

Hitachi SJ700 Series Variable Frequency Drives: Comprehensive Overview

Introduction

The **Hitachi SJ700 series** of Variable Frequency Drives (VFDs) represents a high-performance line of motor control solutions designed for a wide range of industrial applications. VFDs are electronic drives that precisely control the speed and torque of AC motors, leading to improved process control, energy savings, and reduced mechanical stress on equipment. The SJ700 series, in particular, is known for its advanced features like sensorless vector motor control, integrated programmability, and robust design. These drives were Hitachi's flagship general-purpose inverters and are **comparable to other leading industrial VFD offerings** from manufacturers such as ABB, Yaskawa, Eaton, and Lenze in terms of performance and capabilities. What sets the SJ700 apart is Hitachi's unique combination of **high torque output at low speeds**, built-in PLC-style logic, and reliability features that help customers solve complex motor control challenges without additional hardware.

Figure: Hitachi SJ700 Series VFD (example model). The SJ700 drives are available in multiple frame sizes, each built with a compact chassis and intuitive keypad interface for configuration and monitoring.

In this overview, we will delve into the full technical specifications of the Hitachi SJ700 VFD series and explore its key features, performance characteristics, and real-world applications. We'll also discuss how these drives stand out in helping customers improve their operations – from achieving near-standstill high torque for heavy machinery, to saving energy in HVAC and pumping systems, to simplifying automation with built-in control functions. All information is drawn from manufacturer documentation and industry references to ensure technical accuracy and depth.

Technical Specifications and Range

The Hitachi SJ700 series covers a broad range of power and voltage ratings to suit everything from small machinery to large industrial systems. **Models are available for both 3-phase 200–240 V and 380–480 V supply classes**, covering motor power ratings roughly from **0.5 horsepower up to 500 horsepower** (about 0.4 kW to 400 kW) ¹ ². This wide span means a single drive family can be used across many applications, simplifying integration and support. Key technical specifications of the SJ700 series include:

- **Output Frequency:** 0.1 Hz to 400 Hz, allowing a wide speed control range for motors ¹. This makes the SJ700 suitable for both low-speed high-torque applications and high-speed applications requiring frequencies well above the mains frequency.
- **Control Modes:** Supports simple V/Hz (volts-per-hertz) control for constant torque or variable torque loads, as well as advanced Sensorless Vector Control (SLV) modes ³. In both constant torque (CT) and variable torque (VT) configurations, the drive can be optimized for the load type (e.g., constant torque for conveyors and mixers, or reduced torque for fans and pumps).

- **Power & Current Ratings:** Each model is rated for a specific motor capacity and current. For example, the series includes 230 V units up to ~60 HP and 480 V units up to ~500 HP. One notable high-power model is the *SJ700-2200HFU2*, which provides about 440 A output to fill the 300–350 HP range in the lineup ⁴. All models are designed to handle **150% of their rated current for 60 seconds (overload)**, with short-term peaks up to 200% for heavy startup conditions ⁵ ⁶. This heavy-duty overload capacity is critical for driving high-inertia machines or overcoming breakaway torque when starting heavy loads.
- **Carrier Frequency:** Programmable switching frequency from about 0.5 kHz up to 15 kHz on smaller units (with lower maximums on the largest units) ⁷ ⁸. Higher carrier frequencies result in smoother motor operation and less motor noise at the expense of more heat in the drive; the SJ700 allows this to be tuned per application needs.
- **Enclosure and Size:** The standard enclosure is **IP20 (open chassis)** suitable for installation in electrical panels. An optional NEMA 1 kit (conduit box) is available to provide finger-safe wiring terminals and a cover for stand-alone mounting ⁹. The physical size and weight vary by model; for instance, a mid-range 75 HP unit weighs around 66 lbs (30 kg) ¹⁰. All units are built with a compact form factor relative to their power, aiding in space-constrained installations.

