



ABB PSE Softstarters: Features, Specifications, and Benefits

Figure: ABB PSE Softstarters are compact digital soft starters with built-in control interfaces and advanced motor protection features.

Introduction

Soft starters are electronic devices that manage the **gradual acceleration and deceleration of electric motors** to mitigate the mechanical and electrical stress of direct-on-line starting. Unlike across-the-line starters or star-delta starters (which can still cause current spikes and torque surges), a soft starter ramps the motor voltage, resulting in a **smooth startup and stop**. ABB's **PSE series softstarters** exemplify this technology as a *general-purpose, mid-range solution* that balances high starting performance with cost-efficiency. The PSE series is marketed as a **"true general purpose softstarter"** – offering a **perfect balance between high starting capacity and affordability**, and the latest generation even includes **built-in fieldbus communication** for modern industrial networks [ABB PSE Softstarter Product Page](#). In the context of ABB's softstarter lineup, the PSE is known as the "efficient range," positioned between the smaller PSR series and the high-end PSTX series. It was **the world's first compact softstarter to integrate both electronic motor overload protection and torque control**, making it especially effective for pump applications that require controlled stopping without water hammer [\[ABB Softstarter Catalog\]](#). In the sections below, we will explore the PSE series' technical specifications, key features, and the practical benefits it provides in real-world motor control applications.

Key Technical Specifications

The **ABB PSE softstarter series** covers a wide range of motor sizes and system requirements through its robust specifications:

- **Motor Voltage Range:** Operates on mains voltages from **208 V up to 600 V AC** ($\pm 10\%$ tolerance), making it suitable for both North American and international power systems [ABB PSE Softstarter Product Page](#). This wide voltage range means a single product family can be applied in many regions and industries without modification.
- **Motor Current Ratings:** Available in models from **18 A up to 370 A** continuous current capacity. This corresponds roughly to motor power ratings from about 3 kW up to 200–250 kW (e.g. **~5 HP to 300 HP** depending on voltage) – covering the needs of everything from small pumps and fans to fairly large industrial motors [ABB PSE Softstarter Product Page](#). There are about 15 standard frame sizes/ ratings within this series to closely match the motor FLA (Full Load Amps) for optimum performance.
- **Control Supply Voltage:** An **universal control input range of 100–250 V AC, 50/60 Hz** is supported, which means the PSE's internal electronics can be powered from virtually any common control voltage without needing separate variants or transformers [\[ABB PSE Series Technical Datasheet\]](#). This flexibility simplifies design and inventory, as one softstarter model can accommodate different control power arrangements.



- **Built-in Bypass Contactors:** All PSE units include an **integrated bypass** contactor that closes after the motor is up to speed. This feature reduces internal heating and energy losses once the motor is running at full voltage, improving efficiency and prolonging the life of the power electronics [ABB PSE Series Features \(Klinker & Born Industry\)](#). The built-in bypass also **simplifies installation** (no need to wire an external bypass contactor) and contributes to a more compact overall starter design.
- **Environmental Ratings:** The PSE softstarters are designed for **harsh and wide-range environments**. They operate in ambient temperatures from **-25°C to +60°C** (-13°F to 140°F) without issue, with proper derating above 40°C as needed [ABB PSE Series Features \(Klinker & Born Industry\)](#). Additionally, all circuit boards in the PSE have a protective conformal **coating to guard against dust, moisture, and corrosive atmospheres**, ensuring reliable operation in challenging settings like wastewater plants or coastal facilities. The devices are rated for up to 4,000 m elevation and carry an ingress protection of IP20 on the control terminals (IP00 on the main power terminals, as is typical for open-type starters meant to be mounted in an enclosure).
- **Certifications & Standards:** ABB PSE softstarters meet global standards and carry certifications including **CE**, **cULus** (for North America), **CCC** (China), **EAC** (Eurasian), **KC** (Korea), and others, as well as marine approvals from bodies like ABS, DNV, and Lloyd's Register [ABB PSE Softstarter Product Page](#). This broad compliance makes them suitable for worldwide deployment and even in marine/offshore applications where specialized approval is required.

In summary, the PSE series offers a **wide operating envelope** that covers most low-voltage motor applications in the low-to-medium power range. Its integrated design (built-in bypass and protections) and tolerant electrical specs make it a versatile choice for standardizing across different projects.

