Cell-based innovation. Proven reliability.

SINAMICS PERFECT HARMONY medium-voltage variable frequency drive

siemens.com/sinamics-perfect-harmony
PERFECT HARMONY joins the SINAMICS family of innovative drives

Expanded drive line offers reliable solutions for any application

At Siemens, innovation has always been both a core mission and an ongoing source of momentum. For more than half a century, Siemens has been developing, manufacturing and installing medium-voltage drives to meet a wide range of evolving industry needs. The resulting solutions have consistently raised the bar on reliability, efficiency and customer satisfaction—and now they have culminated in the unique cell-based topology of the PERFECT HARMONY drive.

SINAMICS, the world’s largest family of precision-engineered frequency converters, is a testament to Siemens’ tradition of excellence. Based on innovative engineering concepts and a wealth of motor and topology expertise, SINAMICS drives provide cost-effective, energy-efficient solutions with a broad range of power and performance. From flow control and processing to lifting, moving and complex motion control, SINAMICS has the flexibility to support every application.

The benefits offered by the SINAMICS drive family are further strengthened by the addition of Siemens ROBICON PERFECT HARMONY drives. Renamed SINAMICS PERFECT HARMONY, these cell-based drives incorporate technology that stems from a deep understanding of not just medium-voltage drives, but also the industries that employ them. The combination of SINAMICS technology and PERFECT HARMONY cell-based topology results in a solution that maximizes productivity while protecting your process.

Siemens has spent more than 17 years designing and refining the 50+ patented technologies that make up the SINAMICS PERFECT HARMONY drive’s modular topology. As part of Siemens’ Totally Integrated Automation concept, the cell-based drive allows for unsurpassed reliability and outstanding data management and communication at the automation level. It’s the No.1 selling cell-based drive worldwide—with 10,000+ installations—because it’s trusted more than any other when it comes to demanding applications.
The most comprehensive drive family available today

SINAMICS offers a unique range of power and performance for every application

A drive solution for every application

The SINAMICS PERFECT HARMONY drive draws on Siemens’ extensive experience with a wide range of industry applications to deliver the most versatile variable frequency drive available today. From pumps and fans to compressors and extruders, any application can be paired or retrofitted with a SINAMICS PERFECT HARMONY drive to optimize process improvement.

A long-term commitment to customer satisfaction

When you purchase a SINAMICS PERFECT HARMONY drive, you get personalized service from planning through commissioning and beyond. Siemens stands behind every drive it produces with an unwavering commitment to quality and customer satisfaction. By adding PERFECT HARMONY to the SINAMICS drive family and investing more than $25 million in SINAMICS PERFECT HARMONY manufacturing, Siemens has established a solid foundation for ongoing product support and innovation. You can rest assured that as your industry continues to grow and change, Siemens and SINAMICS will help keep you ahead of the curve.

Close-at-hand expertise

Siemens operates a global network of drive manufacturing facilities to ensure you are never far from the support you need. This global approach to engineering helps maintain regional manufacturing standards and allows burgeoning local market needs to shape ongoing research and development. Siemens drive manufacturing is global so that it can keep its drive solutions local.

SINAMICS global factory locations:
- Shanghai, China
- Nuremberg, Germany
- New Kensington, USA
- Jundiai, Brazil
- Nashik, India
Siemens SINAMICS...

- 1969: Introduces the first variable-speed, medium-voltage drive system.
- 1970: Becomes the global market leader in cycloconverters.
- 1996: Pioneers the use of high-voltage IGBTs for medium-voltage converters.
- 2003: Produces the highest-rated high-speed drive (LCI) for an LNG compressor.
- 2004: Acquires PERFECT HARMONY technology.
- 2005: Rolls out parallel drive operation.
- 2006: Implements permanent-magnet motor control.
- 2008: Adds 10 kV-output voltage drive to lineup.
- 2009: Reaches 10,000 drives installed worldwide.
SINAMICS evolved out of the industry’s growing need for cost-effective, application-tailored drive options. In 1969, Siemens introduced its first variable-speed, medium-voltage drive system with DC link converters and within a year became the global market leader in cycloconverters. It seemed that industry leadership was a natural fit for Siemens’ innovations right from the start.

When PERFECT HARMONY was introduced in 1994, it was the world’s first IGBT-based medium-voltage drive. Many more firsts were still to come as the technology evolved to meet both industry demands and inevitable regulation changes. Siemens anticipated these changes and planned ahead to address them before they arose. Siemens believed then, as now, that continued innovation is the only way to ensure optimal reliability for its customers’ critical applications.

Over the last five decades, Siemens has continued to grow and refine medium-voltage drive technology to serve an even greater number of industries. From Advanced Cell Bypass to parallel drive operation, each innovation continues to anticipate customers’ changing needs while improving reliability and plant availability.
SINAMICS has the optimal drive for every application

The world’s largest family of drive solutions at a glance

With SINAMICS, Siemens offers a range of solutions that optimally comply with high requirements in the low-voltage, medium-voltage and DC-voltage ranges. The complete drive family accommodates all performance levels and sets itself apart with its unparalleled flexibility, functionality and efficiency.

