



**Take the sting out of your operating costs.**  
Discover your possibilities

# energy-saving DRIVES

**SIEMENS**



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## Fascinating frugality.

### Drives that develop new savings potential

Energy is a valuable asset. Being the most important resource of the industry, electric power makes motors turn, machines run and plants produce. It is therefore not very surprising that the industry accounts for 40% of the entire power consumption. One surprise, however, is the key role that electric drives play in this context: They account for two thirds of this consumption. A large proportion that offers huge opportunities, especially given the increasing energy costs: By optimally designing and dimensioning the systems and by selecting the right components it is possible to create million dollar savings potentials.

#### Using the right lever

The core and energy-saving lever of a drive system are electric motors and frequency drives. In this context, the continuous operation of the motor is especially important – motors with higher efficiency save valuable kilowatt-hours, and the frequency drive can also save energy when the machine is adjusted to the perfect operating point. For variable-speed drives, the attention should focus on the type of driven machine. For example, optimized machines for pumps, fans or compressors can show their energy-saving potential.

#### A future-proof solution

Obviously, the purchase of energy-saving drive components is an investment. But low operating costs and machine-friendly operation through to the use of frequency drives and energy-saving motors often ensure the amortization after a few months – while your plant keeps saving over its entire life cycle. And this is not only an advantage for you but also for the environment: An energy-optimized drive system makes a sustained contribution to reducing CO<sub>2</sub> emissions.

# Less can still be more. Energy-saving motors that pay off.

Do you want to buy a new motor or overhaul an existing one? Then you should make a keen calculation. After all, one thing is certain: High energy costs will fully impact your operating costs. By reducing your operating costs, you can increase your profitability – and also make your production more environmentally-friendly. Our energy-saving motors demonstrate how economically and effectively some motors work. After all, these require less power for the same performance. We are happy to calculate how they can make you much more efficient.

## A class of its own – our offering

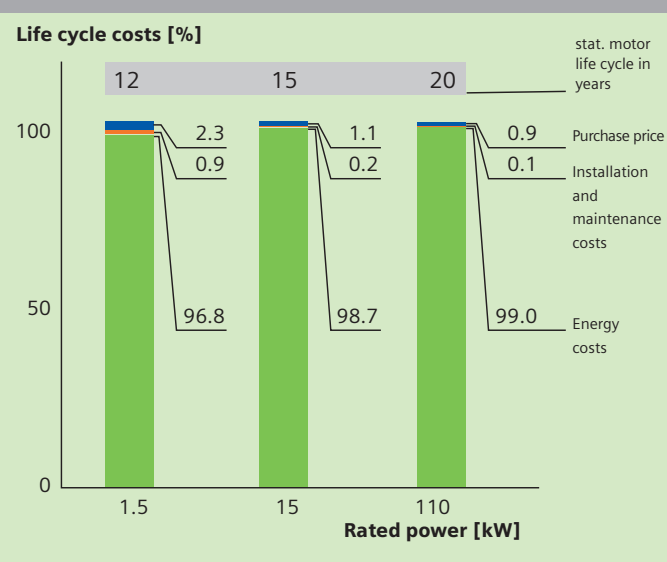
In addition to the highly efficient energy-saving motors in the highest EU efficiency class EFF1, we offer you cost-efficient energy-saving motors in the EU efficiency class EFF2. For use in 60 Hz power supply systems, we offer you IEC standard motors that are electrically designed for NEMA with EAct efficiency – or our NEMA motors. Of course, all of our motors are “standard motors” and therefore fully mechanically compatible. They are

all inverter-capable so that they can optimally run on our inverter series and comply with all standard specifications – worldwide.

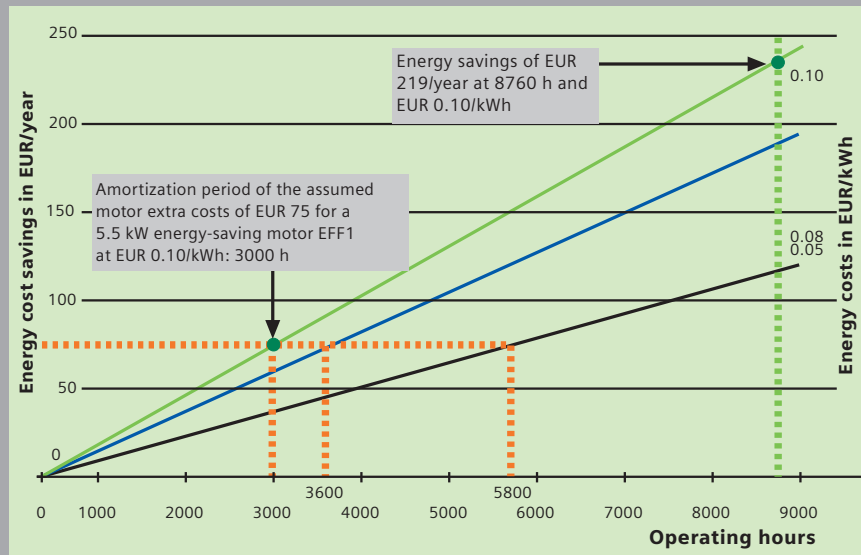
## In the black for a “green balance” sheet

