



ABB ACS880 Variable Frequency Drives (VFDs)

A wall-mounted ABB ACS880 variable frequency drive unit (one of the larger frame sizes). The ACS880 series covers a broad range of modular drives for industrial applications.

The **ABB ACS880** series is a flagship line of low-voltage industrial **variable frequency drives (VFDs)** engineered for high performance and flexibility. These all-compatible drives are designed to control a wide variety of AC motors with precision, from standard induction motors to advanced permanent magnet and synchronous reluctance motors. The ACS880 family spans an **extensive power range from about 0.55 kW up to 6000 kW** (0.75 to 8050 HP), available in voltages from 230 V up to 690 V AC ¹. This broad scalability means a single drive platform can be applied to everything from small pumps and fans to massive multi-megawatt industrial machines. Each drive is built for demanding environments – with enclosure ratings up to **IP55 (UL Type 12)** for dust/moisture protection – and can operate in high ambient temperatures (up to ~55 °C with proper cooling or derating) ² ³. The ACS880's robust design emphasizes reliability, offering a long service life with maintenance intervals of **up to 9 years** in normal operation ⁴ ⁵. In short, ABB's ACS880 VFDs provide a versatile, **high-performance motor control solution** that can be tailored to virtually any industrial sector or application.

Technical Specifications and Range

Power and Configuration: The ACS880 is offered in multiple hardware configurations to suit different installation needs. **Wall-mounted single drives (ACS880-01)** cover power ratings roughly from **0.75 HP up to 350 HP** (at 480 V) for stand-alone use ⁶. For larger motors and systems, **free-standing cabinet units (ACS880-07)** extend the range up to about **1700 HP** at 480 V (and even 3000+ HP at 575–690 V) by integrating the drive into an enclosed cabinet with heavier-duty components ⁷. The ACS880 series also includes specialized variants: **regenerative drives (ACS880-17)** that can return braking energy to the power supply (available in ratings up to ~4250 HP), and **ultra-low harmonic drives (ACS880-37)** with built-in active filters to achieve <3% current harmonic distortion ⁸ ⁹. For multi-motor systems or custom panels, ABB provides ACS880 **drive modules (ACS880-04 and others)** that are optimized for mounting into equipment cabinets. These modules come in both air-cooled and **liquid-cooled** versions – the liquid-cooled modules offer extremely high power density and dissipate ~98% of heat via coolant, enabling **compact installations** with minimal airflow requirements ¹⁰ ¹¹. In fact, ACS880 liquid-cooled drives are prized for **silent operation and durability in harsh environments**, and can even be built into explosion-proof or marine-duty enclosures when required ¹² ¹³. Across all formats, the ACS880 drives maintain high efficiency (around **97–98% efficiency** at full load) and support heavy-duty operation with sizable overload capacity (typically **150% overload for 60 seconds** in high-torque applications) ¹⁴ ¹⁵.

Motor Control and Performance: At the core of every ACS880 is ABB's advanced **Direct Torque Control (DTC)** technology. DTC is a proprietary vector control method that **directly regulates motor torque and flux** in real time, without the need for a fixed PWM carrier frequency. This yields **exceptionally fast torque response** (on the order of 5 ms torque rise time) and precise speed control, even at very low speeds or zero speed ¹⁶ ¹⁷. In practical terms, DTC allows the ACS880 to achieve full torque at zero speed and hold a setpoint without an encoder in most cases. According to ABB, **no feedback device is required in about 95% of applications** because DTC's algorithm is accurate enough to control speed and torque **sensorlessly**.



in almost all normal scenarios ¹⁸. The drive's speed regulation accuracy in open-loop mode is within **10% of motor nominal slip** (which for an induction motor typically corresponds to only a fraction of a percent error in absolute speed), and can reach **±0.01% precision** with an encoder in closed-loop mode ¹⁹. This high level of performance makes the ACS880 suitable for demanding tasks such as cranes, winders, extruders, and test stands that require dynamic response and stable control. DTC also natively supports different motor types – not only standard AC induction motors, but also **permanent magnet synchronous motors and synchronous reluctance motors** – with no change in hardware ²⁰ ²¹. By auto-tuning to the motor's parameters (via a built-in identification routine), the drive can optimize its control for maximum torque per ampere and efficiency. The result is **smooth, reliable torque production across the full speed range** and quick recovery from load transients, without the complexity of manual tuning in most cases.

