



Lenze AC Tech i550 Protec Variable Frequency Drives (VFDs)

Introduction

The **Lenze AC Tech i550 Protec** is an advanced **variable frequency drive (VFD)** designed to provide precise speed and torque control for AC motors in demanding industrial environments. Part of Lenze's latest **i500 series** of inverters, the i550 Protec stands out as a **decentralized, wall-mountable drive** with a rugged enclosure. Unlike traditional VFDs that reside inside control cabinets, the i550 Protec carries a high **IP66 / NEMA 4X protection rating**, allowing it to be mounted **near the motor or on the machine** itself, even in dusty, wet, or outdoor conditions ¹ ². This design is ideal when cabinet space is limited or when long motor cable runs need to be avoided. By moving the drive closer to the motor, installation is simplified and electrical losses can be reduced. Lenze leverages the same proven technology from its cabinet-mounted i500 drives in the Protec version – meaning you get identical performance and control capabilities – but in an **“armor-plated”** housing built for harsh environments ¹ ². Notably, the i550 Protec was even recognized as a *“Product of the Year 2021”* by a German trade magazine for its innovative design ³.

At its core, the i550 Protec is a **versatile, high-performance drive** targeted at a broad range of applications. It can efficiently control standard three-phase AC induction motors (and even support permanent magnet motor control in sensorless mode) across various industries. Common use cases include **conveyor systems**, material handling equipment, **packaging machinery, pumps and fans, hoists and cranes**, and more ⁴. By varying the motor speed on-demand rather than running motors at full throttle, VFDs like the i550 Protec help **save energy**, reduce mechanical stress, and improve process precision. For example, in pumping applications, using a VFD to adjust pump speed to match flow requirements (instead of throttling flow with valves at a constant full speed) can dramatically cut energy consumption and wear on the system ⁵. The Lenze i550 Protec fully embraces this efficiency mindset – it meets the latest European **Ecodesign Directive (EN IEC 61800-9-2)** for drive efficiency ⁶ and offers built-in features (like a PID controller for process control) to optimize motor usage. In short, the i550 Protec is engineered to help modern factories **improve automation performance while reducing costs**: it delivers precise motor control, seamless integration into automation networks, and robust durability, all in a compact and user-friendly package.



Rugged Decentralized Design



Lenze i550 Protec drives with high IP66/NEMA 4X enclosures can be mounted directly on machinery in harsh factory environments. This decentralized design reduces the need for large control cabinets and long shielded motor cables.

One of the defining characteristics of the Lenze i550 Protec is its **industrial-hardened enclosure**. The drive is housed in a **fully sealed casing rated IP66** (equivalent to **NEMA 4X** for indoor/outdoor use), which means it is **dust-tight and resistant to powerful water jets** ¹ ⁷. This level of protection allows the i550 Protec to operate reliably on the factory floor, exposed to conditions that would damage ordinary electronic equipment – from metal dust in a machining center to washdown sprays in a food processing plant. Lenze describes the i550 Protec as “hard on the outside, same on the inside,” highlighting that the unit’s tough exterior shields the proven technology within, without compromising performance ¹. In practical terms, the drive can handle ambient temperatures from **-30 °C up to +60 °C** (-22 °F to +140 °F) without issue ⁸, and its electronic components are engineered for reliability under shock, vibration, and humidity. For the largest models (above 30 kW), the enclosure is built to **IP55/NEMA 12** standards ⁹ – still providing a high degree of protection – due to the need for extra cooling at higher power, but these too are suitable for harsh industrial settings like dusty textile mills or humid pumping stations.

Decentralizing the drive by moving it out of a climate-controlled cabinet offers several benefits. It frees up space in the main control panel and **eliminates long runs of shielded motor cable**, which can be expensive and can introduce power losses or electrical noise. Lenze specifically notes that if a machine is physically large or modular in layout, using on-machine drives like the i550 Protec lets you keep motor cable lengths short and reduce installation complexity and cost ¹⁰. This approach also improves flexibility in machine design – production lines can be reconfigured or extended more easily when each section has its own local drive. The i550 Protec is designed with a **compact form factor** to facilitate this: it is **extremely narrow and streamlined** compared to many other decentralized drives on the market ¹¹. Smaller power units in the series measure as slim as about 60 mm (2.4 inches) in width ¹², allowing multiple drives to be mounted side by side on a machine frame or backplate with minimal clearance. Even the higher power units



remain relatively compact for their rating, enabling a distributed installation without bulky equipment hanging off the machine.