Energy costs account for over 97% of the life cycle costs of motor, whereas procurement and installation account for only 3%. Our EFF1 energy-saving motors pay for themselves particularly fast in continuous operation. An example: With a 4-pole 5.5 kW energy-saving motor in continu-

ous operation, changing from EFF2 to EFF1 – at energy costs of EUR 0.10 per kWh – allows annual savings of EUR 219. This equalizes the extra costs for the purchase already after about 3,000 hours of operation, i.e. after about four months of continuous operation. A favorable balance.



Users can efficiently apply the savings lever with energy-saving motors



Amortization period as a function of energy savings and energy costs



### Full reserves – the energy checklist

What savings potential do you have?  
And when does it make sense to  
upgrade to efficiency class EFF1?

#### Our checklist provides the answers:

- ✓ When buying new electric motors, consider not only the initial cost but also the energy costs.
- ✓ The EFF1 energy-saving motor is basically more cost-effective from 2,000 operating hours per year. The EFF2 energy-saving motor is usually the better choice in the case of actuators or short operating periods.
- ✓ Our software tool SinaSave™ helps you make the decision between EFF1 and EFF2 and calculate the “payback time of the extra cost for EFF1 energy-saving motors”.

- ✓ Replacing existing motors with energy-saving motors will reduce energy costs significantly.
- ✓ Especially when a repair is necessary, you should calculate whether the use of a new energy-saving motor makes economic sense. The high repair costs should be considered, and a new motor winding will usually mean that the efficiency is reduced by several percentage points. Also, motors are almost 100% recyclable.
- ✓ Always consider the use of frequency drives for speed control in order to leverage every savings opportunity.

### Many good reasons in favor of our energy-saving motors:

- Complete product range of energy-saving motors according to EU/CEMEP, EPEP and NEMA
- The efficiency classes (EFF1/EFF2) make it particularly easy to choose the right motor.
- Motors 1LA9 and 1LG6 comply with both the EFF1 and EPEP efficiencies
- Reduced operating costs due to high efficiency with EFF1 or NEMA Premium
- Longer motor life time and lubricant usage duration due to lower motor temperature with EFF1, EPEP and NEMA motors
- Reduction of environmental impact through reduced CO<sub>2</sub> emissions in operation

# Save resources and money.

## IEC motors for all international markets



EFF 1

EFF 2

### At a glance: EU/CEMEP<sup>1</sup> for Europe

#### Status

Voluntary participation in efficiency classification

#### Products covered

2- and 4-pole 50 Hz squirrel cage motors 1.1 to 90 kW

#### Required identification

- Efficiency class on rating plate
- $\eta_N, \eta_{3/4}$  load and efficiency class is documented

<sup>1</sup> CEMEP: European Committee of Manufacturers of Electrical Machines and Power Electronics

<sup>2</sup> EPAAct: Energy Policy Act

Climate conferences, increasing costs of fuel, eco tax – there is a clear trend toward energy-saving solutions. This results not only in improved environmental awareness – new legal provisions call for ecologically convincing solutions. When developing our energy-saving motors, we took care to optimize the use of materials and to achieve high efficiency and long life. In this manner, we make a major contribution to the reduction of CO<sub>2</sub> emissions and to the protection of the environment.

### The right choice throughout Europe – EU/CEMEP classification

The efficiency classification according to EU/CEMEP makes it easier to choose energy-saving motors throughout Europe. Since 2000, the efficiency class is stamped on the rating plate and in the documentation. The big advantage: You see at a glance how efficiently the respective motor works. The three EU/CEMEP efficiency classes are:

- EFF1 (high-efficiency motors)
- EFF2 (improved-efficiency motors)
- EFF3

All of our motors meet at least EFF2.

### Good for the environment – Eco Audit and DIN EN ISO 14001

When producing our motors, we also ensure maximum compatibility with the environment. Our factories already participate in demanding ecological audits and are certified according to DIN EN ISO 14001. This testifies to seamless environmental management at the highest level.