Electrical Specs: The ACS880 drives accept a **three-phase AC supply** and accommodate all common global voltage levels. Standard models cover **230 V (208–240 V)**, **480 V (380–500 V)**, and **600/690 V (525–690 V)** mains, each with ±10% voltage tolerance ²² ²³. Input frequency can be 50 or 60 Hz (±5%), and the drives are rated for a **short-circuit current** of 100 kA (with proper fusing) to meet UL 508C requirements ²⁴. The output of the drive is a PWM-synthesized three-phase voltage that can range from 0 up to the full supply voltage. The frequency output is **controllable from 0 to 500 Hz or higher** (sufficient for high-speed motors) ²⁵. All ACS880 units include built-in line filtering and protection: for example, **DC link chokes** are integrated to reduce harmonics and ripple, and (on most frame sizes) dynamic **braking choppers** can be added or come built-in to dissipate regenerative energy when needed ²⁶ ²⁷. In installations where harmonics must be minimized (to meet IEEE-519 or protect sensitive equipment), the ACS880-37 low-harmonic drives use an active front-end rectifier and filters to keep total harmonic distortion (THD) below 3% ⁸. Conversely, in regenerative applications such as downhill conveyors or cranes, the ACS880-17's active rectifier allows **braking energy to be fed back** into the grid, **recycling power and reducing energy consumption** ²⁸. All ACS880 models have a high input power factor by design (near 0.98) thanks to the choke and diode/IGBT front end, so they draw current efficiently and without big phase-angle losses.

Environmental and Build: Engineered for industrial environments, the ACS880 is rated for operation in ambient temperatures from **-15°C up to 40°C** without derating (and up to 50–55°C with power derating) ²⁹ ³⁰. Cooling is typically by forced air for wall-mounted and cabinet units (with variable-speed fans and temperature monitoring), whereas liquid-cooled modules use a closed-loop coolant circuit. The drives are available in various **enclosure ratings** to match installation needs. Wall-mounted single-drive units can be ordered in **IP20/Open**, **IP21 (UL Type 1)**, or **IP55 (UL Type 12)** enclosures for different levels of ingress protection ³¹. Larger cabinet-built systems likewise offer UL Type 1 or Type 12 options (with filtered air vents for IP42 on some) ³². Conformal coating on circuit boards is standard (IEC 60721 3C2 class) to guard against dust and moisture, and the overall design meets global standards for vibration and environmental durability ³³ ³⁴. The ACS880 carries worldwide certifications – it is **CE marked** and UL listed, complies with the IEC/EN 61800-5-1 drive safety standard and IEC 61800-3 EMC requirements, and even has specific options certified for use in hazardous (ATEX) atmospheres and marine/offshore applications ³⁵ ³⁶. ABB offers marine-duty variants that are type-approved by marine classification societies (ABS, DNV-GL, Lloyd's, etc.) for use on ships and offshore platforms ³⁶. In summary, the ACS880 hardware is built to **withstand harsh industrial conditions** and to integrate into virtually any global installation with minimal adaptation.



