ABB ACS255 Variable Frequency Drives (VFDs)

Overview

The **ABB ACS255** is a compact **micro drive** designed for controlling smaller AC motors with precision and ease. Part of ABB's low-voltage drives portfolio, the ACS255 provides robust performance in a small form factor, making it ideal for OEM machinery and basic industrial applications. It is an enhanced successor to the older ACS250 series, retaining the same dimensions and parameters but adding new capabilities like **sensorless vector control** (for both standard induction motors and permanent magnet motors) and an "operating mode selection" feature for quick configuration [1] [2]. With expanded voltage ratings and environmental protection options, the ACS255 fills out ABB's micro drive lineup to cover a wider range of needs. In short, even the smallest motors can benefit from VFD control – gaining energy savings, soft-start capability, and improved process control – and the ACS255 delivers these advantages with **professional-grade reliability** and **simplicity**.

Power Range and Voltage Classes

One of the standout aspects of the ACS255 series is its broad **power and voltage range** coverage. Models are available for input supply voltages from **115 V AC up to 600 V AC**, accommodating global mains standards and high-voltage systems [3] [4]. Depending on the model, the ACS255 supports both **single-phase and three-phase input** supply: small units can run on 120 V or 230 V single-phase (making them suitable for residential or light commercial power), while larger units take 208–240 V, 380–480 V, or 500–600 V three-phase inputs. The drive outputs standard three-phase power to the motor in all cases. In terms of motor size, the ACS255 covers motors from **0.5 HP** up to about **20 HP** in its core range [5]. Notably, the 480 V three-phase models extend up to **30 HP (22 kW)** for heavier-duty applications, and the 600 V models reach up to **20 HP (15 kW)** for use on 575 V Canadian/U.S. networks [6] [7]. This wide span means a single drive family can handle fractional horsepower pumps and fans as well as larger machinery up to the ~15–22 kW level. All ACS255 drives are rated for a **150% overload** for 1 minute (and even 175% for 2 seconds), ensuring they can handle high starting torque or momentary surge demands without tripping [5] [8]. The output frequency can be adjusted from 0 up to 500 Hz, allowing for high-speed motor operation if required [9]. These specifications position the ACS255 as a very versatile drive suitable for both **variable-torque loads** (like fans or centrifugal pumps) and **constant-torque loads** (like conveyors, mixers, or compressors).

Key Features and Capabilities

Advanced Motor Control: Despite being a micro drive, the ACS255 offers sophisticated motor control algorithms. Users can select between straightforward **V/Hz (volts-per-hertz)** control or more dynamic **sensorless vector control** modes for improved torque and speed regulation [10]. The sensorless vector mode allows the drive to estimate motor parameters in real time, providing better torque at low speeds and fast acceleration without needing an encoder. Importantly, this applies not only to standard AC induction motors but also to **permanent magnet (PM) synchronous motors**, which the ACS255 can drive in open-loop vector mode [11]. This capability is significant for modern high-efficiency motor types. An autotune

function is typically available to calibrate the drive to the motor's characteristics, further improving performance. For most applications, the ACS255's control is more than sufficient to maintain steady speed under varying loads or to limit torque to protect machinery.

Flexible Interface and I/O: Integrating the ACS255 into a control system is made easy by its I/O and communication features. Each drive comes with **two analog input channels** (configurable for 0–10 V or 4–20 mA signals, typically for speed reference or feedback) and **four digital inputs**, two of which can be configured as additional analog inputs if needed [12] [13]. This flexible I/O scheme lets users wire start/stop commands, preset speeds, or sensor signals directly to the drive. In addition, there is **one analog output** (0–10 V) that can be used to meter drive variables (such as output frequency, motor current, or voltage) or it can be configured as a digital output for status indications [14]. A built-in **Form C relay output** provides an isolated switch (for fault alarms or drive-ready signals, for example) [15]. On the communications side, the ACS255 has an **RS-485 serial port** with **Modbus-RTU protocol** built in as standard [16] [17]. This means it can tie into PLCs, SCADA systems, or other networked control schemes with ease – enabling remote start/stop, speed setpoint control, and monitoring of drive status via a common industrial protocol. The inclusion of Modbus RTU at no extra cost is valuable for integrating multiple drives into a coordinated system or connecting to an HMI for centralized control. (The drive uses an RJ45 port for this serial connection and for optional accessories, simplifying the physical interface [18].)