### Good for your balance sheet – higher efficiency

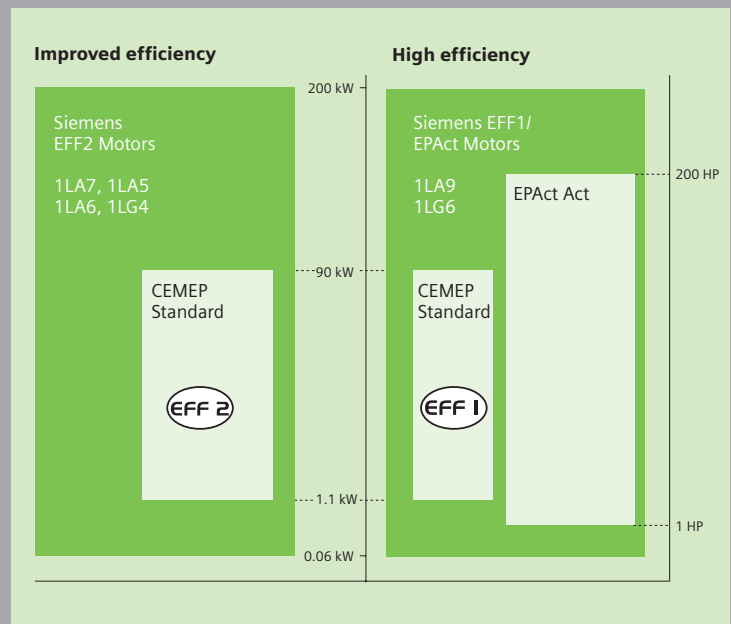
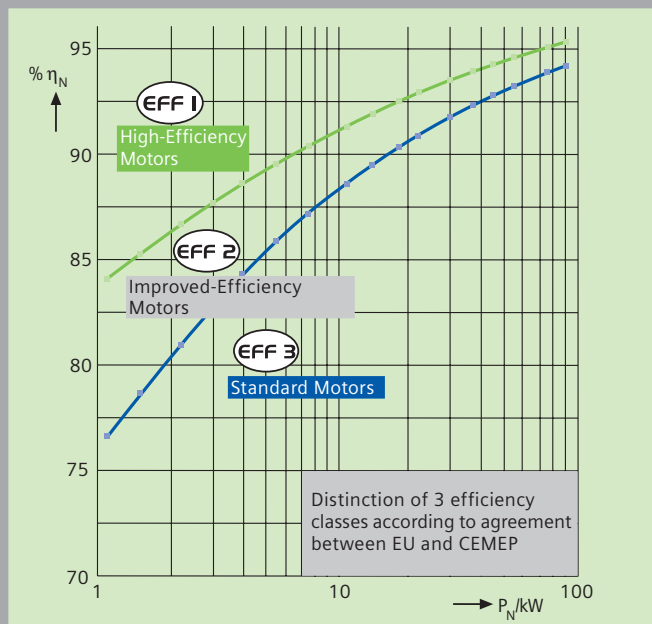
We achieve a reduction of power losses of up to 40% in our energy-saving motors by means of several measures:

- More active material (iron, copper, aluminum)
- Higher quality sheets
- Optimized ventilation system
- CAD-assisted product optimization
- Technical detail improvements with Siemens expertise

- Development and test in our own accredited test and measuring lab

### Global solutions – we are ready

Our energy-saving motors with efficiency class EFF1 not only comply with the relevant IEC standard but also with the strict U.S. federal legislation EPAct<sup>2</sup>. In this context, our EPAct motor series in 60 Hz design features a uniform electrical design according to NEMA MG1 and is CC-certified. In addition to our portfolio for the Northern American market, we can offer motors for your specific regional efficiency requirements upon request, whether for Brazil, Taiwan, Japan or South Africa.



# NEMA motors for the Northern American market.

## Efficiency without limits

Our energy-saving motors of efficiency classes EPAct and NEMA Premium® comply with the U.S. EPAct (Energy Policy Act of 1992 – U.S.A. Federal Law) for minimum efficiency. Our solutions of efficiency class NEMA Premium exceed the even stricter NEMA standards (National Electric Manufacturers Association). All motors are mechanically and electrically designed to NEMA MG1. In addition to the minimum efficiencies that are prescribed in the U.S., they also comply with the regional requirements for Canada (Canadian Standard Association) and Mexico (Norma Oficial Mexicana).

### From now on – even higher efficiencies

Up to now, NEMA motors were distinguished by two efficiency classes: energy-saving motors according to EPAct with 1 to 200 HP – as well as energy-saving motors according to NEMA Premium with 1 to 400 HP. This is now supplemented by a new generation of high-efficiency motors: Ultra NEMA Premium. Equipped with copper die-cast rotors, they achieve even higher efficiencies than NEMA Premium. Efficiency-relevant losses are minimized by up to 10% – resulting in guaranteed minimum efficiencies within a tight tolerance range. Our new Ultra NEMA Premium motors are especially suited for operation on frequency drives according to NEMA MG 1-2003, Part 31.