Key Features and Capabilities

Advanced Motor Control and Dynamics

One of the defining features of the ACS880 series is its **high-precision motor control**, enabled by the aforementioned Direct Torque Control. **DTC** gives these drives a performance edge in applications requiring accurate torque and speed regulation. For example, unlike conventional V/Hz or standard vector drives that may require an encoder for low-speed accuracy, the ACS880 can typically hold **zero speed with full torque** without any encoder feedback ¹⁸ ³⁷. This is particularly beneficial for cranes, hoists, and elevators, or during machine startup, where full torque at 0 RPM is needed to overcome static friction. The **dynamic response** of the control is extremely fast – the drive can react to changes in load or setpoint within a few milliseconds, which means minimal overshoot or delay in critical processes. Tests have shown the ACS880's torque control precision and response time to be at the top of its class, even outperforming ABB's earlier high-end drives (ACS800) in holding a steady torque at near-zero speed without oscillation ³⁸ ³⁹. In practical terms, this precision leads to **smoother processes and less mechanical stress**: conveyors accelerate without jerks, winders keep constant tension, and mixers maintain consistent speeds under varying loads. The ACS880 also supports various control modes to suit different needs – it can run in simple V/Hz (scalar) mode for multi-motor or pump/fan systems, or in full vector control modes (open-loop DTC or closed-loop with an encoder) for highest performance. Switching between modes is straightforward via parameters, and the **primary control program** is uniform across the ACS880 family, meaning the same software features and parameters are available on all drive sizes ⁴⁰ ⁴¹. This consistency simplifies setup and allows users to “learn it once, use it everywhere,” which is a theme of ABB's all-compatible drive portfolio ⁴².

Integrated Safety Functions

Modern industrial drives often include functional safety features, and the ACS880 is **well-equipped with safety integration**. Each drive comes standard with **Safe Torque Off (STO)** circuitry that can instantaneously remove power from the motor upon a safety request. The STO feature in the ACS880 is certified to the highest safety integrity levels (**SIL 3 per IEC 61508 / PL e per ISO 13849-1**), meaning it can be used in applications requiring the highest level of fail-safe performance ⁴³ ⁴⁴. Activating STO (for example, via a safety relay or safety PLC) ensures that the drive will not generate torque, allowing safe access to machinery without fully powering down the entire system. In addition to basic STO, ABB offers an optional **Safety Functions module** that extends the drive's capabilities to include features like Safe Stop 1 (SS1), Safe Brake Control, Safe Speed Monitoring, and safety over fieldbus (via protocols like PROFIsafe) ⁴⁵ ⁴⁶. These enable advanced safety strategies – for instance, the drive can be commanded to ramp to a stop within a defined time (SS1) or hold a monitored low speed for manual inspection, all with built-in redundancy and diagnostics. By having these functions inside the drive, users can often eliminate external safety contactors or complex wiring, simplifying the safety system design. The ACS880's safety options are TÜV-certified and integrate with ABB's Safety PLCs or any other functional safety system. Overall, the **drive-based safety** reduces downtime during maintenance and enhances operator protection while meeting stringent safety standards.

Flexibility and Connectivity

ABB designed the ACS880 series to be highly adaptable, both in hardware and software, to meet diverse customer requirements. On the hardware side, the drives include a **modular I/O and communications**



interface. The standard configuration provides multiple analog and digital inputs/outputs (typically 2 analog inputs, 2 analog outputs, 6 digital inputs, 3 relay outputs on the base control unit) for integration with sensors and controls ⁴⁷ ⁴⁸. For example, you can connect external 4–20 mA signals for speed reference, use digital inputs for start/stop or preset speeds, and have the drive's relays report status or faults to a PLC. If the default I/O isn't sufficient, the ACS880 supports **plug-in option modules** to expand its capabilities – this includes additional I/O extension modules and a variety of **fieldbus/industrial network adapters** ⁴¹ ⁴⁹. The drive can thus communicate with all major automation systems. Supported protocols include **Modbus TCP/IP and RTU (built-in)**, and optional modules for **EtherNet/IP, PROFINET, Profibus DP, CANopen, DeviceNet**, and more ⁵⁰. This breadth of connectivity makes it easy to integrate an ACS880 drive into existing plant control systems or IIoT environments. In fact, ABB refers to the ACS880 and its peers as “all-compatible” drives partly because they can interface with virtually any PLC or control architecture out of the box ⁵¹.

