Smooth ride from the start

PST: The Softstarter that speaks your language

Helena M. Johansson, Sören Kling

Have you ever experienced the abrupt start-up of a conveyor belt or an escalator? Have you encountered the brief dimming of lights when a motor starts? Such sudden transients are not only inelegant and uncomfortable, but they can cause disruption and damage. The brief current inrush on the motor and the resulting voltage dip may cause interference and malfunction of other electrical devices. The sudden torque peak can cause stress, wear and ultimately failure of mechanical drives, belts and couplings. It also leads to surges on pipelines, damage to products on conveyor belts or uncomfortable escalator rides.

Programmable soft starters for regulating motors at start-up have long been available and have grown increasingly sophisticated in their capability and adaptability. ABB's new PST Softstarter range takes these strengths one step further: Rather than having to be set up by entering cryptic codes, PSTs communicate clearly in plain language through a simple ergonomic interface. Setup and diagnosis are as simple as using a mobile phone. Intuitive menus with text in any one of twelve languages allow the user to set up the PST without having to consult a manual. Machine to machine communication is also revolutionized: By using the ABB FieldBusPlug technology, the PST Softstarters make full use of leading communication protocols.

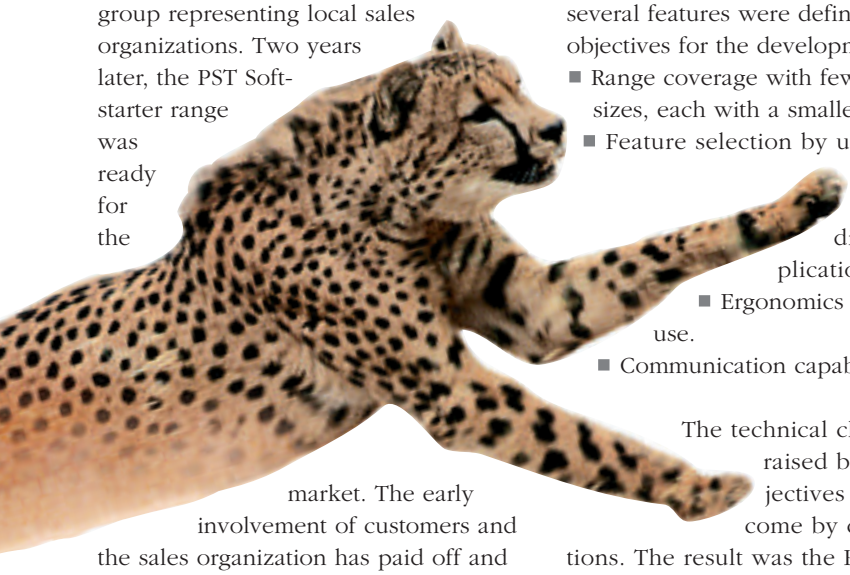
AC motors are highly versatile and economical and are used in numerous applications such as fans, crushers, agitators, pumps and conveyors. However, making start-up as simple as flicking a switch is far from trivial. Full-voltage starting (DoL starting) leads to excessive peaks on the current and torque while causing equally unacceptable voltage drops 1.

Such disturbances can cause real costs through overload of the electricity network and strain on the mechanical drive. More maintenance is required, which in turn leads to higher costs and increased down time. Protective circuitry can help alleviate the problem, but soft starters have established themselves as the more customizable and flexible solution.

ABB is a leading supplier of soft starters for industrial, commercial and building applications worldwide. ABB's Softstarters are used, for example, in pulp and paper, marine, food and processing industries and in water-works and utilities.

PST – more than just a starter

The concept for a new generation of soft starters was developed during 2001 with the involvement of customers from several industries and an ABB focus group representing local sales organizations. Two years later, the PST Softstarter range was ready for the market. The early involvement of customers and the sales organization has paid off and the new product was accepted with enthusiasm.



PST/PSTB Softstarters are available for operating voltages from 208 to 690 V AC and full load line currents from 30 to 1050 Amps. When connected as a star-delta starter inside the motor delta, a PSTB Softstarter can start motors with current ratings of up to 1810 Amperes.

The PST/PSTB range complements the existing PSS Softstarter range introduced in 1999, which covers currents from 3 to 515 Amperes.