In addition to the grey iron casing for general-purpose and severe duty applications, an aluminum housing is now also available for general purpose applications. The motors are certified according to CE, CSA RU and also e.g. NEMA Premium.

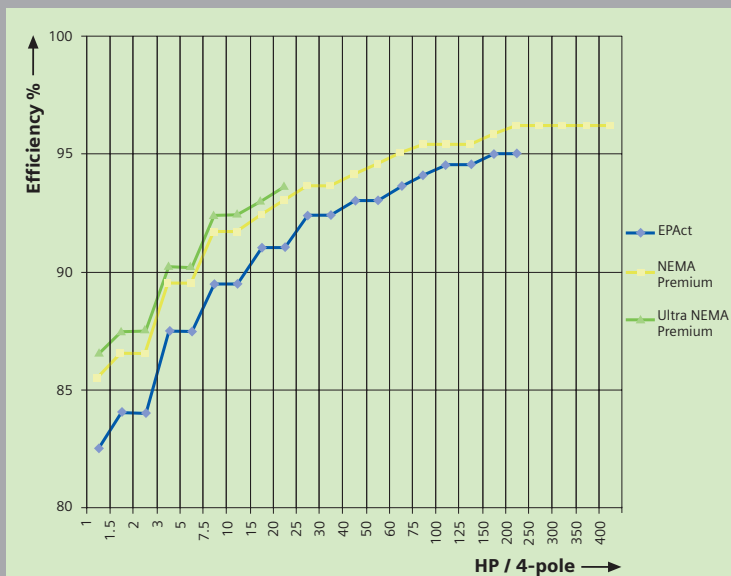
### Moving into the future – short amortization times

In continuous operation, the costs of investment of a NEMA Premium energy-saving motor are often paid off in the first year. With 97% of life cycle costs being energy costs and only about 3% investment costs, this results in huge power saving opportunities. An example: For a 4-pole 20HP energy-saving motor, changing from EPAct to NEMA Premium in continuous operation at 8 ct/kWh results in energy cost savings of over \$6,000 over only 20 years.

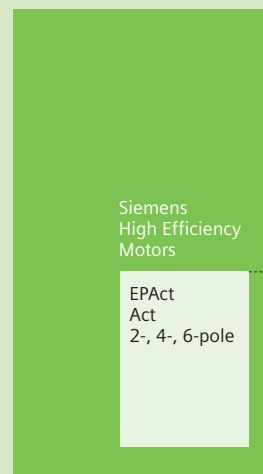
### Ready to run – typical applications

Areas of application of so-called general-purpose motors – primarily in designs with aluminum housing – include the HVAC industry (Heating, Ventilating & Air Conditioning), which requires especially lightweight motors. Severe duty motors in full grey iron design are suitable for use in harsh environments, e.g. in the pulp & paper industry. For use in the oil and chemical industry, the severe duty motor design SD100 IEEE 841 is predestined: It even exceeds the strict IEEE 841 standards.

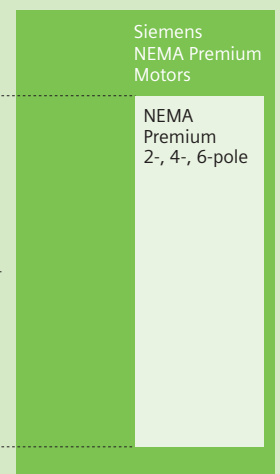
Our Ultra NEMA Premium motors provide superior efficiencies at an unprecedented level.



