



Automation for a Changing World

Delta Power Quality Solutions



www.deltaww.com

 **DELTA**
Smarter. Greener. Together.



Smarter. Greener. Together.

Who We Are

Delta is a market leader that has won wide recognition as a:

- Global power and thermal solution provider for Apple, IBM, HP, Lenovo and more; No.1 in Switching Power Supplies since 2002, DC Fans since 2006.
- Leading telecom power system provider for telecom carriers in Europe, the Americas, Asia and emerging markets; Long term partnerships with Vodafone, Orange, China Mobile, Telefonica and more.
- Leading brand in industrial automation applications, factories, processes, machines, and robots; specific solutions for textile, packaging, machine tools and more.

About Delta Industrial Automation

Since the launch of our first AC motor drive in 1995, the Delta industrial Automation Business Group (IABG) has focused on automation technology with quality, reliability and precision to realize our promise of "Automation for a Changing World". We provide innovative automation products that include AC motor drives, power quality improvement devices, sensors, and control and motion devices. With enhanced integration and industrial network development, our industrial automation solutions find application in a broad range of machinery, including: metal processing machines used in the food industry, textile industry, chemical industry, electronics industry, plastic industry and more; automation equipment used in the pharmaceutical industry and printing industry; and energy-saving air-conditioning and water supply facilities used in buildings. Our mission is: "To elevate our living environment through advanced automation technology and value added innovation". With Delta's innovative, reliable, energy-saving automation solutions and rapid global service, we help make the world "Smarter. Greener. Together." with our partners and customers.

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Power Quality Overview

Delta's power quality solutions provide greatly improved power quality for more stable and effective operations. In addition, Delta offers power regeneration functions for the reuse of energy with no energy waste.

As technology evolves, many industrial and commercial areas have implemented a large amount of electrical equipment such as inverters, UPS and rectifiers to attain high operation efficiency and energy-saving performance. However, the non-linear load characteristics of the electrical equipment also bring power quality problems that pollute the power grid with an unstable power supply. For example, the non-linear current generated during the operation would affect the operation stability and create power quality problems leading to low performance and high operation costs. Common power quality problems include harmonics distortion, reactive power, low power factor, unbalanced loads and voltage fluctuation which impact the equipment with a high failure rate, high energy consumption and high maintenance cost. How to obtain a stable power quality while maintaining energy-saving performance has become a top concern for industry.