Key Features and Functionalities

Beyond raw specifications, the ABB PSE Softstarter includes a number of *advanced features* that enhance motor control, protection, and ease of use:

- **Integrated Motor Protection:** A standout feature of the PSE is its **built-in electronic motor overload protection**. The device can perform the function of a thermal overload relay, tripping to protect the motor if it overheats or exceeds a current/time threshold. It supports **adjustable trip classes (10A, 10, 20, 30)**, allowing coordination with different motor starting profiles and cooling times [ABB PSE Series Features \(Klinker & Born Industry\)](#). By having this protection integrated, **no separate overload relay is needed**, which saves panel space and simplifies wiring. Additionally, the PSE monitors for **underload conditions** – for example, detecting a sudden drop in motor torque or current that could indicate a broken belt or a pump running dry. If an underload is detected (below a set threshold for a certain time), the unit can trip to prevent damage (such as a pump running dry which could overheat or a fan running with a broken coupling). The PSE also provides **locked-rotor (stall) protection**, immediately stopping the motor if it fails to accelerate (for instance, a jammed conveyor or pump) to avoid drawing excessive current or burning the motor. These embedded protection functions give a level of motor safety comparable to dedicated motor protection relays, all within the softstarter unit.
- **Torque Control for Smooth Starting and Stopping:** The ABB PSE was the *first compact softstarter to include torque control, which is an advanced method of managing motor voltage ramp to directly control motor torque*. In practice, this is especially useful for pump applications: **torque control allows for a “soft stop” that avoids the rapid deceleration and flow reversal which causes water hammer in pipelines**. Instead of simply cutting power and letting a pump



freewheel to a stop (or even a linear voltage ramp down), the PSE can manage the motor's deceleration in a way that keeps the pump's hydraulic dynamics stable. ABB highlights that using the PSE's torque control stop can eliminate water hammer, thereby prolonging the lifetime of the pump and piping system and reducing maintenance downtime caused by pressure surges [ABB Softstarters Overview – Motor Starting Solution](#). This feature was developed in collaboration with pump manufacturers and is a major reason the PSE (and its larger ABB siblings) are popular in water and wastewater industries. Additionally, torque control can provide smoother soft starting for high-inertia loads, ensuring that the motor accelerates with controlled torque, which can prevent mechanical stress like belt slippage or sudden jerks.

- **Current Limiting and Kick Start:** For applications where controlling the **inrush current** is critical (such as weak power supply networks or generator-powered sites), the PSE allows an **adjustable current limit** during startup. The user can set a limit between **1.5× to 7× the motor's nominal current** [ABB PSE Series Features \(Klinker & Born Industry\)](#). The softstarter will modulate the voltage to keep the current around that level, sacrificing some acceleration if necessary to avoid tripping feeders or causing excessive voltage drop. This ensures a secure start even when the available short-term power is restricted, improving system reliability. Conversely, in some cases a **high breakaway torque** is momentarily needed – for example, to **start a heavily loaded conveyor or a pump that has a stuck impeller**. For these scenarios, the PSE offers a “**Kick Start**” feature: it briefly applies a higher voltage (or torque boost) at the beginning of the ramp to dislodge the load, then resumes normal soft start ramping. The kick start (a short burst, often a second or less at a higher voltage) can help overcome static friction without resorting to across-the-line jolts, and then the motor accelerates smoothly [ABB PSE Softstarter Manual – Features](#). Together, the current limit and kick start functions give the user fine control to handle both *weak supply* issues and *tough load* issues.
- **Analog Output Monitoring:** The PSE softstarter provides a **4–20 mA analog output** proportional to the motor's current (or power). This can be wired to an external ammeter or a PLC analog input to continuously monitor the motor's operating current in real time [ABB PSE Series Features \(Klinker & Born Industry\)](#). For example, an operator interface could display the motor amperage during startup and running, or a control system could use the analog feedback for advanced functions like load monitoring or predictive maintenance. This built-in feature eliminates the need for a separate current transformer and transducer for basic current monitoring, further simplifying the system design.
- **User-Friendly Interface:** ABB has equipped the PSE softstarters with a **digital human-machine interface (HMI)** to make setup and operation straightforward. On the front of each unit is a **compact display (LCD or 7-segment display with symbols) along with a four-button keypad** [ABB PSE Series Features \(Klinker & Born Industry\)](#). The menu system is language-neutral (using icons and codes) and allows users to configure parameters like ramp time, start/stop profiles, protection set-points, etc., without needing external software. During operation, the display can show status information such as current, voltage, and any warnings or fault codes. This local interface greatly eases commissioning and troubleshooting. For added flexibility, ABB offers an **optional remote keypad (external HMI)** that can be panel-door mounted (with IP66 protection) [ABB PSE Series Features \(Klinker & Born Industry\)](#). The external keypad can both program the device and mirror its display readings, which is useful if the softstarter is installed inside a cabinet – operators can access the controls without opening the enclosure. The external unit can also **copy parameters** from one softstarter to another, simplifying the setup of multiple units with the same configuration.
- **Communication and Automation Integration:** In modern control systems, integration with PLCs and plant networks is a key advantage. The **newest generation of ABB PSE softstarters includes built-in Modbus RTU** communication as a standard feature, enabling direct connection to common fieldbus networks [ABB PSE Softstarter Product Page](#). Using Modbus RTU over RS-485, users can