User-Friendly Control Panel: All ACS255 drives feature an integrated **LED display keypad** on the front, providing a simple interface for programming and operation [19] [20]. The keypad has a 6-character LED display for parameters and status, along with intuitive buttons (typically Start/Stop, directional control, and programming keys). This **built-in control panel** allows for local control of motor speed and direction as well as quick setup without needing a computer. Only the essential parameters are exposed in the basic menu by default, which makes commissioning straightforward even for non-experts [19]. ABB provides several **pre-configured macros** (application templates) that can be selected to automatically configure the I/O and functionality for common scenarios – for example, there may be macros for basic 2-wire or 3-wire start/stop control, PID control, and others [19]. These macros significantly reduce setup time by tailoring the drive's behavior to the intended application with a single selection. An **"Advanced" parameter menu** is also available, unlocking more detailed settings for fine-tuning performance when needed [21]. Additionally, ABB offers a **copy stick tool** (pluggable into the RJ45 port) which allows cloning configuration from one drive to others in seconds [22]. This is extremely handy for OEMs or users deploying multiple drives with the same settings – a technician can program one drive, then use the portable copy device to upload the same parameter set to each additional drive, saving time and ensuring consistency. Overall, the ACS255's user interface and tools are designed to minimize the learning curve and deployment effort.

Performance and Protection: In operation, the ACS255 delivers reliable performance suitable for a wide range of load types. It supports **fully programmable acceleration and deceleration ramps** (0 to 600 seconds) for soft starting and stopping of motors [23]. This soft-start capability greatly reduces mechanical stress on equipment – avoiding the high inrush currents and jerking associated with across-the-line motor starts. (By ramping up the speed gradually, **wear on belts, gears, and the motor itself is reduced**, translating to longer equipment life and less maintenance.) The drive's 150% overload capacity means it can handle demanding **constant-torque** loads (like mixers or conveyors that may require high breakaway torque) without nuisance tripping [5]. For **variable-torque** loads such as fans and pumps, the ACS255 can yield significant energy savings by enabling speed control: for example, reducing a centrifugal fan's speed by 20% can cut its power consumption by roughly 50% due to the affinity laws [24]. This not only lowers electricity costs but also reduces noise and heat. The ACS255 includes a built-in **PI (proportional-integral)**

controller as well [25], which allows it to perform basic process control tasks like maintaining a set pressure, flow, or temperature by modulating motor speed – all without an external PID controller. This is very useful in pump, fan, and HVAC applications where the drive can directly adjust to feedback from a sensor (such as a pressure transducer), keeping the process variable constant.

On the protection side, the ACS255 is equipped with extensive safeguards for both the drive and the motor. It has **enhanced short-circuit protection** and will trip to protect itself if a phase-to-phase fault or excessive current is detected on the motor output [1] [26]. It monitors for conditions like over-voltage (e.g. due to regenerative braking or input surges), under-voltage, drive over-temperature, motor overload (past the 150% threshold), and loss of command signal, shutting down or alerting as appropriate [27]. An electronic motor overload function can mimic thermal overload protection by tracking motor current heating (inverse time), adding an extra layer of safety for the motor [13]. **Safe Torque Off (STO)** is available on the 600 V models, providing an integrated safety function that can SIL2-certify the drive's ability to prevent unintended motor rotation – useful for emergency stop circuits and meeting safety standards [28]. When STO is wired and triggered, the drive immediately disables its output stage so that no torque can be produced, without fully powering down the unit (allowing quick re-enable when safe). This hardware-based safety feature is a notable inclusion on a micro drive. The ACS255's **circuit boards are conformally coated** at the factory [29], protecting the electronics from humidity, dust, and corrosive atmospheres. This coating and the drive's built-in cooling design contribute to its reliability in harsh conditions. The specified operating ambient is typically –10°C to +50°C without derating, and it can tolerate up to 95% non-condensing humidity and altitudes of 1000 m (with modest derating above that) [26] [30]. The drive carries international approvals including UL, cUL, and CE, so it meets global safety and EMC standards for use in various regions [31].

Enclosure Options (IP20 and IP66)

ABB offers the ACS255 in two main construction styles to suit different installation environments: **IP20** panel-mount units and **IP66/NEMA 4X** enclosed units. The **IP20 versions** are compact drives intended for mounting inside electrical panels or enclosures. They have an open chassis design with finger-safe terminals (IP20 protection), and can be either **DIN-rail or wall mounted** without any additional adapter kits [32]. Notably, the ACS255 IP20 models feature **"feed-through" wiring**: the line input terminals are on the top and motor output terminals on the bottom (or vice versa), aligned in a straight-through layout, which simplifies wiring in motor control centers and allows easy replacement of traditional motor starters [33]. This layout is very convenient for panel builders, as it mimics the flow of a contactor-starter, reducing the need to reroute wires. The IP20 units cover the full voltage range (115 V through 600 V) in various frame sizes, yet remain quite small and lightweight – for example, a 1 HP drive is only around 2 pounds and a 20 HP unit is under 8 pounds. Their compact size and lack of required accessory kits make it straightforward to integrate these drives into tight spaces.