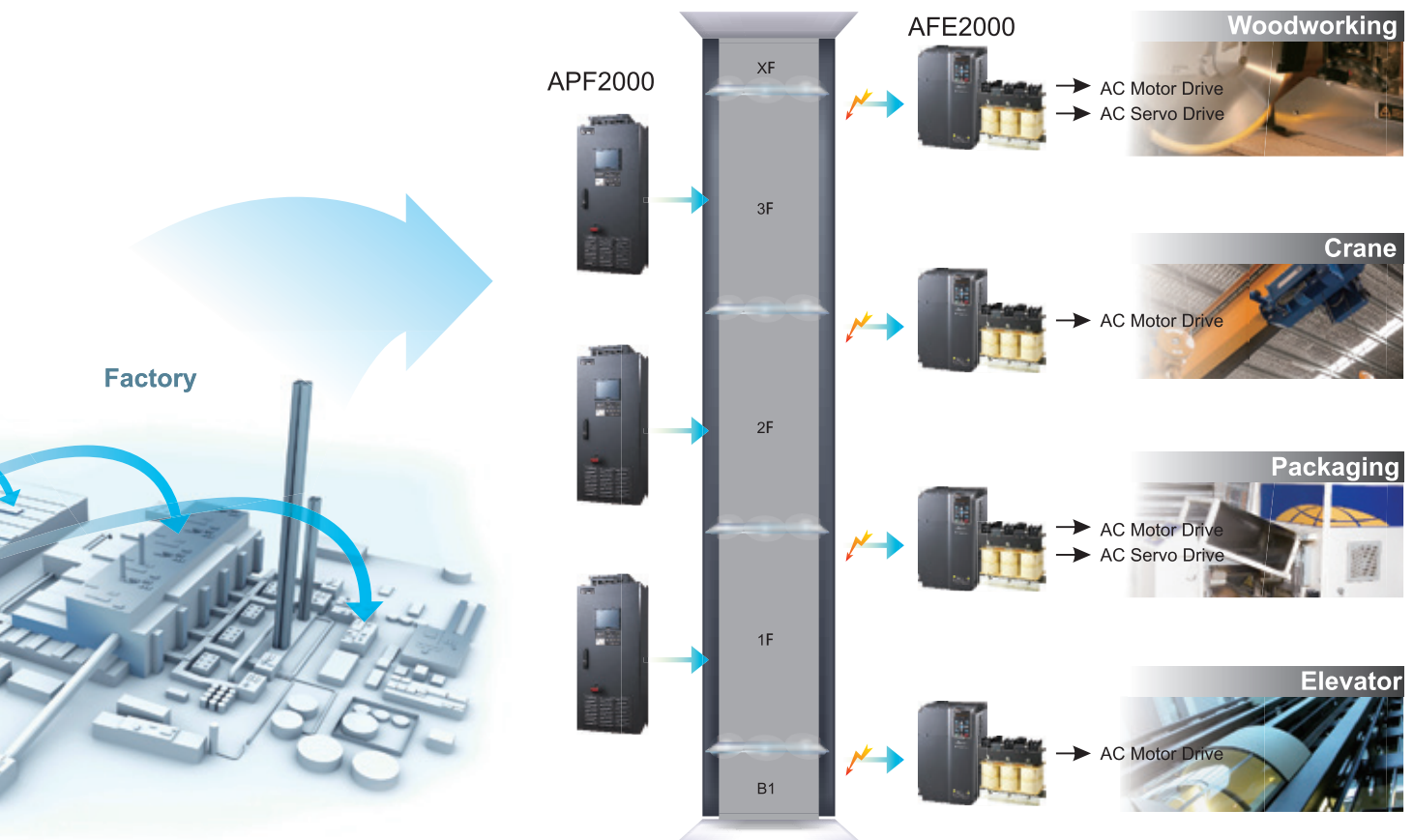


Power Grid



SVG2000

<p>Power Factor</p>	<p>Load Balance</p>	<p>Harmonics Suppression</p>	<p>Power Regeneration</p>
<p>SVG2000</p>	<p>APF2000</p>	<p>AFE2000</p>	<p>REG2000</p>
<p>▲ Applications</p> <p>A new solution to traditional phase-leading capacitors</p> <ul style="list-style-type: none"> • Infrastructure • Commercial and home power distribution systems 	<p>▲ Applications</p> <ul style="list-style-type: none"> • Metallurgy and petrochemicals industries • Mechanical industries • Transportation industries • Telecommunication, medical and construction industries 	<p>▲ Applications</p> <ul style="list-style-type: none"> • Large-inertia loads applications • 4-quadrant loads applications • Quick braking applications • Long energy feedback time applications • Power quality improvement 	<p>▲ Applications</p> <ul style="list-style-type: none"> • Large-inertia load applications • 4-quadrant load applications • Quick braking applications • Long-term energy feedback applications



Harmonics Suppression

Improved harmonics ensure operation stability, prevent system errors and alarms.



Power Factor

Improved power factor helps save on utility company penalties and equipment costs.



Power Regeneration

Power regeneration converts regenerative energy into usable power, and maximizes energy usage utility.



Load Balance

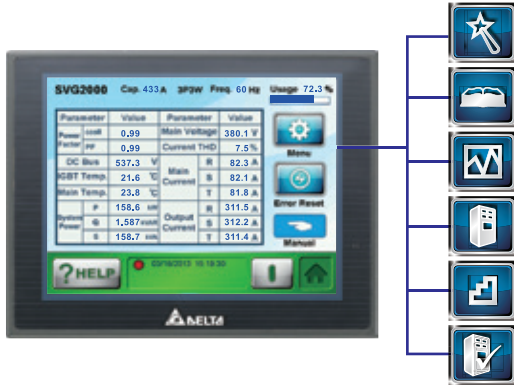
Improved load balance ensures system reliability, and prevents overheating and equipment damage.