start/stop the motor, adjust settings, and monitor statuses (like current, faults) remotely via a PLC or SCADA system. In addition, ABB provides optional plug-in modules (using the ABB FieldBusPlug system) to interface with **Profibus DP, DeviceNet, CANopen, or Modbus TCP** networks [ABB PSE Series Features \(Klinker & Born Industry\)](#). This means the PSE can seamlessly join virtually any industrial communication environment. For example, in a plant with a Profibus-based control system, a simple add-on module enables the PSE to be a node on that network, allowing centralized control of starting/stopping and real-time monitoring of each motor's performance and alarms. This **network capability** significantly improves maintenance and operations: as one case study showed, the ability to **receive diagnostic warnings remotely** from the softstarter (instead of only via local indicators) allowed maintenance staff to respond more efficiently and avoid unnecessary travel to each motor site [ABB Case Study – Höganäs Water Plant](#). Overall, the PSE's communication features support integration into Industry 4.0 and IIoT strategies, where motor data and health can be tracked continuously for preventive maintenance and optimal control.

In summary, the ABB PSE softstarters are **feature-rich devices** that not only provide gentle motor starting and stopping, but also incorporate many functions that would otherwise require separate components or systems. By combining **soft start/stop control, motor protection, user interface, and communication** in one unit, the PSE simplifies design and enhances the capabilities of motor control centers.

Benefits and Real-World Application Examples

Implementing PSE softstarters can yield significant benefits across a variety of industries. Here are some **key advantages and real-world examples** demonstrating how the PSE helps customers solve common motor starting challenges:

- **Reduced Electrical Stress and Energy Savings:** One of the primary reasons to use a soft starter is to **reduce the inrush current** drawn by large motors. High starting currents can cause voltage dips in the network and incur higher peak-demand charges from utilities. With the PSE, users have documented substantial reductions in starting current. For instance, **Rhoss**, an Italian HVAC equipment manufacturer, replaced direct starters on their scroll compressors with ABB softstarters and managed to **cut the inrush current by 60%** while still achieving the required fast acceleration for the compressors [ABB Case Study – Rhoss \(Italy\)](#). This dramatic reduction in start current meant less stress on the facility's electrical supply and on the motors themselves, leading to lower heating of electrical components and improved system reliability. Additionally, by using the **built-in bypass** and only using the power electronics during startup, the PSE minimizes energy losses during steady-state operation. Compared to older reduced-voltage starters or soft starters without bypass, the energy dissipated as heat is much lower, improving efficiency. In one OEM example, adopting ABB softstarters allowed the panel builder to **eliminate up to 80% of extra components** (like separate overload relays and bypass contactors), **reduce assembly time by 60%**, and **cut total panel cost in half** – all while maintaining performance, which ultimately enabled them to offer more competitive systems to their customers [\[ABB Softstarter Catalog – Xylem Case\]](#). Such savings in component count and wiring also translate to fewer points of failure and lower heat generation, contributing to energy and cost savings over the life of the equipment.
- **Extended Equipment Lifespan and Less Mechanical Wear:** Mechanical systems benefit greatly from soft starting and stopping. By **limiting the torque surges** and **gradually accelerating the load**, the PSE softstarter reduces the stress on drive components such as gearboxes, couplings, belts, and the driven machinery. For example, conveyor belts started with a softstarter experience