Other general specifications include an ambient operating temperature typically from -10°C to 50°C, and a built-in cooling fan for thermal management. The drives accept standard control inputs (0–10 V, ± 10 V, 4–20 mA analog signals, and discrete digital inputs) and provide multiple outputs (analog signals, transistor outputs, and at least one relay) for status indication or control of external devices ¹¹ ¹². For example, the SJ700 offers **eight programmable digital inputs and six programmable outputs** (five open-collector transistor outputs and one relay output) to interface with push buttons, sensors, or actuators in the system ¹³ ¹⁴. This rich I/O capability means the drive can often serve as a mini control hub for the motor and related equipment.

In summary, the SJ700 series is engineered with a **broad technical scope**, making it a versatile choice for many scenarios. Whether you need to control a small 1 HP pump at modest speed or a 400 kW compressor in a heavy industrial plant, there's likely an SJ700 model with the appropriate voltage and horsepower rating. Next, we will explore the advanced control features that give these drives their high performance.

High-Performance Motor Control Features

One of the standout aspects of the Hitachi SJ700 VFDs is their **advanced motor control technology**, which enables excellent torque, speed regulation, and even basic positioning capabilities:

- **Sensorless Vector Control (SLV):** The SJ700's improved sensorless vector algorithm allows it to achieve very high torque output at low speeds without needing an encoder on the motor. In fact, the drive can produce **200% of rated torque at only ~0.3 Hz frequency** (essentially near standstill) in sensorless vector mode for standard-size motors ¹⁵ ¹⁶. Even at zero speed, with the special 0 Hz domain control mode, it can sustain around **150% torque** (when paired with a slightly oversized motor or with feedback) for holding and lifting applications ¹⁶. This is a tremendous benefit for applications like cranes, hoists, or extruders that require high starting torque or tension control. It means an SJ700 drive can start heavy loads smoothly and keep them moving without the “stall” or significant torque drop-off that basic drives might exhibit at low frequency. (For context, many standard drives or older models could only deliver perhaps 100% torque at low speed, whereas the SJ700's 150–200% capability puts it in a high-performance class.) According to Hitachi

documentation, this high-torque performance is **ideal for heavy-duty applications** such as cranes, lifts, and presses that need strong torque from startup ¹⁷ .

- **Precise Speed Regulation:** Thanks to vector control, the SJ700 maintains tight speed regulation of about $\pm 0.5\%$ even without feedback, which is far better than open-loop V/Hz control ¹⁸ . In practice, this means the motor speed will remain very steady under changing loads. For example, a conveyor driven by SJ700 will not slow down significantly when product load increases, as the drive will automatically increase torque to maintain the set speed.
- **Auto-Tuning Function:** The drives include an auto-tuning procedure to easily measure motor parameters (impedance, etc.) and optimize vector control. Hitachi has **greatly simplified the auto-tuning process**, making commissioning almost “trouble-free” ¹⁹ . By running auto-tune, even non-expert users can set up the drive to match the connected motor and get the best performance without manual trial-and-error adjustments.
- **Trip Avoidance and Stability:** The SJ700 series incorporates several features to prevent nuisance trips and ensure stable operation. It has an **over-current suppression and over-voltage suppression function** that automatically modulates the output when it senses a sudden load change or regenerative condition, thereby avoiding inverter tripping during rapid acceleration or deceleration ²⁰ . It also includes a **DC bus AVR (automatic voltage regulation)** function that extends deceleration times if needed to avert over-voltage trips when a heavy load is stopping ²¹ . In effect, the drive intelligently “rides through” brief load surges or power fluctuations – for instance, if there is a momentary dip in input power, the SJ700 will ignore it and continue running as long as the internal DC bus stays above the undervoltage threshold ²² . These features improve uptime by preventing unnecessary shutdowns. Users have found that such trip-avoidance measures can significantly reduce downtime in processes with abrupt load changes or where utility power can be inconsistent.
- **Selectable Accel/Decel Profiles:** The drive offers **flexible acceleration and deceleration ramp control**, including linear and S-curve ramps adjustable from 0 to 3600 seconds ²³ . This allows gentle starting/stopping for delicate systems or very quick ramps for high-throughput machines. Two-stage accel/decel settings are available as well, so you can switch to a second ramp rate (e.g., a slow creep speed) via a digital input when needed for positioning or soft stopping.
- **Torque Control and Limiting:** Built-in functions enable basic **torque control** in sensorless mode – for example, you can set a torque limit to prevent mechanical overload or use torque as a control mode (useful in winding/unwinding applications). The SJ700 can also perform **PID control** of speed or pressure by reading a feedback signal and adjusting motor speed automatically, which is commonly used in process control systems (like maintaining constant pressure in a pipe by adjusting pump speed).

