



BENSHAW

Applied Motor Controls

AN AMCONEX GROUP COMPANY

WHITE PAPER



Industry 4.0: The Implications for Industrial Motor Control

Rapid | Rugged | Global

The robots are coming

Industry 4.0 follows three previous trends: The lean revolution of the 1970s, the outsourcing phenomenon of the 1990s and automation in the 2000s.

Most sources explain the term “Industry 4.0” as the fourth industrial revolution. First there was steam and water powered machinery to help with production, second the advent of electrically driven machinery to enable mass production, and thirdly the emergence of the computer and the automation and efficiency it could bring to the production process.

Global consulting firm McKinsey has a different view, saying Industry 4.0 follows three previous trends “the lean revolution of the 1970s, the outsourcing phenomenon of the 1990s, and the automation that took off in the 2000s.”

Whatever your definition, Industry 4.0 is certainly about ushering in a new era for industry, with more intelligence and connectivity. That is, combining machines, computers and connectivity to make systems smarter.

In a practical sense that means being able to improve individual machine efficiency and productivity, and raise quality of production. It also means enhancing overall plant performance, making production systems more flexible, and improving safety, maintainability, and even environmental protection.

This Industry 4.0 talk can seem very futuristic, with some suggesting artificially intelligent robots will basically take over most industrial applications. For many engineers and managers, we just have to focus on what’s happening today, and getting the most out of what we have. Rather than worrying about trying to predict the future, we believe a sounder approach is to prepare for a changing world. That’s mainly about making smarter choices – from energy use, to operations and to control.

In industrial motor control there are implications, especially for mature technologies like soft starters. We believe there is a compelling case for the technology, but using it effectively is about taking a smart approach – to system control, to energy and to operations.

Motor control smartens up: A new perspective on soft starting

Technological advances continue to create new possibilities for optimizing system performance. However, realizing the benefits often involves the integration of multiple components into a complete control system. This can be complex, requiring system design, extra component costs and control panel construction.

This is where things get really interesting for motor control. Industry 4.0 requires motor control solutions to smarten up, playing a much deeper role in controlling and connecting machines and other technologies in an industrial application.

The role of the soft starter is being redefined. With the right technical capability (i.e. - interchangeable smart processor cards) it can move from being a smart and efficient way to start and control a motor, to a method for controlling a whole system. By connecting directly to other devices in a system, (i.e. - pressure, flow, and depth sensors in a pumping application), a starter can make a real difference by becoming one central point of intelligent control and communications.

This is especially important to industrial equipment manufacturers, who are having to put more intelligence in their solutions. They can use a smart processor card to combine functions, reduce cost and create more integrated solutions.

EQUIPMENT WHICH COULD BENEFIT FROM A SMART APPROACH TO SOFT STARTERS:

- Air compressors
- Commercial HVACR equipment
- Water, sewage, purification, collection & distribution equipment
- Irrigation equipment
- Crude petroleum & natural gas extraction equipment
- Lumber and saw milling equipment
- Aggregate processing equipment
- Cement plant equipment

Energy needed for the new era: Efficiency drives Industry 4.0

A driving principle of Industry 4.0 is doing more while consuming less energy to achieve it. Industrial motor control needs to be absolutely focussed on this trend.

Over 30 million new electric motors are sold each year for industrial purposes, and 300 million motors are in use in industry, infrastructure and large buildings. These electric motors consume 40% of the global electricity used to drive pumps, fans, compressors and other industrial equipment.

According to the International Energy Agency, electric motors account for 69% of total industrial electricity consumption in the world. For industrial motor control that means selecting the right kind of technology. If a process does not benefit from varying the speed, then fixed speed motor control is the most energy efficient solution.

Around 80% of motor applications are most effective with fixed speed. Selecting the correct control mode for the application (fixed speed or variable speed) is critical for true energy efficiency.