During the product specification phase several features were defined as prime objectives for the development teams:

- Range coverage with fewer physical sizes, each with a smaller footprint.
- Feature selection by user to easily adapt Softstarter to different applications.
- Ergonomics and ease-of-use.
- Communication capabilities.

The technical challenges raised by these objectives were overcome by creative solutions. The result was the PST Softstarter family.

Physical size

ABB's Softstarter PST/PSTB palette comprises only five physical sizes 2. This fact combined with the wide voltage range that each starter can cope with, simplifies variant diversity. Stocking and ordering logistics are simplified and the same models are used worldwide. This not only facilitates export activities but also helps global customers who can design the same product into their application all over the world.

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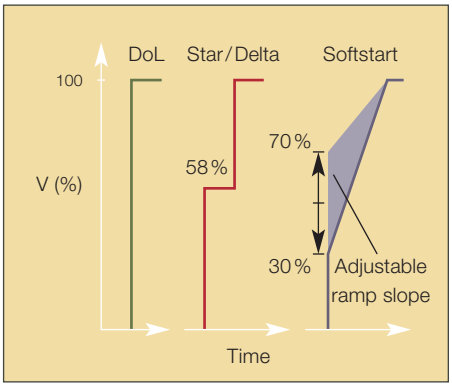
Feature selection

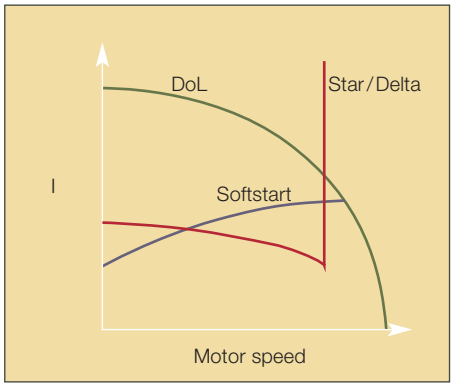
The new Softstarter generation incorporates a number of advanced features including:

- Customizable digital functions for start and stop ramps, kick-start, jog, step-down voltage, current limit and functions for sequential starts of multiple motors or multi speed motors.
- Functions for protecting motor such as electronic overload with dual function, locked rotor, phase-loss, motor-

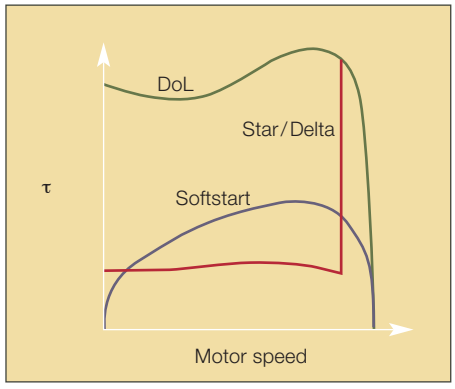
1 Graphs showing the basic differences between direct-on-line (DoL), star-delta and soft starting in terms of the motor voltage (V), motor current (I) and motor torque (τ).



Motor voltage



Motor current



Torque

2	ABB's Softstarter PST/PSTB palette comprises only five physical sizes.

underload, phase reversal and phase imbalance.
- Real time clock and logging of events with time stamping.
- Network communication with, for example, Profibus®, DeviceNet™, or Modbus using ABB's FieldBusPlug technology.

Ergonomics

What really sets PST apart from other soft starters is its user-friendliness. The ergonomics of the keypad interface and the compact and modern design of the product allows for rapid installation, set-up, control and easy use of all the advanced features. The design allows users to customize the functionality for their specific needs in all types of applications.

Additionally, the PST Softstarter is pleasing to the eye. Behind the appealing design is Design Group Italia, which successfully styled a modern product range within the existing ABB guidelines 3. Although bold, the PST Softstarters are designed to match and complement low voltage products from the ABB range.

Communication capabilities

PST has three communication modes. Besides the easy human to machine communication via the keypad and LCD display, the starter can be controlled by traditional hard-wiring or bus connections. The latter uses ABB's flexible FieldBusPlug (see box on Page 26), which ensures a quick and simple connection to the bus 4.