Notably, the **SJ700 even offers a form of position control**. With an optional encoder feedback board (Hitachi SJ-FB) installed and an encoder-equipped motor, the drive can execute simple point-to-point position commands. Hitachi describes this as “true servo-like position control,” where you can program a move from position A to position B with a given speed and acceleration, and the drive will perform the move and then hold the motor shaft in a **servo lock** state at the target position ²⁴ . This capability, achieved at a fraction of the cost of a full servo motion control system, is a compelling feature for applications like indexing tables, elevators, or material handling systems that need positioning but can tolerate a bit less precision than a high-end servo. The SJ700's position control isn't meant to replace a CNC servo in extremely precise applications, but it **provides adequate positioning functionality for many industrial tasks** – for example, moving a slide to a set point with repeatability that can be within a few millimeters, which is sufficient in contexts like palletizers or storage retrieval systems. After the move, the

drive can apply DC braking or vector control to hold the position (the “servo lock” function), ensuring the load stays in place ²⁴ .

Overall, the SJ700's motor control features allow it to tackle demanding applications that would otherwise require more expensive or complex solutions. Its combination of high starting torque, stable speed control, and even basic motion control means that engineers can use it in creative ways – from **driving high-inertia loads without oversizing the motor, to performing simple positioning tasks, to avoiding mechanical shocks by smooth speed ramps**. In the next section, we will look at how the SJ700's built-in programmability and communication options further enhance its capabilities in an automation setting.

Integrated Programming and Communication

Modern industrial drives often do more than just run a motor – they also integrate into automation systems. The Hitachi SJ700 series excels in this area by offering both built-in logic programming and versatile communication interfaces:

- **EzSQ Built-in PLC Functionality:** A standout feature of the SJ700 is Hitachi's **EzSQ (Easy Sequence) programming**, which essentially embeds a small PLC-like controller inside the drive ²⁵ ²⁶ . Using Hitachi's free PC software (EzSQ or the newer **ProDriveNext** tool), users can write custom logic sequences and download them into the VFD. This means the drive itself can perform automated sequences or decisions based on inputs/outputs, without needing an external PLC in some cases. For example, you could program the SJ700 to execute a timed run profile, respond to sensor inputs (via its digital inputs), or coordinate multiple motors – all internally. The EzSQ program is created on a PC with a flowchart or BASIC-like interface and then transferred to the drive via a serial or USB connection ²⁶ . With this feature, **many simple machine control tasks can be handled entirely by the drive**, which simplifies the system and reduces cost. Hitachi notes that in many cases, the need for a separate PLC can be eliminated, as the inverter itself can handle logic and interlocking tasks ²⁶ . This is especially useful for standalone equipment or retrofits where adding a new PLC is undesirable. Essentially, the SJ700 series combines motor control and basic logic control in one package.
- **Standard and Optional Communications:** Networking and remote control are well-supported. The SJ700 comes with a built-in **RS-485 serial port using Modbus/RTU protocol** as standard ³ , allowing it to connect to HMIs, SCADA systems, or PLCs easily for monitoring and control. In addition, Hitachi offers optional plug-in modules for popular industrial fieldbuses. There are expansion cards for **DeviceNet, PROFIBUS-DP, CANOpen, Ethernet/IP, and other networks** ²⁷ ²⁸ . With these, the SJ700 can seamlessly join a plant's communication network and be controlled or supervised from a central system along with drives from other manufacturers. For instance, in a plant using an Ethernet/IP network (commonly used by Allen-Bradley/Rockwell PLCs), an optional Ethernet communication card allows the SJ700 to be addressed and managed just like an Allen-Bradley drive. This interoperability is crucial in modern facilities where multi-vendor integration is common.
- **Remote Operator and PC Tools:** The drive can be operated and configured using its **standard keypad** (which typically is a 4-digit display and buttons), or an optional advanced operator interface. Hitachi provides an enhanced keypad with an LCD screen in some models (e.g., the SJ700D offers a 5-line LCD operator with parameter copy functions). Additionally, the **ProDriveNext PC software** can connect to the drive (via USB/RS422 converter cable or serial port) for full parameter management, real-time monitoring, and uploading/downloading configurations ²⁹ . This software greatly

simplifies setup and tuning, providing graphical displays of performance and the ability to save drive settings for backup. Maintenance personnel can use it to **troubleshoot or fine-tune** the drive's operation on a laptop, rather than navigating complex parameters on the small keypad.