far less jerking, which prevents material spillage and reduces stretching and wear of the belt. In pumping systems, as discussed, the torque control soft stop feature can nearly eliminate water hammer. ABB reports that in a large pumping installation, switching to softstarters with torque control led to an increase in pump and pipe lifetime on the order of **100% (double the life)** because the pressure surges were removed [ABB Case Studies – Water Pumping](#). Even if exact figures vary, it's clear that **smoother operation means fewer breakdowns**: one flood control project in Russia found that by using ABB softstarters on their pump motors, they reduced mechanical maintenance costs by about **30%** due to less wear and tear [ABB Case Study – Flood Control Pumps](#). These real-world outcomes show that PSE softstarters can **pay for themselves** through longer intervals between repairs, extended equipment lifetime, and improved uptime. In industrial refrigeration and HVAC, reducing start/stop stress on compressors not only lowers maintenance needs but also helps maintain efficiency of the system (since pressure spikes and shock loads can adversely affect compressor seals and valves).

- **Improved Operational Control and Uptime:** The PSE's ability to integrate with control systems and provide diagnostics contributes to better overall plant operation. For example, in a Swedish water treatment plant, ABB PSE softstarters were installed to replace older starters on dozens of pump stations. The **coated electronics** survived the corrosive environment, and importantly, the softstarters' **remote monitoring capabilities** allowed maintenance staff to check pump status and alarms from a central control room [ABB Case Study – Höganäs Water Plant](#). This led to **less frequent site visits and faster response** to issues, improving the facility's operational efficiency. The case study noted that these improvements "increased productivity with less downtime for maintenance," as technicians could address warnings proactively and avoid emergency shutdowns. In general, the **predictive warning features** (like temperature or current warnings before a trip) and the communication link mean that a plant can incorporate the softstarter into its preventive maintenance system. For instance, an abnormal number of starts, or a trend of increasing start current over time, could be tracked via the PLC and trigger a maintenance inspection before a failure occurs. Such capabilities **minimize unplanned downtime**, which is often one of the largest hidden costs in industrial operations.
- **Versatility Across Industries:** The ABB PSE softstarter's broad applicability makes it a go-to solution in many sectors. In the **water & wastewater industry**, as discussed, it excels at pump and fan applications by preventing water hammer and easing mechanical stress on rotating equipment. In **HVAC and building services**, softstarters are used for chillers, large air handler fans, and cooling tower pumps to reduce start-up strain and avoid peak electrical demand surges. The **mining and aggregates industry** can use PSE units on crushers, mills, and conveyors to improve starting reliability on generator-powered sites and to avoid equipment shock (where a jam or hard start could otherwise snap a belt or shear a drive key). **Manufacturing lines** benefit from softstarts on machinery such as compressors, mixers, and saws, where smooth acceleration improves process stability and reduces product damage (for example, preventing jars on a conveyor from toppling when a line starts). Because the PSE supports up to 10 starts per hour (at standard duty) and even more frequent starts with derating, it can handle relatively high duty cycles, which is important for applications like **marine cranes or elevators** that may start and stop often. Finally, since the PSE is certified for marine use (ABS, DNV, etc.), it's found in ship engine room systems for pumps and winches, where space is limited and conditions can be harsh – an environment where its compact size and coated boards are real advantages. In all these examples, the **common theme is that using a PSE softstarter leads to smoother operations, fewer surprises, and a more controlled process**, which ultimately yields cost savings and increased safety.



Comparison with Other Solutions

It's worth noting that **softstarter technology is embraced by many major manufacturers** in the motor control industry, underlining its importance for efficient motor management. Companies like **Eaton, Schneider Electric, Siemens, Rockwell Automation (Allen-Bradley), Hitachi, and Yaskawa** all offer soft starters or similar reduced-voltage starting devices as part of their product portfolios. For example, Eaton describes its soft starters as "compact, multi-functional, easy to install, and easy to program," with models ranging from **0.8 A up to 1000 A** to cover a wide spectrum of motor sizes [Eaton Soft Starters – Product Overview](#). This competitive landscape means that end-users have choices, but it also highlights what makes the ABB PSE series stand out. **ABB's PSE softstarters distinguish themselves** by the unique combination of features in a single unit – not all mid-range soft starters from other brands include built-in thermal protection, advanced pump-centric torque control, or such a universal control voltage range in one package. ABB's long experience (over 30 years in softstarter development) is evident in the PSE design, which encapsulates many *best-practice solutions* (like the coated PCB for reliability and the integrated bypass for efficiency). Moreover, ABB provides a consistent user interface and programming philosophy across its softstarter range, which can be advantageous for companies standardizing on ABB – training and integration are easier when the low-end and mid-range starters share similar menus and network protocols. In short, while other manufacturers offer quality soft starters with overlapping capabilities, the ABB PSE series has earned a reputation for **robustness and comprehensive functionality** in a compact form factor, making it a compelling choice for engineers looking to upgrade from traditional starters or to design new systems with reliable motor control.