For more demanding environments, the **ACS255 also comes in an IP66/NEMA 4X rated version** ("B063" or "B068" enclosure options). These models are housed in a **fully sealed enclosure** that is dust-tight and washdown-ready – ideal for installations exposed to water, high humidity, dust, and cleaning chemicals. The IP66 ACS255 drives are constructed from corrosion-resistant materials, including a coated aluminum heatsink and a robust ABS plastic housing, to withstand **harsh industrial and outdoor conditions** [34] [35]. They are often used in food and beverage processing, outdoor machinery, or any application where mounting the drive near the motor (without a separate cabinet) is desirable. The smooth, flat surfaces of the enclosure prevent dirt accumulation and are easy to clean, supporting hygienic requirements in industries like pharma or food. Additionally, the IP66 units are **fanless** – they rely on natural convection

over the heatsink – which eliminates fan maintenance and prevents ingress of contaminants through a fan vent [35]. Despite the rugged enclosure, these drives still include the same intuitive LED keypad interface on the front, so you can program and operate the drive directly on-machine [36] [37].

An especially convenient option for the IP66 models is the availability of **integrated operator controls on the front panel**. ABB offers a variant (using the +F278 or similar option code) that includes a built-in **disconnect switch**, a **directional selector switch (Forward/Off/Reverse)**, and a **speed potentiometer knob** mounted on the drive's front cover [37]. This effectively turns the drive into a self-contained control station – for example, on a conveyor or mixer, an operator could start/stop the motor, change direction, and adjust speed right at the drive, which is mounted near the machine, without needing a separate external operator panel. Such an option saves wiring and panel space and is highly valued in decentralized control setups. The IP66 ACS255 units cover a power range from about **0.5 up to 10 HP** (at 230 V or 480 V input), which addresses most small washdown-duty motor needs [38] [39]. They also support the full input voltage span (115 V through 480 V models are offered, though the 600 V version may not be available in IP66 beyond certain horsepower). With **NEMA 4X** and UL Type 4X ratings, these drives are suitable for outdoor use and corrosive environments, providing reliable speed control without requiring a sealed cabinet.

Ease of Installation and Commissioning

ABB has placed emphasis on making the ACS255 as **easy and fast to deploy** as possible, especially for OEMs and integrators who need to repeat installations. As mentioned, the physical mounting is flexible (DIN rail clips for smaller sizes, or flange mounting slots for wall mount) and the wiring layout is installer-friendly. The drives have **easy access terminals** and clear markings, reducing hookup time [40]. Many users appreciate that only minimal parameter adjustments are needed to get running – typically setting the motor nameplate data and desired control mode is enough for initial operation, thanks to the default macros. The **operating mode selection** feature (introduced in the ACS255) further simplifies setup by letting the user choose a preset mode tailored to the application type [1]. For instance, there may be modes for industrial constant-torque loads versus variable-torque pump/fan loads, which automatically adjust the drive's torque limits, slip compensation, and other behaviors to suit the load. This means out-of-the-box, the drive can be optimized for an application with one setting. The built-in **Modbus RTU** connectivity also eases integration – multiple drives can be daisy-chained on an RS485 network to a PLC, with each drive's node address and baud rate easily set in parameters. This negates the need for expensive I/O wiring for each control point; a single serial cable can command start/stop and speed for dozens of drives. Moreover, ABB provides optional **PC tools and mobile apps** for their drives (such as DriveConfig or DriveComposer) which can interface with the ACS255 for parameter editing, backup, and monitoring, although for most simple needs the front keypad suffices.

In terms of support and standards, the ACS255 aligns with ABB's global practices. It comes with comprehensive documentation, including a detailed user manual covering installation, programming, and troubleshooting [41]. The drive's simplicity means many users can commission it without needing specialist assistance: for example, an electrician can replace a motor starter with an ACS255 in a control panel to provide speed control, and with the PI control loop, even set up a basic closed-loop system (like maintaining tank level or airflow) with just the drive. The fault diagnostics – accessible via the keypad or through serial communication – include a fault log of the last few trips for easier **troubleshooting** [42]. In the event of a fault or power loss, the drive can be configured for **automatic restart** attempts (up to 5 tries) to minimize downtime if the fault condition clears [43]. All these features contribute to a smooth user experience, from installation to daily operation.

Applications and Use Cases

As a general-purpose micro VFD, the ABB ACS255 finds use across a broad array of applications. Its feature set is intentionally kept to the essentials needed for **common motor control scenarios**, without the complexity (and cost) of high-end drives. Some typical use cases include:

- **Conveyors and Material Handling:** The ACS255 is well-suited for small conveyor systems, packaging lines, and automated material handling equipment. It provides gentle start/stop control to prevent product shift and allows the conveyor speed to be tuned to the production rate. For example, an OEM conveyor might use a 1 HP ACS255 to replace a fixed-speed motor starter, giving the end-user the ability to adjust belt speed and ramp up smoothly. The high overload capacity (150% for 1 minute) means even heavily loaded conveyors can start from rest without stalling [5]. In material handling, the drive's compact size lets it fit into decentralized motor control boxes on the machine.