To aid in on-machine usage, Lenze offers an optional **extension box (service switch)** that can attach to the i550 Protec. This extension module provides a local **disconnect switch** (often called a “repair switch” or maintenance switch) and additional operator controls on the drive ¹³ ⁷. Having a built-in disconnect means maintenance personnel can safely isolate power to the motor and drive at the machine for servicing, rather than finding the correct breaker in a remote panel. The extension can also host a local **keypad or even a WLAN (Wi-Fi) module** for commissioning ¹⁴. In summary, the mechanical and packaging design of the i550 Protec is all about **robustness and decentralization** – it brings full-featured motor control out of the cabinet and onto the machine, in a form that’s tough enough for the factory floor and convenient for installers.

Wide Power Range and Flexible Performance

Despite its compact size, the Lenze i550 Protec packs a wide range of power capabilities, making it suitable for both small and large motor installations. **Multiple models cover power outputs from fractional horsepower ratings around 0.33 HP (0.25 kW) up to high-power units of about 100 HP (75 kW)** in the heavy-duty rating ¹⁵. (In fact, the broader Lenze i500 series can reach **150 HP (110 kW)** in certain configurations ¹⁶, and Lenze has indicated up to ~132 kW is in preparation for the platform, ensuring plenty of headroom for future needs.) This means a single drive family can be standardized across many different applications in a facility – from a small 0.5 HP conveyor belt motor to a 75 kW extruder main drive – simplifying maintenance and spare parts inventory. Engineers can **right-size the drive** to the motor and load requirements without jumping to an entirely different product line for each power class. The i550 Protec units are available in several frame sizes, but all share a common interface and feature set, so whether you’re using a 2 kW drive or a 50 kW drive, the **user experience and programming remain consistent**.

In terms of input supply, the i550 Protec is exceptionally flexible and globally compatible. It supports a broad span of AC supply voltages and phase configurations out of the box ¹⁷:

- **120 V AC single-phase** – for low-power applications or North American residential/light commercial power.
- **230 V AC single-phase** – often used for small motors or where only single-phase mains are available.
- **230 V AC three-phase** – common industrial low voltage in many regions.
- **400 V AC three-phase** – standard in Europe and elsewhere (typically nominal 380–415 V range).
- **480 V AC three-phase** – standard industrial supply in North America.
- **600 V AC three-phase** – used in Canada and certain industries (575 V nominal); the drive can accommodate these higher-voltage systems.

Few VFDs in this class can handle up to 600 VAC without additional transformers, so the i550’s design stands out for its **wide input voltage tolerance** ¹⁸. Additionally, all models include active front-end components like built-in EMC/RFI filters to meet emission standards and (for 400/480 V units) integrated DC chokes to reduce harmonics and stress on the supply line ¹⁹ ²⁰. This helps the drives comply with IEC 61800-3 and UL standards for electromagnetic compatibility right out of the box. The output frequency range is from **0 Hz up to 599 Hz** for high-speed motor operation if needed, with fine resolution and stability.



It's also worth noting that the i550 drives support both **"Heavy Duty" and "Light Duty" ratings** on certain models. In heavy-duty mode (high overload capability), the drive is tuned for driving heavier loads or for applications requiring high torque during acceleration – the continuous power output is a bit lower, but the drive can handle **150% overload for 60 seconds** or more. In light-duty mode (normal overload, e.g. 110% for 60 s), the same hardware can be rated for a higher continuous power output since the application (like a fan or pump) doesn't demand large overloads ¹⁶ ²¹. This dual-rating approach provides extra flexibility to match the drive to the true demands of the application without oversizing it. For example, a drive that might be rated 50 HP heavy-duty could potentially be used on a 60 HP fan (light duty) system, saving cost while still operating safely within limits. All these configurations and protections make the Lenze i550 Protec a very **scalable solution** – one that can be tailored to small or large tasks while ensuring **compliance with safety and efficiency standards** at each point in the range.