On the software side, ACS880 drives come with **adaptive, user-friendly programming** features. The drives use ABB's common **Primary Control Program** firmware, which includes a set of standard application macros and logic that can cover most use cases (like basic PID control for a pump, torque control for a winder, etc.). For more customization, users can create sequences with function blocks or even write custom programs (ABB's Drive Application Programming or IEC 61131-based add-ons) to tailor the drive's behavior. Despite this power, everyday configuration is made easy via the **intuitive control panel** and PC tools. The ACS880's optional **graphical control panel** (ACS-AP-x series) has a high-resolution display with plain language menus. It supports multiple languages and offers **visual dashboards** – for instance, you can view bar graphs or trend charts of speed, load, and other parameters in real time ⁴² ⁵². This is helpful for tuning and diagnostics without needing a laptop. The panel also includes a USB port, allowing quick connection to a computer running **ABB Drive Composer** software ⁵³. Using Drive Composer (Standard or Pro edition), engineers can commission the drive, adjust settings, monitor signals, and even do firmware updates in a user-friendly interface. Additionally, ABB provides mobile apps (such as **Drivetune**) which, with a Bluetooth-enabled panel or a wireless adapter, let you monitor and control the drive from a smartphone or tablet. The ACS880 also features a **removable memory unit** that stores all configuration parameters and firmware; this small module can be pulled from a drive and inserted into another, **cloning** the entire setup in seconds ⁵⁴. This greatly simplifies replacing a drive or copying settings across multiple drives – for example, a maintenance technician can swap in a new ACS880, plug in the memory unit from the old drive, and the system is back up with identical settings **without manual reprogramming** ⁵⁵. Overall, the ACS880's connectivity and flexible design help **streamline integration and minimize engineering time**, whether you're retrofitting a single motor or designing a complex automated line.

The ACS880's user interface includes a removable control panel (keypad) with USB connectivity for PC tools. The drives also support plug-in modules for fieldbus communication and I/O expansion, making integration with automation systems straightforward.

Beyond control and networking, the ACS880 offers many **options and features to tailor the drive** to the application. ABB provides a range of add-on modules and + codes (factory-installed options): these include **EMC filters** of various classes to meet strict radio-frequency emission standards, **dV/dt output filters** or sine wave filters to protect motor insulation on long cable runs, and different cooling and mounting arrangements (e.g. flange mounting kits that let the heatsink protrude outside a panel) ²⁶. Braking options are flexible as well – smaller ACS880 units have built-in braking transistor circuits, and larger units can be equipped with external brake choppers or the above-mentioned regenerative front-end to handle energy from decelerating loads ⁵⁶ ⁵⁷. The drives include extensive **monitoring and protection functions** for reliable operation. Standard protections cover overcurrent, overvoltage, undervoltage, motor overload,



ground fault, and overtemperature conditions, among others ⁵⁸ ⁵⁹. Diagnostic features such as **fault logging** and a real-time clock help with troubleshooting; the last faults and events are timestamped and stored in memory for review via the panel or software. For remote monitoring, ABB's NETA-21 module or cloud-connected solutions can be used to gather drive data and provide alerts. In short, **every aspect of the ACS880 can be customized or tuned** – from the firmware logic to the physical configuration – ensuring that the drive can be optimized for performance, efficiency, and longevity in its specific role.

Energy Efficiency and Smart Features

Using VFDs like the ACS880 is generally recognized as a key energy-saving measure in motor-driven systems. By matching motor speed to the actual load demand, the drive eliminates the wasteful throttling or mechanical damping that occurs when motors run at full speed unnecessarily. The ACS880 goes a step further by incorporating dedicated **energy optimization features**. For example, it includes an **Energy Optimizer** control mode that automatically reduces magnetization current in lightly loaded conditions, maximizing the motor's torque-per-amp and avoiding excess energy draw ⁶⁰. The drive's software also calculates **energy consumption and savings** in real time – users can view on the panel how many kilowatt-hours have been used and an estimate of energy saved (versus a fixed-speed baseline), as well as the corresponding reduction in CO₂ emissions or cost savings ⁶¹. These built-in energy calculators help in fine-tuning processes for efficiency and provide immediate feedback on the benefits of using the VFD. In applications like pumps and fans, energy savings on the order of 20–50% are common when replacing throttle or on/off control with variable-speed control, and the ACS880 makes it easy to monitor and document these improvements.