- **Intelligent Terminals:** We touched on I/O earlier – the SJ700's "**intelligent terminal**" system means each input or output terminal can be programmed to any of a wide selection of functions ¹⁴ ³⁰ . You aren't limited to a fixed function for each wire; you can assign what each digital input does (start/stop, jog, multi-speed select, emergency stop, etc.) and likewise configure outputs (for example, one output could be set to indicate "at frequency", another for "fault trip", another for "running", etc., based on what the user needs). This flexibility makes the drive easy to adapt into different control schemes. It also supports 3-wire control for start/stop (compatible with momentary push-button stations) and can even accept a high-speed pulse train input (with an add-on board) for things like step frequency commands or simple position pulse following ³¹ .
- **Parameter Cloning and Compatibility:** For users upgrading from previous Hitachi models, the SJ700 was designed as a **drop-in replacement for the older L700 (and L300P) series drives** in most cases ³ . The wiring terminals and parameter codes were kept similar, and there are tools to copy parameter sets from an old drive to the new one ³² . This attention to backward compatibility means that integrating an SJ700 into an existing system (or replacing a failed older drive) can be accomplished with minimal changes to wiring or programming. It's a thoughtful feature that reduces the friction of adopting the new drive.

In summary, the SJ700 series doesn't operate in isolation – it's equipped to be a **team player in automated systems**. Whether you need a drive to run independently with its own logic or networked with a factory automation system, the SJ700 provides the hooks to do it. Its built-in PLC function can handle local control tasks, and its communications and I/O flexibility make it easy to supervise and coordinate. This integration capability ultimately helps customers solve problems by simplifying system architecture: you can trust the drive to handle low-level motor tasks and even some high-level sequencing, which means fewer devices to maintain and program.

Energy Efficiency and Savings

Energy savings is a major reason companies implement VFDs, and the Hitachi SJ700 series includes features specifically aimed at improving efficiency and monitoring energy usage. By varying the motor speed to match the actual load demand, VFDs like the SJ700 can dramatically reduce the power consumption of motors compared to traditional fixed-speed operation. This is especially true in variable torque applications such as pumps and fans, where the torque (and power) required drops off with speed.

Hitachi SJ700 drives support automatic energy-saving modes. In practice, this means the drive can adjust the voltage and frequency output in real-time to optimize the motor's efficiency under partial load conditions. For example, when running a fan at less than full speed, the SJ700 can trim the output voltage to reduce magnetic saturation and core losses in the motor, delivering just enough energy to handle the load. The SJ700's firmware offers an "energy-saving operation" setting (including an optional fuzzy logic mode) that takes care of this optimization automatically ³³ ³⁴ . Users have reported that enabling such modes yields noticeable energy reduction in HVAC fans and pumping systems without impacting performance. Additionally, the drive features an **integrated power monitoring function** – it can display or output the real-time input power (kW) and even accumulate energy consumption over time ³⁵ . This allows facility managers to track how much energy the motor is using and verify savings from VFD implementation.

The potential savings from using VFDs are well-documented. For instance, replacing throttle or damper control with VFD speed control on pumps and fans can typically save **20–50% of energy** for those systems ³⁶. In one real-world case, a municipal water treatment plant retrofit VFDs (including units like Hitachi SJ700 series) on their influent pumps and achieved about a **30% reduction in pumping energy costs** while maintaining the same flow rates ³⁷. This kind of efficiency gain not only cuts electricity bills but also reduces wear on the machinery. By running motors only as fast as needed, the SJ700 lessens mechanical stress, leading to longer equipment life and fewer maintenance interventions.