Conclusion

The **ABB PSE Softstarter** series is a powerful solution for anyone seeking to improve motor control and protect mechanical assets without the complexity or cost of a full variable-frequency drive when full speed operation is all that's required. The PSE provides **smooth ramp-up and ramp-down of motors**, drastically reducing electrical inrush and mechanical shocks. Its **integrated features** – from electronic motor overload protection to torque-controlled soft stopping – set it apart as an all-in-one device that simplifies design and enhances reliability. Users benefit from **extended equipment life, reduced downtime, and energy savings**, as evidenced by numerous case studies where the PSE solved chronic problems (such as frequent motor failures, water hammer damage, or nuisance electrical trips). The ease of setup via the built-in keypad and the ability to tie into modern automation systems (via Modbus or optional protocols) mean that the PSE can be smoothly incorporated into both legacy installations and cutting-edge smart factories.

In a world where nearly **90% of industrial motors run at full speed** and simply need a better way to start and stop, softstarters like the ABB PSE have a crucial role. They offer a **cost-effective, efficient, and reliable method** to optimize motor performance and longevity. Whether it's a pump in a municipal water station, a compressor in an HVAC system, or a conveyor in a manufacturing plant, the ABB PSE softstarter helps ensure that the motor *starts easy, runs steady, and stops smoothly*. By choosing a solution like the PSE, companies can achieve **lower maintenance costs, improved safety, and greater control** over their motor-driven processes – ultimately contributing to higher productivity and a lower total cost of ownership for their equipment.



References

1. [ABB PSE Softstarter – Official Product Page \(ABB Low Voltage Products\)](#) – Manufacturer’s overview of the PSE series, including key features, ratings (18–370 A, 208–600 V), and built-in Modbus connectivity.
 2. [ABB Softstarter Catalog – “The Efficient Range PSE”](#) – Technical catalog describing ABB’s softstarter ranges (PSR, PSE, PSTX), with details on PSE features like electronic overload, torque control, bypass, and protection functions.
 3. [ABB PSE Softstarter Technical Datasheet \(Valin Online PDF\)](#) – Data sheet listing PSE specifications (operational voltage, control voltage, ambient temperatures) and feature summary (current limit 1.5–7×, kick start, analog output, etc.).
 4. [Klinger & Born Industry – ABB PSE Softstarter Product Description](#) – Distributor website providing an in-depth description of PSE series capabilities, including application notes on how soft starters reduce wear and electrical stress.
 5. [ABB Case Study – Höganäs Water Purification Plant, Sweden](#) – Real-world example where PSE softstarters improved pump station operations with coated PCB reliability and remote monitoring, reducing maintenance downtime.
 6. [ABB Case Study – Rhoss HVAC Manufacturing \(Italy\)](#) – Example of an HVAC company that achieved a 60% reduction in compressor start-up current using ABB softstarters, alleviating electrical stress and mechanical strain.
 7. [ABB Softstarters “Panorama” Brochure \(2018\)](#) – ABB brochure highlighting softstarter benefits (torque control eliminating water hammer, motor overload protection, etc.) and statistics on energy use and motor starting practices.
 8. [ABB Softstarter Case Studies – Global Examples](#) – Compilation of case study highlights (e.g., pump lifetime doubled, maintenance costs reduced, starting current slashed) from various industries using ABB softstarters.
 9. [Eaton Soft Starters – Product Overview](#) – Example of a competitor’s soft starter lineup, demonstrating that multiple manufacturers offer similar solutions for gentle motor starting (Eaton’s range spans 0.8 A to 1000 A, with emphasis on compact, multi-functional design).
 10. [ABB Softstarters Application Paper – Motor Starting Solutions](#) – White paper/catalog that includes user stories (like Xylem’s 50% panel cost reduction) and technical insights into how softstarters improve system design and reliability.
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