Ease-of-use

The PST Softstarter has a large two-line graphical liquid crystal display (LCD). With a four button keypad and an easily understandable menu structure, it is as simple to operate as a mobile phone. The LCD interface displays plain text in any of twelve selectable languages (English, Chinese, German, Italian, Spanish, French, Finnish, Swedish, Dutch, Portuguese, Russian and Turkish). The interface is intuitive and does not require the user to study paper manuals or learn cryptic codes.

Standard settings are available for many common applications such as driving pumps, conveyors, mixers and crushers. Customized settings are easy to implement, for example for specific start/stop profiles, sequence starting of up to three motors and advanced warning profiles.

Data such as motor current and voltage, start counts, running time and motor temperature can be accessed via the display at any time. If a fault should occur, this is also indicated on the LCD in clear text in the selected language.

By communicating clearly in the user's native language, a PST Softstarter permits quick access to status information and easy troubleshooting and reduces the risk of misinterpretations. If desired, the user can set a password to prevent unauthorized changing of the settings.

> The PST Softstarter has a built-in fieldbus-independent interface that facilitates connection to any existing protocol.

Benefits are faster fault-finding and restart, which result in reduced stop times, hence enhanced production levels. An important customer objective has been met.

Flexible fieldbus communication

The PST Softstarter has a built-in fieldbus-independent interface that facilitates connection to any existing protocol within the FieldBusPlug range. This means that every PST unit can be connected to any of the AS-Interface, Profibus DP®, DeviceNet™,or Modbus protocols. This interface can be used to control the Softstarter, acquire status information and set or inspect parameters.

The interface between the PST and the FieldBusPlug is standardized. Any fieldbus protocol can be used, even if this is defined at a later date than the starter, because the protocol is defined in the FieldBusPlug itself. This creative solution allows the customer to choose the fieldbus independently of the choice of Softstarters giving him the flexibility he desires.

An option launched in 2004 is an external keypad. This is an extended human to machine interface that gives the user access to all functions, even when away from the panel door. All assembly details are included in the kit, including a 3-meter communication cable. If used handheld, it can be used for fast setting-up of parallel soft starter units as settings can be uploaded from one unit and downloaded to another. Mounted on the panel door, the keypad fulfils the ingress protection standard IP66.

Perfect protection

The PST incorporates an advanced electronic motor overload protection that can be set to four tripping classes (10 A, 10, 20 and 30). It is also possible to select the overload protection so that one tripping class applies during the start-up and another during continuous running (dual overload protection). In a heavy-duty application, for example, tripping class 30 may be used at start-up, to be replaced by the more sensitive class 10A during normal operation. If required, underload protection can also be set. This can be used to detect that a motor is running without load, as may occur when a belt breaks or a pump runs dry.

3	Design Group Italia has designed a modern product range within the existing ABB guidelines.

4	ABB's flexible FireldBusPlug, a device that contains the electronics to interface between the device and the bus, ensures a quick and simple connection.

Furthermore, the PST provides protection against locked rotor, phase-imbalance, phase-reversal and against over-current. These customizable protection features reduce nuisance tripping while still ensuring a high level of motor protection.

In addition to these advanced motor protection capabilities, PST has a built-in self-protection to prevent damage to the starter through overload. Even so, PST Softstarters are robust and designed to continuously handle 15% over-current. This is useful when the motor is used for higher than rated load, which is possible when the motor has good cooling conditions or works at low ambient temperatures.

Early warning system

Another powerful feature of the PST is that it permits the user to define application specific warning systems to avoid unnecessary downtime. For example, the soft starter can detect a pump running without water and automatically signal water to be filled, or detect a conveyor or driving belt without load and send a warning to the operator. By custom defining the highest and lowest tolerable current, motor and thyristor loads, the PST can signal a warning before any real fault occurs, so enabling preventative intervention.