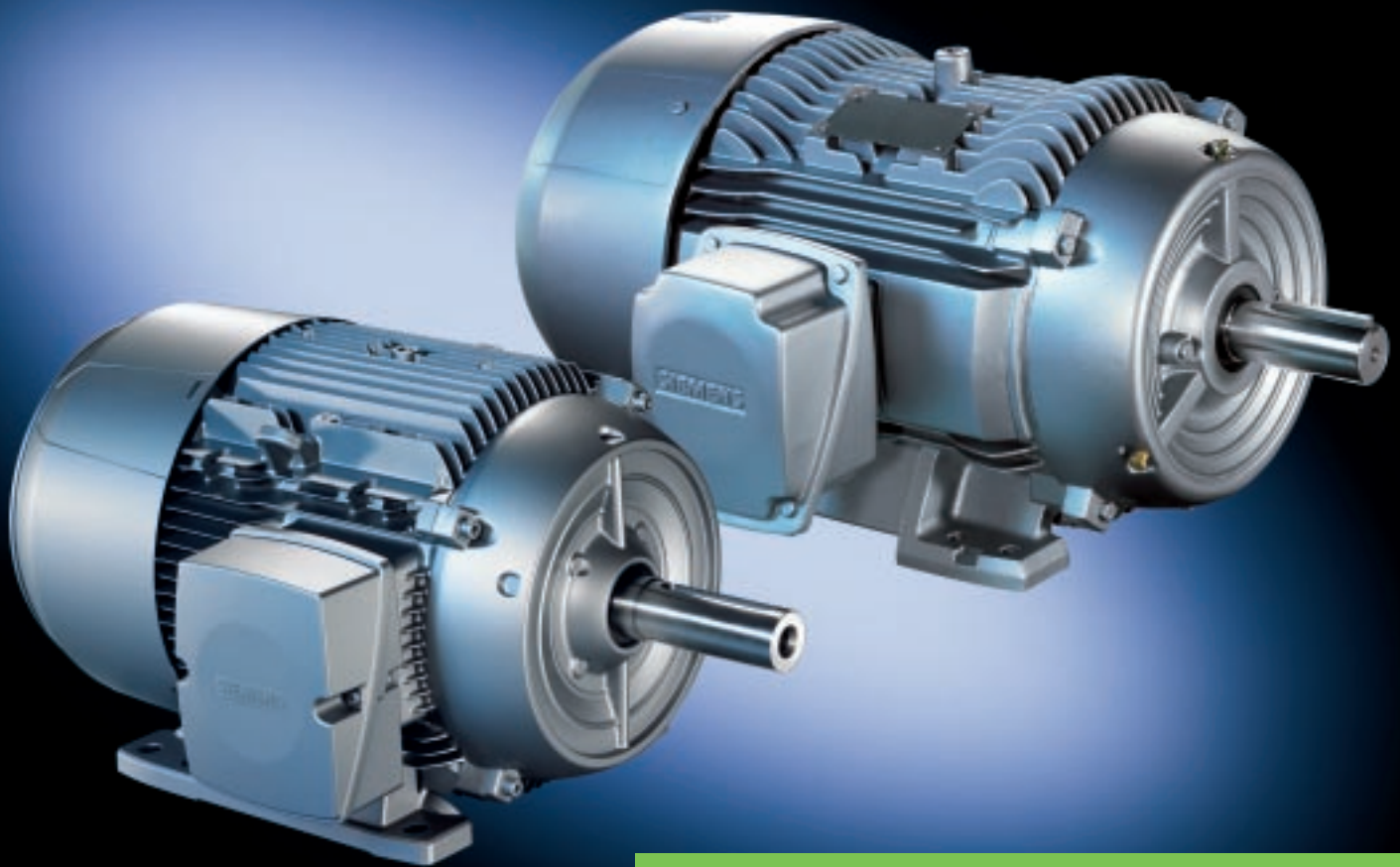
### High efficiency



### NEMA Premium® efficiency







#### At a glance: NEMA motors for Northern America

##### Status

EPAAct, NEMA Premium and Ultra NEMA Premium efficiencies

##### Covered products

2-, 4- und 6-pole 60 Hz squirrel cage motors  
1-200 HP (EPAAct) and 1-400 HP (NEMA Premium)

##### Identification

Nominal efficiency and guaranteed minimum efficiency are indicated on the rating plate (Ultra NEMA Premium)

From the left:  
NEMA Motor GP100A and  
NEMA Motor SD100

Cross-section of the copper  
die-cast rotor of an  
Ultra NEMA Premium motor



EPAAct:	Energy Policy Act of 1992 – U.S.A. Federal Law: legally prescribed minimum efficiencies for motors according to NEMA MG-1 standard
NEMA:	National Electric Manufacturers Association
NEMA Premium:	Efficiency standards according to NEMA
CSA:	Canadian Standard Association
NOM:	Norma Oficial Mexicana

# The right turn at the right moment.

## Frequency drives that provide tangible savings

Flow machines such as pumps, fans and compressors are often controlled by traditional and proven control methods. Major disadvantage: The motor will always run at its rated speed at maximum delivery rate although this is rarely required in practice. The result: operation with continuously high energy losses, e.g. using reactor control. Variable-speed operation on a frequency drive, however, can save a considerable amount of energy.