SOFT STARTERS CAN DELIVER ENERGY EFFICIENCY GAINS WITH FIXED SPEED:

- Many applications within the **water & wastewater industry** can benefit from the use of a soft starter, from pumps and separators to aerators and milliscreens
- Pump, compressor, blower, fan and centrifuge applications in the **oil & gas industry**
- **Mining & quarrying** – auger, blower, compressor, conveyor, crusher, hydraulic power pack, mill, pump, vibrating screen
- **Sawmilling** – bandsaws, circular saws, debarkers, chippers and edgers
- **Building services** – compressor, escalator, fan, pump and moving walkway applications

RESPONDING TO PREMIUM EFFICIENCY MOTORS

Around the world engineers are embracing the use of new generation “premium efficiency” motors, and governments have sought to regulate their use. IE3 motors are now mandatory in Europe for new installations between 7.5 k W and 375 kW, in line with other jurisdictions around the world.

IE3 motors are more efficient than IE2 motors. The improved efficiency results in lower lifetime energy usage and energy costs, which has obvious value. However, other IE3 motor characteristics are affected by the changes made to achieve this efficiency.

These new motors do pose some motor starting issues. Key among these are:

- Higher inrush and starting currents that stress electrical supply circuits.
- “Spiky” pullout torque curves that can make smooth control of acceleration and deceleration more difficult.

Soft starters can make a difference by:

- Limiting inrush and starting current to the minimum necessary to start load. Using the right amount of energy for motor starting enables design of efficient distribution circuits and prevents breaker trip due to motor starting.
- Precise control of the starting and stopping of IE3 motors. A soft starter needs to offer control over acceleration and deceleration to cater for motors with tough torque curves.

THE MOST ENERGY EFFICIENT OUTCOME FOR FIXED SPEED APPLICATIONS

99.5%
Efficiency

An internally bypassed soft starter is 99.5% efficient when running.

80%
Reduction in
wasted energy

Compared to a misapplied drive the 99.5% efficiency of a soft starter equates to around an 80% reduction in waste energy.

0%
Harmonics

The soft starter produces no harmonics during run, improving overall power quality and eliminating system losses resulting from harmonics.

Reducing the human touch: Making it easier

Industry 4.0 also means more automated and easier operations of industrial machines. Engineers and other technical staff have to do more with less, so time saved on setup and installation is critical. Reliability and uptime are important, as is the ability to automate as many routine features as possible.

INDUSTRY 4.0 READY SOFT STARTERS OFFER THE FOLLOWING ADVANTAGES:

1. Ease of use for technical staff

A graphical display with the capability to accommodate multiple languages is crucial to making information easily available on the ground. Whether it is during commissioning, operation monitoring or maintenance the right data must be easily accessed by technical staff.

Built-in intelligence such as application setup menus make installation and commissioning easier and faster. The ability to replicate these settings across multiple starters by extracting parameter information using a standard protocol like USB is also important.

2. Ability to extract and share data

Connecting with other devices and support services must be straightforward, including a range of communications modules enabling network connections.

For efficient maintenance and support, technicians typically require a USB port to allow the upload, download and storage of starter and performance information as well as the updating of firmware to ensure latest feature availability.

Mobile technology is also being leveraged by soft starter manufacturers, with smartphone app access to extracting starter and performance information for analysis and sharing.

3. Automation capabilities

Built in timers and schedulers improve system efficiency and allow operations to be tailored to a site's requirements. Automatic resets and flexible protection options are able to be programmed to eliminate manual interventions and ensure continued operation.

4. Operational reliability

While offering advanced capabilities a soft starter must continue to be a rugged and resilient piece of equipment in any industrial setting. That means the inclusion of starter, motor and system protection functions and associated notification and alarm capability, and features like emergency override to bypass all protections for a situation when the machine simply has to run.

Conclusion

Much of the talk about Industry 4.0 is long on hype and short on practical implications. However we believe looking ahead to what the world of Industry 4.0 will bring tomorrow helps us think about how we can improve the application of motor control solutions today. For soft start technology this opens up considerable opportunity to make a broader and smarter contribution.

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