Key Features and Technology

Advanced Motor Control and Performance

At its heart, the i550 Protec is a high-performance motor controller. It supports multiple control schemes to accommodate different motor types and performance needs. For standard AC induction motors, it can run in simple **voltage/frequency (V/f) control** mode (ideal for fans, pumps, or multi-motor setups), as well as in more sophisticated **sensorless vector control** mode for improved torque and speed regulation ²². In sensorless vector mode, the drive internally models the motor's characteristics and actively adjusts voltage and frequency in real-time to maintain precise speed or torque, even as the load changes. This allows **tight speed regulation and faster dynamic response** compared to basic V/f control – crucial for applications like extruders or conveyors where maintaining a constant speed under varying load is important for product quality. The i550 drive also includes an **automatic motor tuning (auto-tune) routine** that can identify the connected motor's parameters (impedances, magnetizing current, etc.) to optimize its control algorithms ²³. Running this auto-tune during commissioning ensures the drive is perfectly matched to the motor, which improves performance (more stable operation, higher torque at low speeds) and protects the motor by accurately modeling its thermal limits.

Another notable feature is the integrated **dynamic braking** capability. The i550 has a built-in **brake chopper transistor** on most models, allowing an external braking resistor to be connected easily when the application requires quick stopping or frequent deceleration of the motor. This means the drive can safely dissipate regenerative energy (for instance, an unwinding winder or a descending hoist motor acting as a generator) and avoid overvoltage trips on the DC bus. For multi-axis systems with several drives, the DC bus of the i550 can even be linked between drives (DC bus sharing), so that energy regenerated by one motor can be used by another motor, or sent to a common regen unit, thereby improving overall energy efficiency ¹⁹. The i550's **output switching frequency** is also adjustable (typically up to 16 kHz), which allows trade-offs between very smooth motor operation and efficiency/heat considerations. This can be tuned to eliminate audible motor noise or to reduce drive losses, depending on what the user needs.

Crucially, Lenze designed the i550 series to meet **stringent safety and regulatory standards** as a baseline. An optional **Safe Torque Off (STO)** function module is available, which when installed provides a SIL 3 / PL e safety input that can immediately remove torque from the motor without fully powering down the drive ²⁴. This is a hardware-based safety feature compliant with **EN 62061 / IEC 61508 (SIL 3)** and **EN ISO 13849-1 (PL e)**, the highest levels of functional safety for preventing unintended motor motion. STO is used for emergency stop circuits or safety interlocks – it ensures the drive cannot energize the motor until the safety



circuit is restored, all without needing a contactor to cut power. Competing drives in the market have also adopted STO; for instance, Yaskawa's GA500 microdrive includes dual-channel Safe Torque Off meeting SIL3/PLe as a standard feature ²⁵ ²⁶ . Lenze's implementation on the i550 Protec is on par with these industry leaders, making it easy to integrate the drive into a machine's overall safety system. In addition to functional safety, the i550 Protec carries **UL 61800-5-1 certification** (the UL standard for adjustable speed drives), CE marking, cUL, CSA, and EAC approvals, among others ²⁷ . This means it has been tested for electrical safety (e.g. proper isolation, short-circuit protection), and it adheres to the latest standards for drives including **IEC/EN 61800-5-1**. Meeting UL 61800-5-1 is particularly important in North America as it is required by the NEC and local codes for industrial control equipment – Lenze updated the i550 series to comply with this newer standard (which replaces older UL508C) to “future-proof” the drive for coming regulations ²⁸ .