Product / Function	Power Factor Correction	Harmonics Suppression	Reactive Power Compensation	Load Balance	Power Regeneration
SVG2000	•	•	•	•	
APF2000	•	•	•	•	
AFE2000	•	•			•
REG2000					•

SVG2000 Series

System Structure

■ SVG Power Quality Improvement System



■ Optimized Ventilation Design

- Modular fan design
- Continuous variable transmission (CVT) fan
- Highly efficient heat pipe ventilation system

■ Hardware Modularized Design

- Easy-to-assemble power factor module
- Digital signal integrated circuit board
- Plug-in capacitance module

■ Digital Signal Processing (DSP) Control

- Filter self diagnosis
- Intensified overloading protection
- Innovative PWM variation technology
- Multi-functional programmable digital input / output terminals

■ Built-in High Voltage Lightning Protection Module

■ Standard Power Input with Hardware Protection



Applications

■ Metallurgy and petrochemicals industries:

Rectifier, converter, rolling mill, electric arc furnace, medium frequency furnace, inverter

■ Chemical and electrolysis industries:

Rectifier, calcium carbide furnace, electric soldering, inverter

■ Mechanical industries:

Rectifier, rolling mill, inverter, electric arc equipment

■ Metal, paper, plastic processing and textile industries:

Rectifier, rolling mill, inverter, electric arc furnace, electric furnace

■ Transportation industries:

The rectifier and the inverter of electric vehicles, electric motorcycles and metro systems

■ Automobile manufacturing industry:

Soldering equipment, car painting equipment, battery charger and inverter

■ Telecommunication, medical and construction industries:

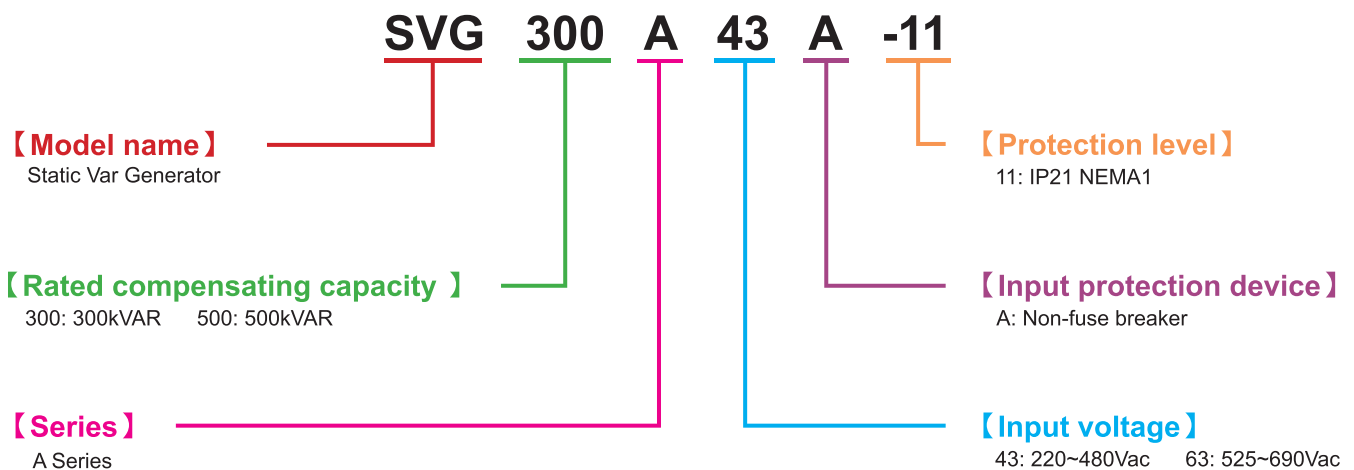
Server station, EPS, UPE, converter, charger, inverter

Features

- Improves power factor**
 Continuously outputs and compensates reactive power to maintain power factor above 0.99. The compensation performance is 1.2 times better than traditional compensators.
- Suppresses harmonics**
 Real-time configuration of the required amount of reactive current compensates reactive power and reduces high order harmonics.
- Fast response**
 Fast configuration capability provides fast analysis and response time. Cycle response time < 20ms and dynamic response time < 500 μs.
- High operation efficiency and low power loss**
 SVG adopts a new electronic component design that provides efficiency of more than 96% and low power loss.
- Modular design for flexible extension**
 No need for reactor and capacitor saves installation space by 20~30%. The modular design with special ventilation path provides flexible extension, ease of maintenance and ease of assembly.
- Highly reliable and safe**
 Robust design for power system eliminates resonance problem and there is no more amplified harmonic current and voltage.