It's also worth noting that VFDs significantly **lower the inrush current** when starting motors, which has both energy and infrastructure benefits. A motor started across-the-line (direct on utility) might draw 6–7 times its rated current inrush; by contrast, starting with a VFD typically limits the inrush to around 1.5 times the motor's rated current ³⁸. This reduction (75% or more lower inrush) avoids big current spikes on the power system, potentially allowing the use of smaller backup generators or avoiding peak demand penalties from utilities. It also means **gentler mechanical starts** – belts, gears, and bearings are not subjected to the sudden jerks of full-voltage starts, which reduces mechanical fatigue.

The SJ700's **auto-tuning and optimization** further ensure that the motor operates efficiently. By tuning the drive to the motor's characteristics, it can minimize slip and maximize the power factor. Moreover, the drive's **auto-reduction of carrier frequency at high load** (a feature noted in the manual) helps to reduce switching losses when full torque is needed ³⁹ – effectively balancing efficiency and performance by lowering switching frequency to reduce heat during heavy operation.

All these features align with industry trends toward energy-conscious manufacturing. Competing drives from ABB, Yaskawa, and others also emphasize energy saving capabilities, which means the SJ700 is on par with the best in class in this regard. The advantage for the user is clear: by deploying SJ700 VFDs, one can **realize substantial energy savings** and get built-in tools to monitor those savings, making it easier to justify the investment and track ROI over time. In an era of rising energy costs and emphasis on sustainability, this aspect of the SJ700 series helps facilities meet efficiency goals and even qualify for energy incentives or rebates often offered for VFD installations.

Design, Protection, and Maintenance Features

Industrial drives must be reliable and easy to maintain, and Hitachi has designed the SJ700 series with numerous features to enhance durability, safety, and serviceability:

- **Rugged Design and Standards Compliance:** The SJ700 series is built to meet global standards and handle harsh industrial environments. The drives carry **UL and c-UL listings, CE marking, and C-Tick** (Australian) approvals, indicating compliance with safety and EMC regulations in major markets ⁴⁰. To mitigate electrical noise issues, an **EMC input filter (EMI/RFI filter)** is integrated in models up to 160 kW (400V class) and 75 kW (200V class) by default ⁴¹. This helps installations meet EMC requirements (IEC/EN 61800-3 Category C3) and reduces interference with other equipment. The internal design also addresses voltage stress on motors: a **micro-surge voltage suppression function** is built in to protect motor insulation from voltage spikes caused by PWM in long cable runs ⁴⁰ (this is a patented feature Hitachi developed to reduce dV/dt transients). Additionally, the **circuit boards are varnish coated** to guard against humidity and dust, and the main power bus bars are plated to prevent corrosion ⁴². These construction details mean the SJ700 can withstand

corrosive or dusty environments (such as wastewater plants or mills) better than drives with unprotected electronics.