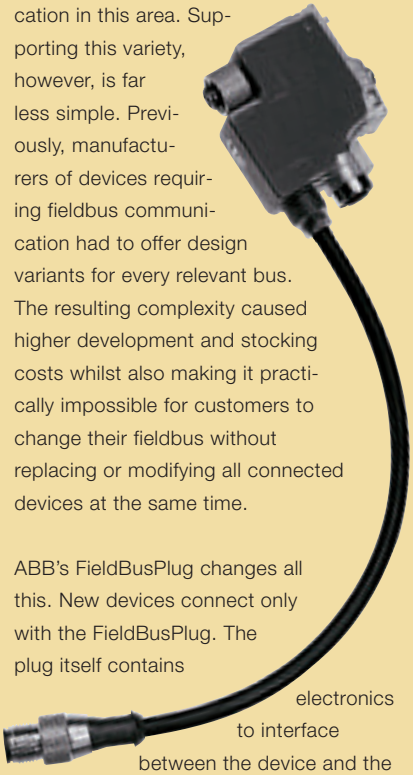
Optimization of space and equipment

As with ABB's PSS range, a PST Softstarter can be connected in-line with the motor or inside the delta circuit of a motor as a star-delta starter. Inside delta connection reduces the maximum current load of the starter by a factor of $1/\sqrt{3}$. This reduces space

Field Bus Plug

A fieldbus is a communication system for exchanging information between field devices, sensors and actuators.

When it comes to selecting a fieldbus standard, the customer is more than spoilt for choice. Some common fieldbuses are AS-Interface, DeviceNet, Foundation Fieldbus and Profibus. Increasingly Ethernet is also finding application in this area. Supporting this variety, however, is far less simple. Previously, manufacturers of devices requiring fieldbus communication had to offer design variants for every relevant bus. The resulting complexity caused higher development and stocking costs whilst also making it practically impossible for customers to change their fieldbus without replacing or modifying all connected devices at the same time.



ABB's FieldBusPlug changes all this. New devices connect only with the FieldBusPlug. The plug itself contains electronics to interface between the device and the bus. FieldBusPlugs are available for the principle fieldbuses on the market.

Customers buying FieldBusPlug compatible devices can remain loyal to their preferred fieldbuses and can continue to use older devices.

ABB is committed to supporting and developing the FieldBusPlug for many years to come. FieldBusPlug compatible devices manufactured today will be able to work with future fieldbus generations, protecting the customer's investment and simplifying the future changeover.

For more information, please see ABB Review 1/2002, pages 30-34.

and costs by allowing a smaller and less expensive starter to be used. PST automatically detects the connection mode, which means that no special settings are necessary.

The larger sized starters (PSTB 370 to PSTB 1050) have a by-pass contactor built into the unit. When the motor is running at full voltage, the starter is by-passed and the motor connected directly from the supply line. This reduces power losses and permits a more compact design. Power losses during normal operation are reduced by 90 percent or more; energy is saved and environmental impact reduced. The integrated protection functions continue to be enabled even when the starter is by-passed.

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Further savings are made possible through the space saving design of the unit and the faster installation (the wiring is already configured inside the unit). A recent example is an electrical utility in the USA where the customer fitted 14 PSTB's in seven enclosures with a total width of 4.2 m. In the previous configuration, the customer used 14 enclosures occupying twice the space! Yet another customer objective is met.

Sophisticated relay features

The smaller units (PST 30 to PST 300) do not have built-in by-pass contactors. However, economical bypass operation is still possible: Signal relays are provided on the PST series for controlling external contactors.

The function of the three potential-free relays is individually programmable to *Run*, ie, the soft starter is feeding the motor, *Top Of Ramp*, ie, the motor is at full voltage and the relay can enable the by-pass, and finally *Event*. When the Event option is selected, a signal for protections, prewarnings, fault signals or a combination of these can be defined. Any of the numerous events can be turned on or off individually.

No need for additional equipment

The new PST Softstarter generation integrates many functions that previously had to be implemented separately. The PST is not just a soft starter, but integrates an overload relay, an underload sensor, an ampere meter, a PTC relay (protecting against overheating) and for the larger sizes, a by-pass contactor.

This has great advantages in terms of space savings and reduced wiring and installation time. It also simplifies selection, ordering, commissioning and trouble-shooting. Because all functions can be adjusted and monitored through a single user interface, and the unit is complete and tested on delivery, considerable time and money is saved.

The PST series has had a smooth run right from the start.

Helena M. Johansson
Sören Kling
ABB Automation Technologies AB
Västerås, Sweden
helena.m.johansson@se.abb.com
soren.kling@se.abb.com