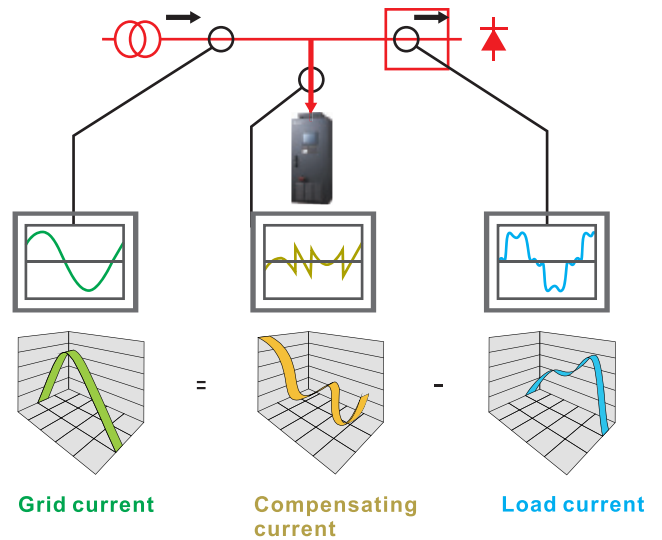


Model Name



APF2000 Series

Delta's Active Power Filter - APF2000 is a power filter device that can monitor load current and filter harmonics in real-time to maintain a linear current. It monitors the load current using a current transformer and injects the exact opposite phase to the network of components that are to be filtered. It can also provide leading and lagging reactive current in real-time to improve the power factor and compensate reactive power.



System Structure

■ APF Power Quality Improvement System

- 7" HMI TFT LCD 65536 Color (800 x 600)
- Real-time and continuous monitoring of grid data and 3-phase wave form
- 100 sets of error records
- Data logging and export
- USB Host and plug-in USB disk
- Supports SD card
- Ethernet monitoring and control

■ Digital Signal Processing (DSP) Control

- Filter self diagnosis
- Intensified overloading protection
- Innovative PWM variation technology
- Multi-functional programmable digital input /output terminals

■ Built-in High Voltage Lightning Protection Module

■ Standard Power Input with Hardware Protection

*Optional insulation fuse switch or non-fuse breaker

■ Optimized Ventilation Design

- Modular fan design
- Continuous variable transmission (CVT) fan
- Highly efficient heat pipe ventilation system

■ Hardware Modularized Design

- Easy-to-assemble power factor module
- Digital signal integrated circuit board
- Plug-in capacitance module



Applications

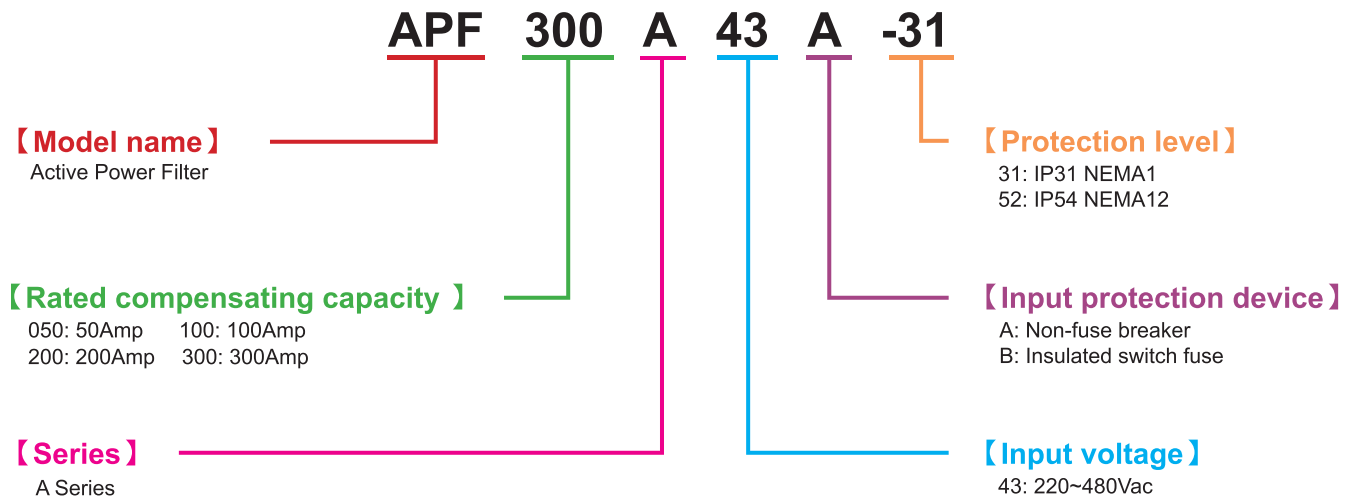
- **Metallurgy and petrochemicals industries:**
Rectifier, converter, rolling mill, electric arc furnace, medium frequency furnace, inverter
- **Chemical and electrolysis industries:**
Rectifier, calcium carbide furnace, electric soldering, inverter
- **Mechanical industries:**
Rectifier, rolling mill, inverter, electric arc equipment
- **Metal, paper, plastic processing and textile industries:**
Rectifier, rolling mill, inverter, electric arc furnace, electric furnace
- **Transportation industries:**
The rectifier and the inverter of electric vehicles, electric motorcycles and metro systems
- **Automobile manufacturing industry:**
Soldering equipment, car painting equipment, battery charger and inverter
- **Telecommunication, medical and construction industries:**
Server station, EPS, UPE, converter, charger, inverter