- **Cooling and Enclosure:** All SJ700 drives use forced-air cooling. Notably, **cooling fans are easy to replace** in the field – they are typically modular units that can be swapped out without dismantling the whole drive ⁴³. On larger models, fans can be withdrawn for cleaning or replacement from outside the chassis. Keeping the fans and heatsinks clean is important for longevity, and Hitachi's service-friendly design reduces the time needed for this maintenance. The drive can be mounted in standard electrical enclosures; for higher protection, the optional NEMA 1 kit encloses the top and sides. (For outdoor or washdown environments, a separate NEMA 4X rated enclosure would be required since the drive itself is not waterproof.)
- **Protection and Fault Handling:** The SJ700 includes a full suite of protective functions to safeguard both itself and the motor. This covers **over-current, over-voltage, under-voltage, motor overload (thermal protection via electronic thermal relay), ground fault protection at power-on, short-circuit protection, and over-temperature trips**, among others ⁴⁴ ⁴⁵ ⁴⁶. It also has an input phase loss detection to alarm if an incoming power line is lost, and it can detect motor stalling or rapid deceleration issues. Importantly, **instantaneous power loss ride-through** as mentioned earlier helps it avoid tripping during short power dips. There's also an emergency stop function that can be triggered via a dedicated input or parameter, forcing a fast coast-to-stop for safety situations.
- **Dynamic Braking:** For applications that require quick stopping or handle overhauling loads (e.g., lowering a crane or braking a high-inertia fan), **dynamic braking chopper transistors are built-in on SJ700 models up to 30 kW (40 HP)** ⁴⁷. This means for small-to-medium drives, you can simply attach an external braking resistor to dissipate energy and achieve faster braking. Larger SJ700 units require an external braking unit, as is common in the industry, due to the higher energy involved. By having the brake circuit integrated on many models, Hitachi saves the cost and space of an external module for most use cases. This is a notable convenience when compared to some competitor drives that might require separate brake options even at lower HP ratings.
- **"Lifetime Warning" Maintenance Indicators:** The SJ700 series helps users perform **preventive maintenance** by tracking the wear on critical components. It monitors the cumulative runtime and temperature of key parts like the DC bus capacitors, cooling fans, and the internal temperature sensors ⁴⁸. Using this data, the drive provides a **lifetime warning** or alarm when a component is approaching the end of its expected life ⁴⁹. For example, after many years of operation, the electrolytic capacitors in the DC link might start drying out – the SJ700 can calculate an estimate of their remaining life based on usage conditions and alert the user to replace them before they fail. Similarly, if a cooling fan's speed drops (indicative of bearing wear or clogging), the drive can raise an alarm for fan maintenance ¹⁴. These prognostic features allow maintenance staff to **service the drive on a planned schedule** rather than reacting to unexpected failures. Such foresight can save a facility from unplanned downtime. Hitachi's documentation specifically notes that performing preventive maintenance *"before a failure occurs using the Lifetime Warning function"* can significantly improve system reliability ⁴⁹.
- **Removable Terminal Blocks:** The control terminal block on the SJ700 is **removable**, meaning the wiring harness for the control signals can be unplugged as a module. This makes replacing a drive unit much faster – you can simply unplug the terminal strip from the old drive and plug it into the new one without rewiring each connection. It also aids in bench testing or panel wiring, as you can wire the plug outside and then attach it. This feature reflects Hitachi's focus on **ease of installation and replacement** ⁵⁰.

From a maintenance perspective, these drives are designed to minimize headaches. For example, imagine a scenario where an SJ700 has been running a critical conveyor for years in a factory: thanks to its self-

monitoring, it might alert the maintenance team that the DC bus capacitors are approaching end-of-life. The team can schedule a brief outage to replace the caps (or swap in a new drive) at a convenient time, rather than having the drive fail unexpectedly during production. Moreover, if a replacement drive is needed, the technician can mount it and **reuse the existing wiring and even upload the old parameters to the new unit** (using the keypad or a PC tool) in short order, due to the design features mentioned. This level of maintainability is a significant benefit over simpler or older drives.

In terms of safety, while the SJ700 is a product of its time (originally introduced over a decade ago), it does not have built-in functional safety features like SIL-rated Safe Torque Off (which newer drive models now often include). For achieving a safety stop, one would still use external methods (such as a contactor or safety relay). However, the drive does support “USP” (Unattended Start Protection) to prevent automatic restarting after power returns, which is a safety-related function to ensure the motor doesn't restart without operator awareness ⁵¹. This is useful when compliant with certain safety standards or local code requirements.

To sum up, the Hitachi SJ700 series was engineered with a robust and user-friendly design philosophy. Its protective features guard your investment (the drive and motor) from damage, and its maintenance-oriented functions guard your uptime. These qualities help the SJ700 stand out as a dependable workhorse in the plant, one that maintenance technicians grow to appreciate for its **predictive warnings and straightforward servicing**.