### Saving in the double-digit percentage range – made possible by precision design

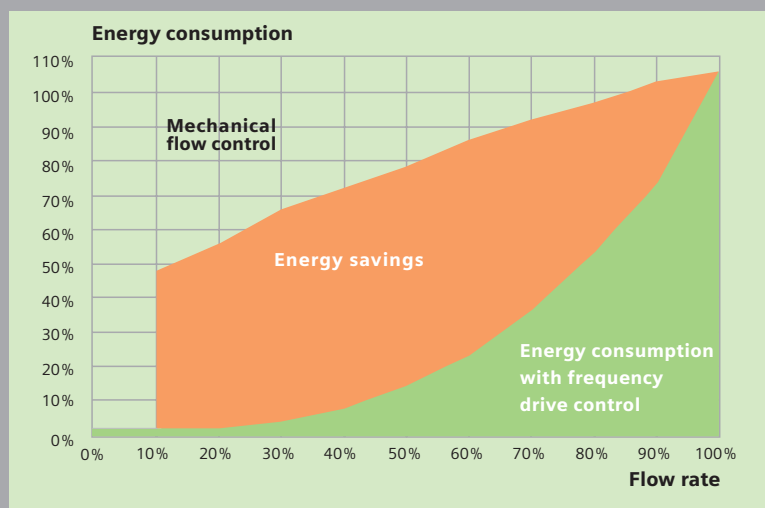
The right turn at the right moment can save a lot of money. Variable-speed drives with converters always adjust their power consumption to the current requirements. By varying the rotational speed, the motor characteristic is always optimally positioned for the process. The motor will only consume the power that is required at a specific moment. The power factor and the efficiency will remain nearly constant. And this means for you: energy savings of up to 50%.

### Going easy on your plant and on your budget

Frequency drives control energy. They prevent current peaks, surges as well as unfavorable operating conditions and ensure smooth run-up and run-down to offload the entire drive train. A mechanical controller is not required. The result: improved performance, reduced maintenance, longer life cycle. This goes easy on your plant and also on your budget.

### Leverage the full potential – with matching frequency inverters

Cost-effective, robust, reliable and easy to use – SINAMICS® and MICROMASTER®. These innovative frequency drives allow you to fully leverage energy-saving potentials. In addition to voltage frequency control capabilities, SINAMICS and MICROMASTER feature vector control with or without encoders. In addition to frequency drives without regenerative feedback, the new SINAMICS G120 frequency drive – in conjunction with the PM250 Power Module – features line-commutated regenerative feedback. All devices can be customized using a wide range of available components and options. The result is an optimized price-performance ratio.



# SINAMICS family of drives.

## More drive for every application

**The SINAMICS family of drives offers future-oriented, universal solutions for the entire range of drives. In the low-voltage segment, the frequency drives G120 , G130 and G150 are particularly relevant. With or without regenerative feedback, they offer a complete portfolio with outputs up to 1,500 kW.**

### SINAMICS frequency drives: Driven by efficiency

All members of the SINAMICS family of drives benefit from a universal technological basis and feature the same look & feel. For example, all high-performance SINAMICS cabinet-mounted units feature an advanced operator panel with a user-friendly graphical user interface and self-explanatory screens. This greatly simplifies both operation and diagnostics.

### Engineering tools that think of everything

All drives of the SINAMICS family can be uniformly configured and commissioned using only two engineering tools – SIZER and STARTER. SIZER and STARTER consistently adhere to the general SINAMICS philosophy, representing a maximum of uniformity, flexibility and scalability. Both tools are based on a universal operating concept and are optimized for the requirements of configuration and commissioning:

- SIZER supports you in planning and configuration – no matter what drive task that you need to solve.
- STARTER is predestined to handle the commissioning, optimization and diagnostics of all SINAMICS drives.

### At a glance: SINAMICS family of drives

- Universal functionality based on platform concept and integrated engineering
- High degree of flexibility and numerous combination options
- Wide performance range, designed for worldwide use
- “Safety Integrated” functionality available for SINAMICS G120
- Improved cost-effectiveness and efficiency

# SINAMICS G120 frequency drive.

## High performance up into the medium power range



For the power range up to 90 kW, we offer an efficient solution with our new frequency drive SINAMICS G120. With a modular design and featuring Safety Integrated functionality as well as multiple communication interfaces, it is suitable for use in a wide variety of applications. Particularly convincing: the line-commutated regenerative feedback feature – the best solution to save energy.

### Wide range of capabilities

The SINAMICS G120 is fully modular, which enables it to be adapted to specific application requirements. The Power Modules and Control Units are available as separate functional units and can be mixed and matched as required. The frequency drive offers voltage frequency control, vector control and Flux Current Control (FCC). A Fail-safe Control Unit enables safety-critical applications to be implemented.

### Full savings potential

The SINAMICS G120 with the innovative Power Module PM250 offers unprecedented energy-saving potentials using line-commutated regenerative feedback. The amount of energy saved depends on the application. Instead of "burning" energy with a braking chopper and connected brake resistor, the PM250 feeds excessive energy from the process back into the power supply system, enabling considerable energy savings.

### Easy to use

The G120 has a very user-friendly design and is universal thanks to a number of Control Units. Various solutions for communications are available: RS485 (CU240S), PROFIBUS (CU240S DP) but also Control Units with Safety Integrated. All are parameterized with the STARTER commissioning software or using an operator panel.