- **Pumps and Fans:** Many **fans, blowers, and centrifugal pumps** in HVAC or industrial processes can benefit from variable speed control to save energy and reduce wear. The ACS255's built-in PI controller and macros make it easy to set up a fan or pump to maintain a target pressure or flow. For instance, in a water pumping system, an ACS255 can modulate the pump speed according to a pressure sensor, ensuring consistent output while drawing only the power needed – a big improvement over throttling valves or on/off cycling. Energy savings are substantial: running a fan at 80% of full speed might use only **50% of the power** (or even less), thanks to the cubic relationship between speed and power in variable torque loads [24]. The ACS255's reliability in these scenarios is enhanced by its ability to handle plumbing for outdoor or wet environments when using the IP66 variant. **Fan/Pump "sleep" functions** can also be implemented via the PI control to stop the motor when demand is low and restart on a drop in pressure, for further energy optimization.

- **Mixers, Agitators, and Food Processing:** With its NEMA 4X washdown-rated models, the ACS255 is popular in food & beverage processing machinery such as mixers, dough kneaders, bottling lines, and augers. These applications often require cleaning with high-pressure water or caustic solutions, so having the drive right on the machine in an IP66 enclosure is a huge advantage. A case in point is a dairy facility where small gearmotors on mixers are each controlled by an ACS255 mounted nearby – the operator can adjust speed via the local potentiometer to fine-tune mixing intensity, and at the end of the day, the entire assembly (drive included) can be hosed down for sanitation. The conformal coating on the circuit boards and the sealed enclosure ensure long life even under these harsh conditions [34] [35]. The drive's **Safe Torque Off** on applicable models is an added safety benefit for food machinery, as it can be tied into E-stop buttons or safety interlocks on access doors to guarantee the mixer cannot rotate when someone is accessing the equipment.

- **General Machine Control:** The ACS255 is frequently used by **OEM machine builders** for various small machines – from woodworking equipment (saws, lathes, sanders) to textile machines, printing presses, and door/gate operators. In all these cases, the drive's **low cost and quick setup** make it attractive. For example, a woodworking shop could retrofit an ACS255 on a dust collection fan or on a spindle motor to gain speed variability for different materials. An automatic gate or garage door system might use the drive to smoothly accelerate and decelerate the motor, preventing jerks and extending mechanical life (the drive's soft-start greatly reduces gear and chain stress). Because the ACS255 can handle **constant horsepower loads** up to a point (by driving motors beyond base speed

at reduced torque), it's also useful for winding machines or certain mixers that need higher speed with lighter load. ABB specifically lists applications like **conveyors, fans, pumps, mixers, material handling, automated gates, printing, and woodworking machines** as typical examples for the ACS255 [44] – a testament to its versatility across industries.

In all of these use cases, **Precision Electric, Inc.** and other ABB distributors provide the ACS255 as a reliable solution to improve process control and efficiency. By replacing across-the-line motor starters or adding speed control where there was none, end users can realize energy savings, better product quality (through improved control), and reduced mechanical wear and downtime. The ACS255's combination of a **professional feature set** with an **accessible, user-friendly design** means that it often delivers a very quick return on investment for these applications.

Conclusion

The ABB ACS255 VFD is a comprehensive micro drive solution that brings big capabilities to small motors. It strikes a balance between simplicity and technical depth: the drive is **easy to install, program, and use**, yet it doesn't sacrifice the key functionalities that users expect from more advanced drives (such as vector control, network communications, and safety features). With its wide power range, global voltage support, and available IP66 protection, the ACS255 can be deployed virtually anywhere – from inside control panels in factories to directly on machines in washdown environments. Its design is clearly optimized for fast commissioning and integration, which is a major benefit for OEMs and system integrators working on cost-sensitive projects or high-volume machine builds. Real-world users of the ACS255 have found that it helps solve practical challenges: whether it's **reducing energy consumption** on a fan by matching speed to demand, **improving an assembly line's flexibility** by allowing variable conveyor speeds, or **minimizing downtime** with quick-swap parameter copy tools and reliable protective features. ABB's pedigree in drive technology and rigorous testing of each unit (every drive is fully tested at the factory) gives confidence that despite its small size, the ACS255 will perform day in and day out in industrial conditions [45]. Overall, the ABB ACS255 series stands out in the micro drive category for its combination of **ruggedness, versatility, and user-centric design**. It empowers customers to gain precise motor control and efficiency gains in applications that previously might have been left with simple on/off control – **delivering "big drive" benefits to small motor applications**.

References

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