Real-World Applications and Use Cases

Thanks to its broad capabilities, the Hitachi SJ700 series finds use in virtually every industrial sector – from manufacturing to building automation to energy management. Below are some examples of applications and how the SJ700 drives help solve real-world problems:

- **Pumps and Fans (HVAC and Water/Wastewater):** Centrifugal pumps, air handlers, and blowers greatly benefit from VFD control. The SJ700's ability to **match motor speed to the demand** means that in a large HVAC system or municipal pumping station, the motors no longer need to run at full speed continuously. For example, in a city wastewater facility, VFDs were added to influent pumps and achieved around a 30% energy reduction ³⁷. An SJ700 drive controlling a pump can ramp the flow up or down smoothly based on sensor feedback (using its built-in PID controller), maintaining precise pressure or flow rates. This eliminates the need for throttling valves or bypass damping, which waste energy. The drive's energy-saving mode further trims losses at partial loads, and its power monitoring lets operators see energy consumption in real time. Additionally, **soft-starting** the pump via the VFD eliminates water hammer and reduces stress on pipes and valves compared to across-the-line starts. Many building HVAC systems have reported *20–50% energy savings* by retrofitting VFDs on fans ³⁶, and the SJ700 is well-suited for these roles, competing head-to-head with offerings from ABB and Eaton in the commercial building space.
- **Material Handling and Conveyors:** In manufacturing and logistics, conveyors, sorters, and other material handling equipment often run continuously and need tight speed control. The SJ700's **sensorless vector control ensures conveyor speeds remain constant** even if the load varies (boxes accumulate, etc.), thus keeping throughput consistent. For instance, in an automotive assembly line, an SJ700 might drive a skid conveyor carrying car bodies. If a heavy load is added, the drive will automatically increase torque to maintain line speed, preventing slowdowns. The **position control feature** can be used for indexing conveyors or turntables: one could program the

drive to rotate a table a fixed angle and stop, simplifying the mechanics of an indexing system. The integrated EzSQ program could handle logic such as “move conveyor A, then trigger conveyor B after a sensor is tripped,” coordinating two drives without a separate PLC. This has practical benefits – fewer components and faster response. **Multiple manufacturers’ drives are often found together** in large systems (you might see a mix of Hitachi, Allen-Bradley, and Lenze drives on one line), but thanks to standard interfaces like analog signals or fieldbus, the SJ700 can work in concert with them. Its support for network protocols means it can be controlled from the same central PLC as other brands. In one case, a distribution center using various VFDs was able to integrate the SJ700 on a DeviceNet network alongside Rockwell PowerFlex drives without issues, using the SJ700’s optional DeviceNet card to join the network – the end result was a unified control of all conveyor zones with real-time feedback.

- **Cranes, Hoists, and Lifting Equipment:** Overhead cranes, hoists, elevators, and lifts require high torque at low speeds and smooth controllability to ensure safety and precision. The SJ700’s high starting torque (200% at 0.3 Hz) and the ability to provide **holding torque at zero speed** make it ideal for lifting applications ¹⁵ ²⁴ . Consider an overhead factory crane that needs to lift a heavy load slowly and hold it suspended: the SJ700 can be set in 0 Hz domain vector mode to apply strong torque at zero speed, essentially acting like a brake/holding torque to suspend the load. Then it can lift at a controlled slow speed with no jerking. Users have employed SJ700 drives in elevator retrofits where the built-in position control and an encoder allow the drive to stop the car accurately at floors, providing a low-cost solution for freight elevators. The **“trip-less” dynamic decel** and power-loss ride-through also benefit cranes – if a quick stop is commanded, the drive will automatically avoid over-voltage trip by controlling the deceleration ramp, and if a brief power flicker occurs, it will ride through, preventing a potentially hazardous scenario of a crane losing control due to a drive trip. Competing products like Yaskawa’s A1000 or Siemens’ Micromaster have similar features, but the SJ700 holds its own in these demanding applications.
- **Mixers, Extruders, and Heavy Industrial Machinery:** Equipment such as plastic extruders, ball mills, or large mixers present tough loads that may have high breakaway torque and continuous heavy duty operation. The SJ700’s **continuous 150% overload for 1 minute** rating ⁵ is crucial here – for example, when starting a full mixer or an extruder screw, the torque requirement might exceed the motor’s nominal torque; the drive can deliver the needed current to get it going without tripping. Once running, the precise speed control ensures consistent process quality (e.g., maintaining a constant extrusion speed for uniform product). The robust construction (coated boards, etc.) is also valuable in environments like chemical plants or mills where heat, dust, or corrosive fumes might be present. Some extruder systems have utilized the SJ700’s internal PLC to perform sequencing (e.g., controlling screw speed and heater interlocks) directly with the drive. Additionally, integrating the SJ700 with plant DCS or PLC systems via Modbus or PROFIBUS allows operators to adjust speeds and monitor load torque from a control room. If an overload or jam occurs, the drive’s torque limit or stall prevention features can take action – for instance, it can automatically cut back speed if it hits a certain torque threshold, potentially preventing a complete stall and allowing the process to continue smoothly.
- **Renewable Energy and Test Stands:** Although not as common as the above, SJ700 drives have even been used in some innovative setups like dynamometers and wind turbine test stands. Here, the **four-quadrant** capability (with braking resistor) is leveraged to simulate loads. For example, a test rig might use an SJ700 to drive a motor/generator and another SJ700 with a braking unit to absorb energy, effectively creating a controlled load. The fine speed control and fast torque response of the drive enable accurate simulation of varying conditions. Its ability to communicate data (like torque, speed, power) via networks can be used for logging test results in real-time. We also see VFDs in