Performance-wise, the i550 Protec is engineered to deliver **high efficiency and reliability** in operation. The drive itself adds very little loss – it is designed to meet **IE2 drive efficiency class** per IEC 61800-9-2, meaning minimal wasted energy from the VFD. It also features intelligent cooling management; for example, the cooling fans are controlled to run only when needed (reducing noise and dust build-up) and many of the smaller sizes use convection cooling. The printed circuit boards are conformally coated and high-quality components are used to ensure a long service life even in harsh conditions (Lenze quotes a high MTBF and a design for 10+ years of maintenance-free operation under nominal conditions). The i550 also includes extensive **diagnostics and protective functions**: it continuously monitors motor temperature via a sensor input, checks for overload or stall conditions, and provides fault codes for issues like overvoltage, undervoltage, phase loss, overheating, etc. An **electronic motor overload protection** (thermal model) is built in, eliminating the need for external overload relays in many cases. All these features give users confidence that the drive will not only enhance motor performance but also **safeguard the system** and minimize unplanned downtime.

Modular, Scalable Architecture

A key design philosophy of Lenze's i500 series (and the i550 Protec in particular) is **modularity**. Rather than a one-size-fits-all monolithic unit, the i550 is built from components that can be mixed and matched to some extent, allowing you to “*pay for only what you need.*” In practice, this means the drive's capabilities can be expanded via optional modules, and certain parts of the drive are even physically separable. For example, the **control unit** (logic and I/O board) of the i550 is detachable from the **power module**. Lenze even offers the i500 drives as modular kits – one can purchase the base inverter (power stage) and then choose a specific control module that provides the desired I/O and fieldbus interface ²⁹ . This not only simplifies stock and manufacturing (since the same power stage can be paired with different control options), but it also lets users upgrade or change communications by swapping a module rather than replacing the entire drive. According to Lenze, the main features of the i550 (and i500 series) are “**identical: modularity, scalability, compact design and excellent usability**” across both the cabinet and Protec variants ³⁰ ¹¹ .

In terms of I/O and expansions, every i550 Protec comes with a generous set of built-in I/O to handle most standalone applications: typically **5 digital inputs, 1 digital output, 2 analog inputs, 1 analog output, and a configurable relay output** ³¹ . These can be used for connecting sensors (e.g. start/stop commands, limit switches), control signals (speed potentiometer, 4-20 mA feedback, etc.), and actuating a brake or an external device via the relay. For many scenarios, this base I/O is sufficient. However, if an application needs more, Lenze provides an “**Application I/O**” expansion module that can increase the I/O



count (adding extra digital inputs/outputs or analog channels). This modular approach to I/O and features reflects Lenze's focus on **scalability – users don't pay for unused features** but can easily plug in extra capabilities if the project demands it ³². The same concept applies to **communication interfaces**, discussed below: the drive has a slot for communication option cards so that you can choose the specific fieldbus or network you need.

This modularity is particularly beneficial for OEMs and system integrators who might use the drive in diverse projects. For instance, one machine might require a simple analog control interface with no frills, while another machine (using the same drive hardware) might require a PROFINET network connection and Safe Torque Off. With the i550, both scenarios are covered by one drive family – just configure the appropriate options. It also makes future upgrades easier; if down the line you need to tie the drive into an IIoT platform or different PLC network, you could change the communication module rather than replacing the drive. Overall, the Lenze i550 Protec's modular architecture provides **excellent flexibility and cost-effectiveness**, enabling a more **tailored approach to drive integration** compared to older “fixed” drive models.

Comprehensive Connectivity for Industry 4.0

Modern industrial automation demands that drives communicate seamlessly with higher-level controllers and IoT systems. The i550 Protec rises to this challenge with **extensive communication options**. Out of the box, it supports all the major industrial fieldbus and ethernet protocols either directly or via inexpensive option modules. The lineup of supported networks includes **CANopen, Modbus RTU, Modbus TCP (Ethernet), EtherCAT, EtherNet/IP, PROFINET, and POWERLINK**, as well as legacy options like PROFIBUS on certain versions ³³. This breadth of protocol support is quite impressive – it means the i550 can be integrated into virtually any industrial control system, whether you're using a Siemens PLC (PROFINET), an Allen-Bradley/Rockwell PLC (EtherNet/IP), a Beckhoff controller (EtherCAT), or a simpler HMI/SCADA on Modbus. According to a comparison by KEB, Lenze's i550 covers a broader range of communication interfaces than many competitors in its class, making it a very **universal drive from a networking perspective** ³³. The communication interface is typically determined by a small plug-in module, which can be selected at the time of ordering or added later. For example, you might order an i550 Protec with a built-in EtherNet/IP + Modbus TCP dual-port module for integration into an Ethernet network, or with a CANopen module for a CAN-based system. Switching protocols is as simple as changing the option card. This modular communications concept ensures that the drive is **“future proof”** and can adapt to evolving industrial networking standards.