The ACS880's **ultra-low harmonic (ULH) drive** option contributes to energy efficiency at the system level by improving power quality. With less than 3% current harmonics reflected back to the supply ⁸, these drives reduce wasteful heating in transformers and generators and help avoid power factor penalties. Clean power draw also means you can often **avoid oversizing** backup generators or transformers that would otherwise need to handle harmonic currents – saving on infrastructure costs. Meanwhile, the regenerative ACS880 units can deliver significant energy recovery. Instead of dissipating braking energy as heat in resistors, the drive uses active rectifier technology to **feed energy back into the electrical network** during deceleration or braking events ²⁸. For installations with frequent braking cycles (such as cranes, elevators, test dynos, or centrifugal machines that decelerate large masses), the energy savings and heat reduction can be substantial. This not only cuts electricity use but also lowers cooling requirements in electrical rooms (since less heat is rejected from braking resistors).

Real-world examples have demonstrated the impact of these features. In one case, a **food processing facility** struggling with irregular motor loads installed ACS880 drives on its equipment and saw a **25% reduction in energy consumption** after the upgrade, while also resolving the torque control issues that had been causing downtime ⁶² ⁶³. Another example comes from a manufacturing plant that retrofitted older drives with ABB ACS880 units and efficient motors – the plant reported energy savings on the order of **20% annually** and a throughput increase of around **15%** in the production line, thanks to the more responsive speed control and elimination of bottlenecks ⁶⁴ ⁶⁵. These improvements translated to a rapid return on investment (in some cases under 2 years) due to lower utility bills and higher productivity. Even in applications primarily installed for performance rather than energy reasons, the ACS880's efficiency and smart control can yield secondary benefits like reduced peak power demand and improved power factor (nearly unity, ~0.98, under most conditions ¹⁴). Furthermore, by using features like **flux optimization, scheduled standby modes, and networked process control**, plants can optimize when and how motors



run, avoiding needless idling and thus extending equipment life. Many industrial users also appreciate the ACS880's **"eco" features** that quantify energy usage – metrics like kWh saved and CO₂ reduction help facilities meet sustainability targets and document their energy conservation measures.

Applications and Use Cases

As a general-purpose industrial drive, the ABB ACS880 finds application across virtually **all major industries**. Its combination of high power capability, precise control, and configurability make it suitable for everything from heavy manufacturing to infrastructure systems. Some example sectors and uses include:

- **Manufacturing and Materials:** In the **metals industry**, ACS880 drives control rolling mill motors, extruders, and large cranes, where their high torque and regenerative braking handle heavy loads efficiently. **Pulp and paper mills** employ ACS880 drives on large paper machine sections and winders, benefiting from the DTC's smooth torque to prevent web breaks. **Automotive assembly lines** use the drives for conveyors, robots, and test stands – one automotive case noted improved assembly throughput by 30% after integrating ACS880 drives for better torque control ⁶⁵. The drives' robust design and 3-phase 690 V capability also suit **mining and cement** applications (e.g. ball mills, hoists, conveyors in mines), where reliable operation in harsh, dusty conditions is essential.
- **Energy and Utilities:** The ACS880, especially in its cabinet and multi-drive configurations, is used in **power plants and water treatment facilities** to run large pumps, fans, and compressors with high efficiency. For example, in municipal water pumping, replacing throttle valves with ACS880 VFDs allows pumps to run at their best efficiency point, significantly cutting energy costs. ABB in Australia reported helping an irrigation provider achieve notable cost savings and lower energy use by optimizing pump speeds with ACS880 drives in a large-scale project ⁶⁶. The ultra-low harmonic models are attractive in hospitals, data centers, and airports – installations where maintaining clean power is critical for avoiding interference or penalties.
- **Motion and Transportation:** In **cranes, elevators, and material handling systems**, the ACS880's combination of STO safety and regenerative braking is highly valued. For instance, port cranes retrofitted with ACS880 regenerative drives not only save energy by feeding power back during lowering, but also exhibit less wear on mechanical brakes (since the drive handles much of the deceleration load). Elevator systems use ACS880 drives (often in redundant configurations) to ensure smooth acceleration and stopping with full torque control for comfort and safety. The drives are also found in **marine propulsion and thruster systems** (with liquid-cooled variants), as well as in large **winches and windlasses** on ships, thanks to their marine certifications and ability to deliver high torque at zero speed.
- **Process Industries:** **Chemical and petrochemical plants** employ ACS880 drives for mixers, centrifuges, extruders, and blowers where hazardous-area rated motors and drives are needed – ABB's compliance with ATEX and optional explosion-proof enclosures allow the drives to be used in these zones ¹². Similarly, in **oil and gas** (on drilling rigs or pipelines) the drives power large pumps and draw-works, with the reliability and remote monitoring features helping to minimize downtime in these critical operations. **HVAC and refrigeration** systems in commercial buildings or industrial facilities also use ACS880 drives on chillers, cooling tower fans, and compressors; one retrofit case