### At a glance: SINAMICS G120 frequency drive

- Power range 0.37 to 90 kW
- Voltage classes 400 V, 690 V
- Up to 9 digital inputs, up to 3 digital outputs, up to 2 analog inputs and up to 2 analog outputs
- Line-commutated regenerative feedback (PM250)
- Low system perturbations (PM250)
- Line-commutating reactor not required (PM250)
- Maximum robustness due to innovative cooling concept and varnished electronic modules
- Quiet operation
- High overload capability
- Prepared for use on IT networks
- Sophisticated vector control (speed/torque) for consistently high drive quality even in case of sudden load variations
- Torque control ensures fully controlled torque down to the lowest speed, even zero speed
- Load torque monitoring
- Evaluation of motor pulse encoders (integrated encoder evaluation with CU240S xx)
- 4 skip frequencies to avoid resonances and thus prevent damage to the machine
- Automatic restart
- Motor-friendly connection to the rotating motor (flying restart)
- 3 drive data sets
- Free function blocks
- Comprehensive fault diagnostics, e.g. for evaluation of motor temperature for motor protection and temperature monitoring of the Power Module

# SINAMICS G150 und G130 frequency drives.

## For high-output single drives

Our SINAMICS G150 and SINAMICS G130 frequency drives are the first choice for variable-speed drives with high output, especially for pumps, fans and compressors. Both feature fast planning, easy integration and easy assembly for profitable solutions. This is ensured by a wide variety of available components and options. Of course, SINAMICS G150 and SINAMICS G130 are compliant with all relevant international standards. They are also an integral part of Totally Integrated Automation, which facilitates communication, data management and parameterization.



### Ready-to-connect cabinet units: SINAMICS G150

Ready-to-connect in standard cabinets – this is how our SINAMICS G150 AC-AC frequency drives are delivered to you. Designed for an output range from 75 to 1,500 kW, they are available with cabinet widths from 400 mm in grid steps of 200 mm.

Two design variants offer sufficient space for customized requirements: While variant A offers ample installation space for all available options, the space-saving variant B is primarily designed for applications where the power connection components are already accommodated in a central low-voltage distribution board.

### Modular built-in units: SINAMICS G130

SINAMICS G130 enables a cost-effective drive solution to be tailored according to your requirements in an output range of 315 to 800 kW. Higher outputs can be achieved by parallel connection. The built-in unit consists of two modular, self-contained components: the Power Module and Control Unit. These can be mounted in different places or together as a unit. The Power Module contains a slot for the Control Unit.

### Medium-voltage frequency drives for the megawatt range

For pumps, fans and compressors in the multi-megawatt range, medium-voltage frequency drives are the most cost-effective solution. We can offer the SINAMICS GM150 and ROBICON PERFECT HARMONY for this purpose.

### At a glance: SINAMICS G150 and G130 frequency drives

- Output range from 75 to 1,500 kW
- Voltage classes 380 to 400 V, 500 to 600 V and 660 to 690 V
- Compact and quiet due to advanced IGBT power semiconductors and innovative cooling concept: up to 70% smaller footprint than traditional converters and noise emission of only 69 db(A) in full operation
- Available as cabinet units with or without power connection components or as built-in units, depending on requirements
- Improved plant availability due to maintenance-friendly design with good accessibility and clearly structured, modular design
- Easy to integrate in overall automation systems via PROFIBUS and PROFINET interface and a number of analog and digital interfaces
- Easy commissioning and parameterization with user guidance on AOP 30 Advanced Operator Panel with graphical LCD and plain text display

# MICROMASTER frequency drives.

## Compact all-rounders

Frequency drives of the flexible MICROMASTER family are universal solutions for nearly any segment of the industry. As a part of Totally Integrated Automation, these compact all-rounders can easily adapt to new requirements with low effort. All units meet the requirements of the EU low-voltage guideline and carry both the CE mark and UL and CUL certifications. All major protection and overload functions are already integrated in the standard design.

### Versatile and user-friendly

MICROMASTER frequency drives combine cost-effectiveness with highest technical requirements and versatile functionality – from the basic version MICROMASTER 420 for universal applications to the specialized version MICROMASTER 430 for pumps and fans to the high-performance version MICROMASTER 440 with Sensorless Vector Control. Each member of this family features an extremely user-friendly design: whether in assembly, commissioning or operation in a running system.

### Fast and easy integration

Each MICROMASTER frequency drive permits the flexible combination of inputs and outputs for optimized interfacing to a wide variety of digital and analog signals. With its documented factory default setting, it is immediately ready for service.