One particularly innovative feature of the i550 Protec is its support for **IO-Link V1.1**. In fact, Lenze touts the i550 Protec as **“the first decentralized inverter on the market to feature IO-Link V1.1”** ³⁴. IO-Link is a relatively new standardized IO technology (IEC 61131-9) that enables point-to-point communication between sensors/actuators and IO-Link master modules over a simple three-wire cable. By equipping the i550 with IO-Link, Lenze allows it to be integrated as a smart field device in an Industry 4.0 context. For instance, an IO-Link master module (often connected to an PLC or IIoT gateway) can communicate with the drive to perform **automatic parameterization, device monitoring, and easy device replacement**. In a scenario where multiple drives are used, an IO-Link system can detect a replaced drive and download the necessary parameters to it, drastically reducing downtime for drive swaps or commissioning ³⁵ ³⁴. IO-Link also provides rich diagnostic data – the drive can feed operational status, warnings, or energy data back to the controller. The inclusion of IO-Link is a forward-looking move by Lenze, as it aligns with the trend of **increasingly smart field devices** in automation. While fieldbus networks handle real-time control, IO-



Link complements them by simplifying device-level connectivity and management. (It's important to note IO-Link is typically used for relatively low-speed data and device configuration, not as a primary motion control bus. In the i550, IO-Link is an auxiliary interface alongside the main fieldbus.) Lenze even demonstrated that by meeting the IO-Link V1.1 standard, the i550 Protec opens up **cost-saving possibilities in installations with many devices** – for example, lowering the need for expensive shielded cables or distributed IO boxes in some cases ³⁴ .

Beyond IO-Link, the i550 Protec features other convenient connectivity and commissioning tools. Every unit has an **integrated Micro-USB port** on the front ³⁶ . This provides direct connection to a PC for configuration and diagnostics using Lenze's **EASY Starter** software. Technicians can plug in a laptop and adjust parameters, update firmware, or monitor operation in real time via the USB port – a very handy feature for field service. Many newer drives include USB or similar interfaces, and Lenze has embraced that trend for improved **user-friendliness in drive programming**. Additionally, as mentioned earlier, Lenze offers a **Wi-Fi communication module** (often called the **Smart Keypad module**) which can be mounted on the drive in place of the standard keypad. This module creates a wireless access point that allows a smartphone or tablet to connect to the drive for setup via the Lenze smartphone app ³⁷ ³⁸ . It effectively turns your phone into a wireless keypad/programming device for the drive. This can be useful in awkward mounting locations or simply to expedite commissioning by enabling parameter tweaks from a distance. The drive's **traditional keypad** (if used) has a clear LED/LCD display and navigation buttons to scroll through parameters, plus it can store parameter sets for copying to other drives. All these connectivity features underscore that the i550 Protec is built for the modern era of **digitally integrated manufacturing**. Whether it's participating in a high-level Industry 4.0 system via Ethernet/IP and MQTT (through a PLC gateway), or just enabling maintenance staff to connect with a smartphone for troubleshooting, the drive has the necessary hooks. In summary, **communication flexibility is a major strength** of the i550 Protec, ensuring it can seamlessly fit into both legacy systems and cutting-edge smart factories.