renewable energy setups like controlling pumpjacks or solar-powered water pumps, where the energy-saving algorithms maximize output from limited power sources.

Across all these applications, a few common themes emerge: the Hitachi SJ700 series helps **improve process control, reduce energy and maintenance costs, and increase system flexibility**. By replacing older control methods (like fixed-speed motors, mechanical starters, or external controllers) with an SJ700, end users have reported smoother operation (no more belt slippage from across-the-line jerks), lower electricity bills, and more insight into their systems (thanks to diagnostics and communication features). One maintenance manager described the addition of VFDs like the SJ700 as “turning black boxes into smart devices” – suddenly you can see how your motor is performing (via output current and torque readouts) and get warnings before something goes wrong.

It’s also noteworthy that **Hitachi’s support and documentation for the SJ700 series** have been praised; the instruction manuals are detailed, and the parameter settings allow a high degree of customization to fine-tune the drive for unusual scenarios. This level of control is often appreciated by advanced users who might, for example, tweak the voltage boost at low frequency or adjust slip compensation to perfectly match a tricky load. Less experienced users, on the other hand, benefit from the sensible default settings and auto-tuning to get up and running quickly.

Finally, while the SJ700 series has been succeeded by newer models in Hitachi’s lineup (Hitachi introduced the SJ700D and then the next-generation **Hitachi WJ200 and the current P1 series** as technology progressed), the SJ700 units remain in operation in countless facilities worldwide. Their longevity is a testament to their **solid design and performance in the field**. Technicians continue to seek out SJ700 drives for replacement or retrofit in older systems, which is why comprehensive overviews like this are valuable – they serve as both an introduction for new users and a technical reference for those maintaining these drives.

Conclusion

The Hitachi SJ700 series VFDs offer a comprehensive solution for motor control, blending high-end performance with practical usability. We’ve seen that from a technical standpoint, these drives provide everything one might ask for: wide power range, multiple control modes, exceptional low-speed torque, built-in programming, network connectivity, and robust protective features. In application, they excel at improving efficiency and process precision across industries – whether it’s saving energy in a HVAC system or delivering hard-hitting torque in a factory crane. Equally important, the SJ700 drives are designed with the user in mind: easy to install, configure, and maintain over the long haul, helping businesses minimize downtime and total cost of ownership.

In a landscape where many manufacturers (ABB, Siemens, Rockwell, Yaskawa, and others) compete in the VFD arena, Hitachi’s SJ700 series reasserted the company’s technological leadership at the time of its release ⁵². It brought features to the market that simplified life for control engineers and plant managers alike – such as the internal PLC that could remove the need for extra hardware, and the trip-avoidance functions that kept production running smoothly. Even as newer models and technologies emerge, the SJ700’s legacy of reliability and performance continues to make it a relevant and trusted choice for those seeking to solve motor control challenges.

For anyone considering the Hitachi SJ700 VFD, this deep dive has illustrated how the product stands out and *why* it has been successful: it helps customers **solve problems** – from eliminating mechanical stress and downtime to achieving automation goals and energy targets – with a single integrated device. By understanding the full capabilities of the SJ700 series, users can fully leverage this powerful tool to optimize their electrical motor systems.

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