for an office's chiller pumps documented a huge energy savings after adding VFDs (though not unique to ABB, it highlights the potential in HVAC retrofits) ⁶⁷ .

What sets the ACS880 apart in many of these applications is how it helps **solve specific problems** for customers. For example, in systems with frequent starts and stops, the drive's gentle acceleration and deceleration profiles eliminate water hammer in pipelines or mechanical shocks in conveyors. In high-precision manufacturing, the accurate speed holding of DTC reduces product variation and scrap – improving overall quality. The **integrated safety** means machine builders can meet safety requirements (like OSHA or EU Machinery Directive) more easily by using the drive's STO instead of bulky contactor arrangements. And from a maintenance perspective, the ACS880's diagnostic intelligence and long service intervals contribute to higher uptime. Technicians can trust the drive's **built-in protections and alarms** to guard the motor and process (e.g. warning if a pump is running dry or a motor bearing might be failing based on load trends). If a drive does need service, the **modular design** (especially in cabinet units) allows quick replacement of power modules or fans, often without removing cables thanks to ABB's convenient mechanical design for modules ⁶⁸ . All these attributes mean that end-users not only get energy savings and performance, but also a solution that can reduce their total cost of ownership through improved reliability and maintainability ⁶⁹ ⁷⁰ .

Conclusion

ABB's ACS880 VFD series stands out as a comprehensive, high-performance solution for variable speed motor control. It combines **state-of-the-art control technology** (like DTC for unparalleled torque and speed precision) with a **rugged, user-centric design** that addresses real-world industrial needs. Every facet of the ACS880 – from its broad power range and modular hardware options, to its safety integration, networking capabilities, and energy-saving features – is geared toward enabling flexible use across industries while **maximizing reliability and efficiency**. The drives arrive essentially “feature-complete” for most purposes: much of what might be optional in lesser drives (such as input chokes, safe torque off, or expanded I/O) is built-in or easily added, simplifying the selection and installation process.

By using ACS880 drives, companies have managed to **improve process control and product quality**, thanks to the precise motor regulation, and simultaneously achieve **significant energy reductions** and operational savings. Real-world case studies have shown reduced downtime, lower electricity bills, and fast payback periods when upgrading to modern ACS880 systems ⁷¹ ⁷² . Furthermore, ABB's global support network and the common architecture across their “all-compatible” drive family ensure that adopting the ACS880 is a future-proof choice – users can expect long-term support, easy upgrades, and compatibility with newer technologies in automation. In summary, the ABB ACS880 VFDs bring together **power, performance, and practicality**. Whether the goal is to drive a single critical motor with utmost accuracy, or to outfit an entire plant with energy-efficient automation, the ACS880 provides a solid, proven platform that helps customers **solve complex motor control challenges** and advance their operational excellence.

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