Industry demands increasingly require flexible, scalable drive solutions that are not just safe and efficient, but also application-specific. That’s why, for the past 50 years, Siemens has been using proven technology to continually improve the versatility, reliability and energy efficiency of its SINAMICS drives. Today, the drive family offers a full portfolio of solutions that—depending on the application—can reduce power costs by 20 to 70 percent while increasing your productivity and sharpening your competitive edge.

### Low voltage AC

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*Exception: V20 – does not require an engineering tool; G180 is commissioned using the IMS software (Inverter Management Software)*
The SINAMICS drive family spans a wide range of power ratings – from 0.12 kW to 85 MW – and includes both low- and medium-voltage options for a high degree of flexibility with other drive system components. It also accommodates all voltage classes from 200 V to 11 kV, motor speeds from 10 to 15,000 rpm, and all levels of dynamic response and performance. And whether you need a single-motor drive or a multi-motor system, all SINAMICS drives are harmonized and coordinated accordingly.

No matter which drive task is involved, SINAMICS always offers the optimal safety-integrated solution. And now, with SINAMICS PERFECT HARMONY cell-based drives added to the lineup, finding a drive that meets your application’s specific needs is simpler than ever.
The advantages of cell-based technology

Every element of a SINAMICS PERFECT HARMONY cell-based drive is engineered to maximize productivity and protect your process in a way that other drives can’t. Its modularity allows for a scalable solution that achieves near-100 percent reliability and 99.99 percent availability, which means greater productivity and a significantly reduced total cost of ownership over the drive’s life cycle. A cost-effective series cell configuration allows it to withstand failures that would overwhelm conventional drives and shut down the plant process. And only SINAMICS PERFECT HARMONY cell-based drives include the reliability and efficiency of clean power input, high-quality output, and cell bypass and redundancy.

Cell bypass and redundancy
Scalability is only one of the advantages of using multiple cells to create medium-voltage output. This type of configuration also promotes reliability through cell redundancy, preventing the process from being interrupted if one or more cells fail. Together with cell redundancy, cell bypass offers additional security by isolating a failed cell and placing it in bypass to keep the power output constant. Failed cells can be changed out later in 30 minutes or less.

Cell-based drives are:

- **Highly reliable**
  Fault-tolerant with cell redundancy and cell bypass

- **Energy-efficient**
  Increased process control with improved throughput and reduced energy waste

- **Line-friendly**
  No harmonic voltage or current distortion; near-unity power factor

- **Motor-friendly**
  No harmonic heating and no insulation stress

- **Load-friendly**
  No significant torque pulsations
Clean power input
SINAMICS PERFECT HARMONY drives meet the most stringent IEEE-519-1992 requirements for voltage and current harmonic distortion. An integrated sinusoidal converter not only eliminates the need for harmonic filters, power factor correction capacitors or extra bus capacity; it also protects other online equipment from harmonic disturbances. Depending on the configuration, input waveform equivalents can range from 18-pulse up to a 48-pulse rectifier, resulting in less than 3 percent total voltage distortion and less than 5 percent total current distortion.

High-quality output
No drive offers a higher quality waveform output than the SINAMICS PERFECT HARMONY. Its cell-based design accommodates any standard motor without requiring additional output or dv/dt filters—which can reduce efficiency and reliability—and it provides the lowest peak voltage to the motor windings. Together with the drive’s inherently low harmonic content, these features extend motor life by protecting the motor insulation and preventing motor bearing failure.

Environmental tolerance
Only SINAMICS PERFECT HARMONY drives are engineered to operate reliably in environments with temperatures ranging from −40° C to 50° C. What’s more, the liquid-cooled unit’s liquid-to-air single cooling loop can tolerate environments from −40° C to 40° C without derating or the use of chillers. Our secondary liquid-to-liquid cooling loop can accept water from an ocean, lake or stream at temperatures ranging up to 45° C. SINAMICS PERFECT HARMONY drives also can be provided in an integral external enclosure that allows them to withstand the harshest outdoor weather conditions, from tropical environments to the open deck of an ocean platform. No other general purpose, air- or liquid-cooled drive can tolerate such a broad range of extreme conditions.
Reliability, patented technologies, and high-quality input and output power have made the SINAMICS PERFECT HARMONY GH180 the drive of choice for medium-voltage, variable-speed applications.

Siemens designed the SINAMICS PERFECT HARMONY GH180 drives in both liquid-cooled and compact air-cooled configurations to provide maximum versatility, efficiency and process availability for the most demanding applications. With these drives, reliability is paramount – as evidenced by the incorporation of 50+ patented technologies proven to increase the dependability of critical processes.