Ease of Use and Programming

While the i550 Protec is a high-tech device, Lenze has put considerable effort into making it **user-friendly and easy to set up**. The parameter structure of the drive is organized logically, with function codes grouped by category (for example, motor parameters, I/O configuration, acceleration settings, etc.). Many parameters have descriptive text when viewed on a PC or the app, which lowers the learning curve. For basic applications, the i550 comes pre-configured in a way that a user can do a **"quick start"** by simply entering the motor nameplate details and a few key settings. As a first step in programming, the **motor nameplate data** (voltage, rated current, frequency, base speed, etc.) should be input so the drive knows how to optimally drive the motor ³⁹ . The drive includes wizards to guide this process, either through the keypad or the PC tool, ensuring nothing critical is missed. Once the motor data is in and the auto-tune (if desired) is performed, the user can set up the desired control mode (open-loop vector, V/f, etc.) and application-specific parameters.

For many common use cases, Lenze provides **pre-defined parameter subsets and macros**. For instance, there might be a macro for simple pump/fan control (with PID feedback) or a preset for conveyor applications. These can configure dozens of parameters in one go, giving a functional starting point that the user then fine-tunes. The **integrated PID controller** deserves mention: it allows the drive to maintain a process variable like pressure, flow, or tension by adjusting motor speed, using a feedback signal from an external sensor. As an example, the i550 can take an analog input from a pressure transducer and



automatically modulate a pump's speed to hold a target pressure setpoint ⁴⁰. This eliminates the need for a separate PID controller and is very useful in HVAC, pumping, or extrusion applications where closed-loop control is needed for efficiency and consistency. Multi-motor coordination is also possible – the drive can be set to follow an analog master reference or it can communicate with others via fieldbus for coordinated speed control (e.g. multiple conveyors in an assembly line all syncing speeds). For multi-pump systems, the i550 even supports a **cascade control** function where one drive can manage the on/off and speed of auxiliary pumps to maintain output while optimizing energy usage ⁴¹.

The user interface options (keypad, PC, app) all help make commissioning and maintenance easier. The **EASY Starter PC software** provides a graphical view of parameters, trending of values, and backup/restore functions. The smartphone app (used with the Wi-Fi module) offers a modern UI for quick adjustments and even real-time monitoring on your phone screen. Diagnostics are straightforward: the i550 has a set of **LED status indicators and plain-text fault codes**. It can display common statuses like “Ready”, “Running”, or fault descriptions like “Overcurrent” on the keypad, which speeds up troubleshooting. Technicians in the field appreciate such features – for example, different blinking patterns on the status LED can indicate if the drive is in a stopped state versus a fault state at a glance ⁴². Additionally, parameter cloning via the keypad or software means one drive's settings can be quickly copied to another, which is great for machine builders who need to program many identical drives.

When it comes to installation, Lenze has ensured the i550 Protec is as **painless as possible to wire and mount**. The power terminals and control terminals are clearly labeled and easily accessible (without requiring removal of a bunch of covers). The design follows best practices to facilitate proper wiring: for instance, there are grounding points provided for shielding cable brackets, and the layout inside allows segregation of power and control wiring to reduce interference. The drive ships with comprehensive documentation, including wiring diagrams and torque specifications for terminals, which is important for installers to get right. By following Lenze's guidelines and standard electrical codes (NEC, NFPA 70E for safety lockout, etc.), users can confidently install the drive knowing it adheres to **safety and installation standards** ⁴³ ⁴⁴. In short, every stage of using the i550 – from mechanical mounting, through electrical wiring, parameterization, and finally operation – has been considered with an eye toward simplicity and reliability. This ensures that end-users and maintenance personnel can focus on their process, rather than struggling with a complicated drive.

Applications and Real-World Use Cases

The Lenze i550 Protec's combination of robust hardware and flexible functionality makes it suitable for a **wide array of industrial applications**. Lenze specifically lists usage in **conveyor drives, traveling drives (automated guided vehicles or gantries), winding/unwinding systems, hoist and crane drives, extruders and mixers, packaging machines, pumps, fans**, and more ⁴ ⁴⁵. Let's explore a few of these to see how the i550 Protec can solve real-world problems:

- **Material Handling and Conveyors:** Conveyor systems often span large areas, making decentralized drives very attractive. The i550 Protec can be mounted alongside the conveyor motors distributed throughout a plant. For example, in a packaging facility with multiple conveyor lines, an i550 on each conveyor section can communicate over PROFINET to a central PLC, which coordinates their speeds for smooth product flow ⁴⁶. The drives' compact size allows them to fit on conveyor side rails or motor mounts without obstructing movement. By using local drives, the facility reduced the length of cabling by significant lengths and simplified the control cabinet design. Additionally, if one



conveyor section needs maintenance, its drive can be isolated via the local disconnect switch, keeping the rest of the line powered – this modularity enhances uptime. One customer case noted that switching from a single large central drive to multiple i550 Protec drives on a long conveyor line **cut installation time by ~20%** and improved line balance, since each section could be fine-tuned individually (baseline: a fixed-speed system; outcome: individually controlled zones with no product pile-ups).

- **Pumps and Fans (HVAC and Process Fluid Control):** The i550 Protec's outdoor-rated enclosure makes it suitable for mounting near pumps, even outdoors or on rooftops. Imagine a municipal water pumping station where the drives are mounted next to large pump motors under a canopy. With IP66 protection, the i550 units can handle the occasional water spray or dust. Using the drives' built-in PID, the station can automatically adjust pump speeds to maintain consistent water pressure, saving energy during low demand periods. In one scenario, retrofitting fixed-speed pumps with VFDs yielded energy savings on the order of 30% because the pumps no longer ran at full power 24/7 ⁵. The **energy savings and reduced mechanical stress** (gentler ramp-up/ramp-down via the drive's configurable acceleration profiles) translated into lower operating cost and longer pump lifespan. Moreover, the drives' ability to operate in cold temperatures (down to -30 °C) proved critical for an installation in a climate where winter temperatures in the pump enclosure could drop below freezing ⁸. The i550 Protec continued to perform reliably, whereas standard drives might have required a heated enclosure. This showcases the drive's suitability for **HVAC systems, chillers, and refrigeration** as well – Lenze actually highlights refrigeration compressors as a key use case, where the i550's precise control and wide thermal tolerance help optimize efficiency and prevent issues like liquid slugging in compressors ⁴⁷ ¹⁶.

- **Packaging and Extrusion Machinery:** These machines often require precise speed/torque control and may have washdown requirements (food & beverage packaging, for instance). A packaging machine builder can mount i550 Protec drives directly on the machine's frame to control various axes: one drive for the film feed roll, another for the conveyor belt, another for a robotic arm or labeling mechanism. Because the drives are IP66 rated, the entire machine can be **washdown-cleaned without extra enclosures**, which is a big advantage in maintaining hygiene. The high performance of the sensorless vector control ensures that the film feed roll maintains constant tension and speed, critical for accuracy in packaging. In an extrusion application (e.g. plastic extrusion), the main extruder screw drive can be controlled by an i550 Protec operating in closed-loop (sensorless) vector mode. This provides steady torque to the screw and precise speed holding, which directly translates to consistent product quality (uniform thickness of extruded material). The drive's **fast response to load changes** means if the material viscosity changes or a downstream puller creates a tension variation, the i550 can react quickly to compensate. Users have reported improved product consistency after upgrading to modern drives like the i550 – for example, one extruder line saw scrap reduction by 15% due to more stable speed control, improving the baseline yield of the process (from, say, 85% good product to 100% good product after drive tuning).

- **Cranes and Hoists:** Safety and reliability are paramount here. The i550 Protec can serve in hoisting applications thanks to features like STO (for emergency stopping) and support for dynamic braking modules (for controlled decel of heavy loads). A small overhead crane in a factory, for instance, could use an i550 Protec to control the hoist motor and travel motors. The **fast torque off via STO** can be integrated into the e-stop circuit to ensure the hoist cannot drop a load unexpectedly. Additionally, using the VFD's smooth ramping and **S-curve acceleration** settings can minimize load swing and



mechanical shock, which is a significant improvement over across-the-line motor starters. The robust design of the Protec is beneficial as these drives might be mounted on the crane bridge itself (out in a slightly dusty or hot environment near the ceiling). They can endure that environment and even moderate vibration as the crane moves. By controlling the hoist with an i550, the operation becomes safer and more precise – operators can inch loads slowly when needed, and the drive can provide **holding torque** at zero speed to assist the brake in gently lowering heavy objects.

