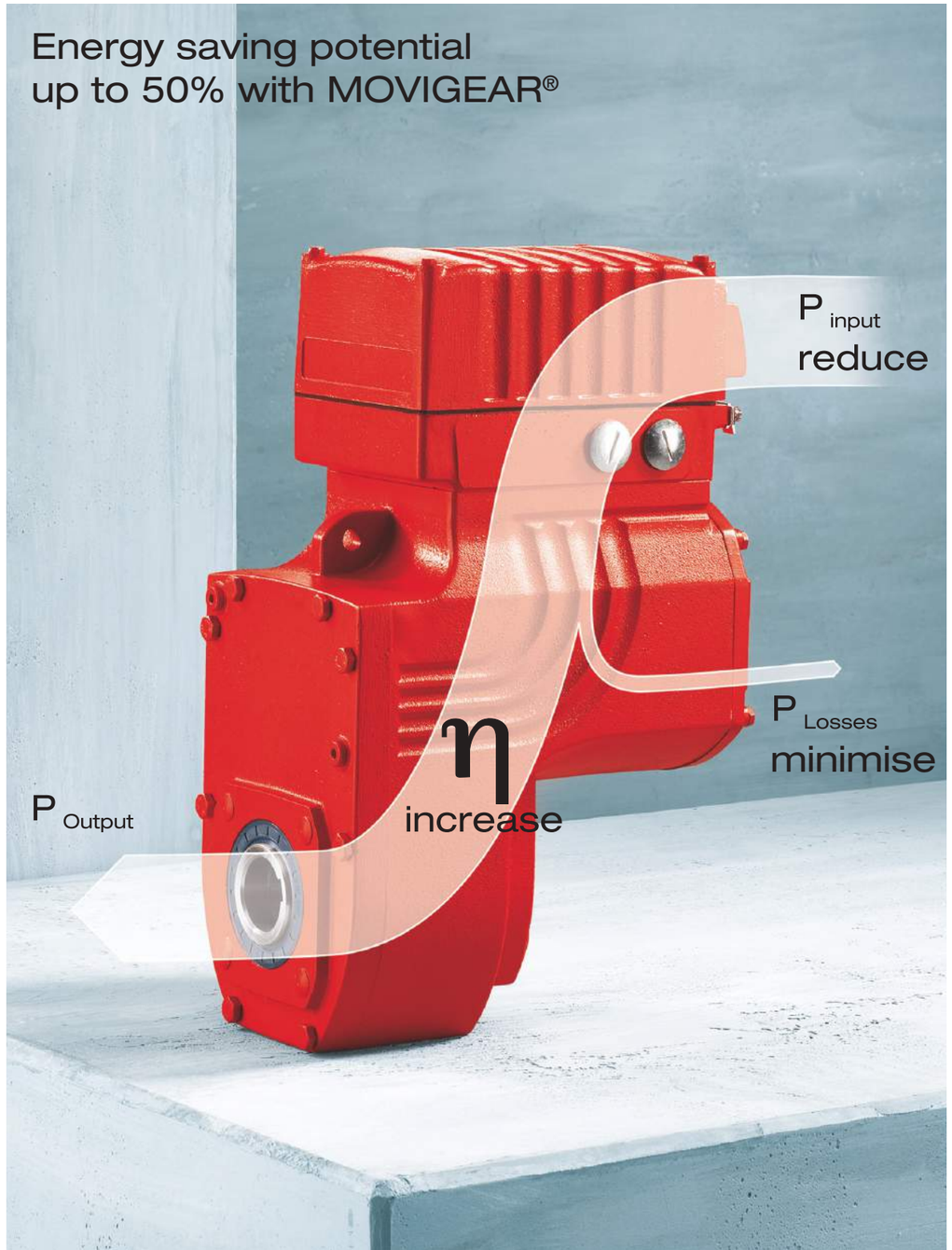
Q. What happens if I have to replace a failed drive or other component?
A. If the decentralised system you're using is simply a drive housed in an enclosure, you will have to replace the entire unit. If you're using an SEW-EURODRIVE solution, you just need to replace the failed component.

Q. Can I reset a fault remotely?
A. Faults can be reset remotely over fieldbus or manually at the machine.

OTHER CONSIDERATIONS

Q. Does a decentralised control system require overload protection?
A. Overload protection against excessive heating due to motor overload is a requirement for any control system. SEW integrates overload protection into its decentralised drive technology. With other systems you will have to add an overload relay.

Q. Do I have to use a safety PLC or safety network?
A. There are many safety system options, including safety PLCs and safety networks. SEW offers a safety concept that meets EN945-1, category 3 by disconnecting the 24 V safety circuit from the drive. This approach eliminates the need for contactors. This safety architecture presents an opportunity for huge savings because you're able to use one safety relay instead of one safety relay and two contactors for each drive.



Q. What type of connection technology is available?
A. There are many connector options available from suppliers like Harting, Phoenix Contact and Amphenol. Customers typically have had to wire a drive to the motor during installation, but with new connector options and plug-in cables, all manual wiring by the customer is eliminated, which reduces installation time and costs and wiring errors.

Q. What are some of the standard options available with decentralised control systems?

A. One of the most common options is a keypad for manual operations, which also serves as a maintenance start/stop for diagnostics and repair. In addition, a wide variety of connector options are available for faster installation and replacement of motors.

Q. What type of cabling is available and do I need to use shielded cable?
A. Shielded cable is required for the 400V motor leads from a panel-mounted drive to protect surrounding equipment from EMC noise problems that often arise from PWM (pulse width modulated) signals sent from the drive to the motor. In a decentralised system, shielded cable is not required for the input power and is only necessary for the short distances between the drive and motor. For all other purposes, standard cables are used. When the drive is actually mounted on the motor, no shielded cables are required.

Q. What type of sensors can I use with a decentralised system?
A. Most any sensor can be used in a decentralised control system, including proximity and photoelectric sensors. Many systems treat each I/O point as a separate node on the fieldbus, which makes the fieldbus system larger. In an SEW control system, only the fieldbus distributor has its own node, so you can add more devices like sensors to your system without using additional nodes.

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Company background:

The SEW-EURODRIVE group is a global designer and developer of mechanical power transmission systems and motor control electronics, headquartered in Bruchsal, Germany. Its broad spectrum of integrated solutions includes geared motors and gear units, high torque industrial gear units, high-efficiency motors, electronic frequency inverters and servo drive systems, decentralised drive systems, plus engineered solutions and after-sales technical support/training.
The Australian division of SEW-EURODRIVE is headquartered in Melbourne and is supported by a network of offices in Sydney, Brisbane, Townsville, Rockhampton, Adelaide and Perth. A comprehensive service and technical support centre is located in Melbourne, and is complemented by production, service and assembly facilities in all mainland states.
SEW-EURODRIVE offers a full 24 hour emergency breakdown service on its products to put customer's minds at ease.
SEW-EURODRIVE can also tailor a training program to equip customers' with a comprehensive set of skills to get the most out of motor and drive technologies and applications. The company's customer base includes large-scale corporations and smaller entrepreneurial enterprises across Australia.

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