During operation, Advanced Cell Bypass technology enables SINAMICS PERFECT HARMONY drives to bypass failed cells so that the drive remains operational, power stays constant and production is maximized. You’ll also find that cell replacement is quicker due to the reduced cell weight, front-accessible bolted connection and custom-designed cell lifter. With these features in place, cell replacement takes less than 30 minutes. Should a disturbance occur, our Process-Tolerant Protection Strategy (ProToPS™) will provide a hierarchical system of warnings that allow ample time for your operator to evaluate the issue and respond appropriately to avoid system shutdown.

As with all SINAMICS PERFECT HARMONY drives, these drives also include synchronous transfer technology to protect equipment from excessive torque transients. This closed-transfer approach is used to soft-start multiple motors, pumps or compressors placed in a series and efficiently transfer them across the line without over-stressing the power grid.

Siemens optimized the SINAMICS PERFECT HARMONY GH180’s fully integrated variable frequency drive systems for easy access to all components so drive maintenance is simplified and downtime is limited. Each drive includes an integrated isolation transformer, power electronics, controls and a cooling system that can tolerate temperatures from −40°C to 50°C. Designed for longevity, the drive’s cabinets are constructed to meet the most stringent industrial requirements and withstand the harshest weather conditions.
Advanced Cell Bypass

In less than a quarter of a second, the SINAMICS PERFECT HARMONY GH180 drive can bypass multiple failed cells to maintain a balanced output voltage. With one cell in bypass, the drive still produces sufficient voltage to allow the process to continue uninterrupted, and the quality of the voltage and the waveform remain virtually unchanged.

Process-Tolerant Protection Strategy (ProToPS™)

With a proven record of 99.99% process uptime, ProToPS™ protects your process from faulty sensors or data. Unlike typical systems that simply trip the drive and automatically shut down the system due to a malfunction, ProToPS™ offers a proactive control strategy for applications where failure avoidance is critical.

Technical Data at a Glance

Efficiency
- Typical power converter efficiency: 99%
- Typical total drive system efficiency: 97%

Input transformer
- Air-cooled: aluminum or copper windings, forced-air cooling
- Liquid-cooled: copper windings, liquid-cooled

Line supply connection
- Input voltage and voltage tolerance: 2.3 to 13.8 kV, ±10%
- Input frequency: 50 or 60 Hz, ±5%
- Input power factor: ≥ 0.95 above 10% load

Motor-side inverter
- Multilevel drive PWM topology
- IGBT power modules

Motor control
- Induction motors
- Synchronous motors
- Permanent-magnet motors
- Wound rotor motors

Output dv/dt
- 1,000–3,000 V/µs (dependent on model)

Output torque
- Rated torque (2-quadrant) available from 10 to 167 Hz

Control
- Vector Control (NXGII series)

Input current harmonics
- ≤ 5% TDD (total demand distortion)
- Meets or exceeds IEEE-519-1992

Ride-through
- Minimum of 5 cycles after loss of input MV without tripping

Output frequency and drift
- 0.5 to 330 Hz, ± 0.5%

Output voltage harmonics (THDi)
- Between 2.0 to 2.5%

Regenerative (4Q) operation
- Air-cooled: 2Q only
- Liquid-cooled: 4Q available as option
## SINAMICS PERFECT HARMONY

### GH180 drive specifications

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<tr>
<th>No. of cells</th>
<th>Output current</th>
<th>Type rating</th>
<th>Shaft output**</th>
<th>Xfmr (KVA)</th>
<th>Cooling method</th>
<th>Height*</th>
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* Reflects typical output power; motor type or size may affect actual output power.

** Typical output value provided; output power may change based on the type or size of motor.

*** Brackets denote additional digits to be determined based on order detail.
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| 15 | 40 | 415 | 344 | 462 | 500 | Forced-air | 115 | 2,926 | 194 | 4,928 | 55 | 1,397 | 6SR4[02-2][A35-0][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][][[banknote]]
Based on the world’s most comprehensive and consistent product range in the field of drive systems, Siemens Integrated Drive Systems are the answer to the increasingly complex demands that drive technology has to meet.

As part of Siemens Integrated Drive Systems, SINAMICS drives can be combined with a variety of SIMOTICS electric motors for exceptional versatility in both new and retrofit solutions. Relying on a single source for all aspects of a drive system makes specification, purchase, implementation, operation and maintenance faster and easier than ever before. The bottom line is greater reliability, higher efficiency and superior productivity.

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Productivity
- Higher throughput
- Reduced engineering effort
- High degree of flexibility
- Shorter time to market

Reliability
- Improved operating times
- Faster supply of new and replacement components
- Condition monitoring
- CAPEX security

Efficiency
- More energy-efficient
- Simplified maintenance
- Better environmental protection
- Reduced OPEX

Drive components:

- Drives: SINAMICS PERFECT HARMONY
- Motor: SIMOTICS
- Couplings: FLENDER
- Gear boxes: FLENDER
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