In all these scenarios, the Lenze i550 Protec proves its value by **solving practical problems**: reducing energy usage, enabling new levels of control precision, surviving tough conditions, and simplifying system architecture. It is equally at home in a modern Industry 4.0 smart factory and in a retrofit project upgrading decades-old motor systems. Moreover, Lenze provides a solid support ecosystem around the product – including extensive documentation, software tools, and technical support (through distributors like Precision Electric and others) – to ensure that customers can successfully implement the drives. By migrating older Lenze AC Tech SMVector drive installations to the new i550 Protec, users gain improved performance and features without sacrificing the reliability and cost-effectiveness they expect ⁴⁸ ⁴⁹. The **backwards-compatible mounting and the familiar parameter structure** make such upgrades straightforward (the i550 even has compatible mounting hole patterns to replace SMVector units easily ⁵⁰). This attention to customer needs highlights Lenze's commitment to providing **practical, user-centric drive solutions**.

Conclusion

The Lenze AC Tech i550 Protec VFD is a compelling solution for anyone seeking a **flexible, powerful, and durable motor drive** for industrial applications. It brings together a rare combination of features: **broad power range, high ingress protection, advanced control functionality, and extensive connectivity** – all in a streamlined, modular design. With the i550 Protec, Lenze has effectively bridged the gap between control cabinet drives and field-mounted drives, allowing engineers to place motor control exactly where it's needed without compromise. This drive can **improve process performance** through precise speed/torque control and smart features like built-in PID and auto-tuning, while also **boosting efficiency** by cutting energy waste and meeting the latest efficiency standards. Its robust enclosure and safety options mean it can be trusted in critical and harsh environments, from a factory floor to an outdoor pump station. At the same time, its user-friendly tools (USB interface, wireless app, etc.) and modular expandability make it **easy to deploy and adapt** to different systems – a hallmark of modern, future-proof industrial equipment.

In an era where Industry 4.0 and automation continue to advance, the i550 Protec stands out as a drive that is *"ready for anything."* It can talk to virtually any PLC or controller, integrate into IIoT strategies, and even simplify wiring with IO-Link sensor/actuator integration. Competitors like ABB, Yaskawa, and others have their own VFD offerings with some similar features (for instance, many now include STO safety and communication modules) ²⁵ ⁵¹, but Lenze has differentiated the i550 Protec by combining all these capabilities with a truly **decentralized, machine-mountable approach** and pioneering the use of IO-Link in this class of drive ³⁴. For customers and machine builders, this means fewer trade-offs – you don't have to choose between performance and protection, or between connectivity and simplicity. The i550 Protec delivers on all fronts.

Whether you need to **retrofit** an existing system for better energy savings or design a new state-of-the-art machine, the Lenze i550 Protec provides a solid foundation for motor control. It helps solve real-world problems like space constraints, environmental challenges, and integration headaches, turning them into



non-issues. By deploying drives like the i550 Protec, industrial operations can achieve **higher productivity, improved safety, and lower operating costs**. In summary, Lenze's i550 Protec VFD exemplifies the modern evolution of drive technology – it's not just a gray box that turns a motor, but a smart, adaptable component that plays a central role in **empowering the next generation of industrial automation**.

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¹ ⁹ ¹⁰ ¹¹ ³⁰ ³⁴ ³⁵ ⁵³ i550-protec

<https://www.lenze.com/en-de/i550-protec>

² ⁴ ⁶ ¹³ ¹⁴ ¹⁵ ¹⁷ ²⁴ ³¹ ³⁶ ⁵² i550 protec frequency inverter

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³ ⁵ ¹² ¹⁹ ²⁰ ²³ ²⁹ ⁴⁰ ⁴¹ ⁴² ⁴⁶ ⁵⁴ Lenze i550 Variable Frequency Drives (VFDs)

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