### At a glance: MICROMASTER frequency drives

#### Hardware

- Power range from 0.12 to 250 kW
- Voltage classes 200 to 240 V, 380 to 480 V and 500 to 600 V
- Compact housing and simple assembly
- With or without integrated Class A EMC filter
- Prepared for use on IT networks
- High overload capability (200% in CT mode)
- Various expansion options (PROFIBUS, encoder feedback, Advanced Operator Panel)
- Configurable for constant torque (CT) and square-law torque (VT) mode
- Integrated braking chopper (MICROMASTER 440)
- Up to 2 analog current/voltage inputs, up to 2 analog current outputs, up to 3 parameterizable relay outputs

#### Software

- Different control modes from V/f control to vector control with sensor
- Guided commissioning
- DC and compound braking for controlled emergency braking
- Free function blocks (MICROMASTER 430/440)
- 4 skip frequencies offload machines in case of resonances
- Automatic restart after power failure or malfunction
- Gentle connection to the rotating motor (flying restart)
- Possibility of evaluating the motor temperature with external sensor
- Possibility of controlling up to 3 motors (MICROMASTER 430)
- Integrated PID controller for temperature and pressure control (MICROMASTER 430/440)
- Dry run detection for pump drives (MICROMASTER 430)
- Power-save mode (MICROMASTER 430)

## Easy calculation of savings potential. SinaSave puts you in the picture

Our software tool SinaSave® can show you how quickly an investment in an IEC or NEMA energy-saving motor or frequency drives pays off. Based on key data of your system, the program calculates the energy savings for a specific application. The amortization period is then derived from the total monthly savings and the initial costs of the motor or frequency drive. Often it is just a few months.

### Valuable information you can take at face value

The SinaSave energy-saving program is designed for applications for motors in **on-line operation** (fixed speed) and frequency drive mode (variable speed). In on-line operation, you can calculate the cost savings and payback time of the extra cost of the motor for our energy-saving motors EFF1 or NEMA Premium on the basis of three comparison cases. In comparison to ...

- motors EFF2 or EPAct – **Case 1**
- individually selected known motors – **Case 2**
- known motors within a complete system evaluation – **Case 3**

With **variable speed**, SinaSave takes all necessary plant-specific parameters into account. This includes values that are required for the process, such as delivery flow and height for pumps, mass flow

and total delta pressure for fans as well as the density of the transported medium. Additional parameters: the efficiency of the flow machine, the electrical efficiency and the total efficiency of the system. Additional basic data of the program include the number of workdays and shifts as well as the conveyance profile over the day and the year, which determines the energy-saving effect.

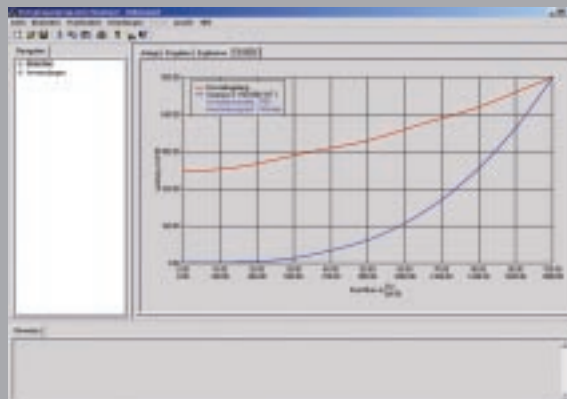
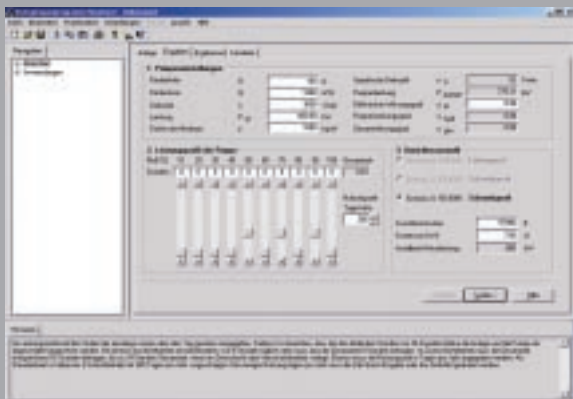
Based on the plant-specific basic data, the program will, in a first step, derive the drive system with a suitable performance and the price of the matching frequency drive. In a second step, it determines the energy requirements of the variable-speed drive system for the specific application. The results are compared with the equally calculated values of all applicable alternative concepts, e.g. throttle valves, bypass, angular

pre-control or pole-changing motors. The difference is the energy saving in kilowatt-hours, which the program converts into an amount, based on the currently applicable costs of energy supply for the plant.

In other words: SinaSave delivers a reliable calculation of the payback period based on the investment costs for the motor or frequency drive and the resulting energy saving.

Your fast-track address to success:

[www.siemens.com/energysaving](http://www.siemens.com/energysaving)



# Worldwide service. Where everything revolves around you

Whether you want a tailored planning for your drive application or need delivery, assembly, commissioning or maintenance: Our experts are always at your service – worldwide, wherever you are, in 130 countries.

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