Regulation Standards

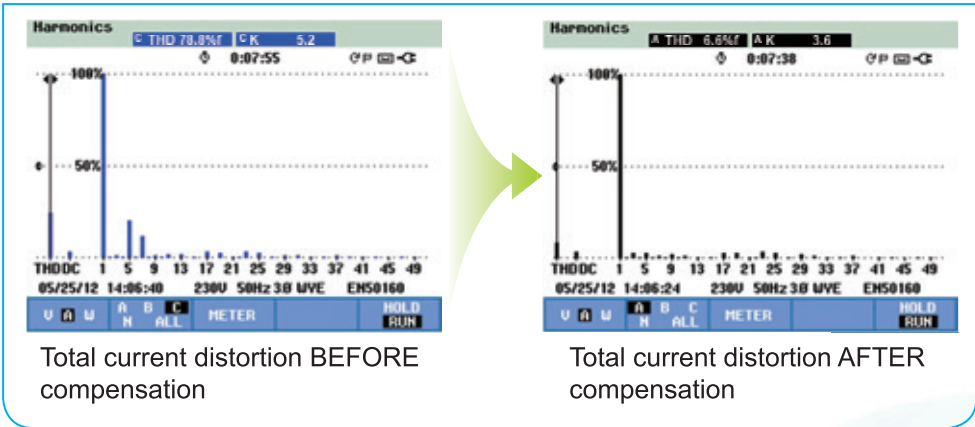
International Standards	
IEEE519-1992	IEC/EN61000-2-2
IEC/EN61000-3-12	IEC/EN61000-3-3
IEC/EN61000-3-4	IEC/EN61000-2-4
IEC/EN61000-3-2	TOR D2
G5/4	D-A-CH-CZ

Model Name

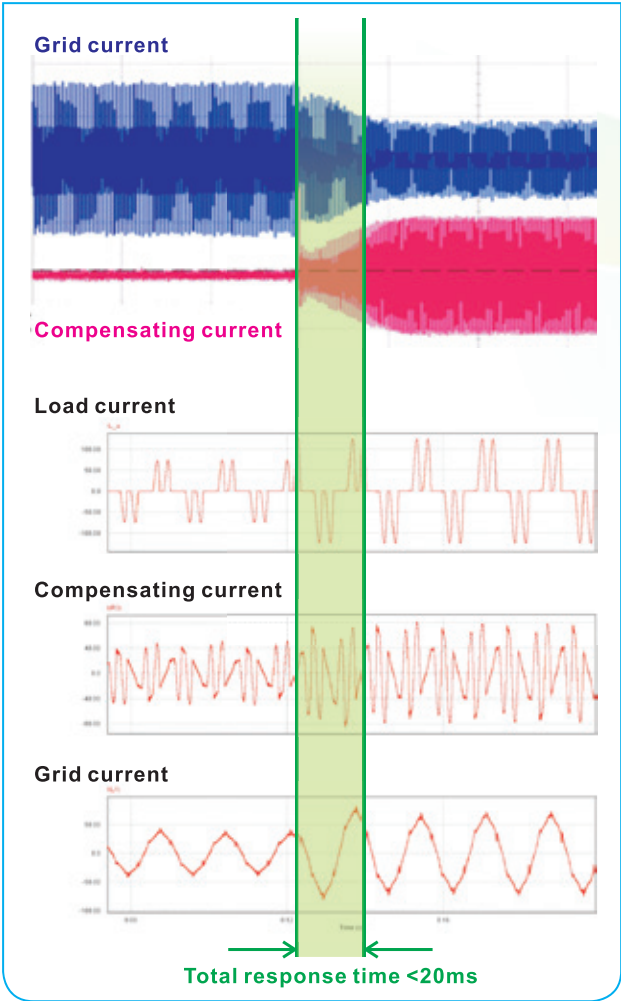


APF2000 Features

Excellent Filtering Results



Fast Response and Real-time Current Compensation



Compensation to Current, Harmonics and Power Factor

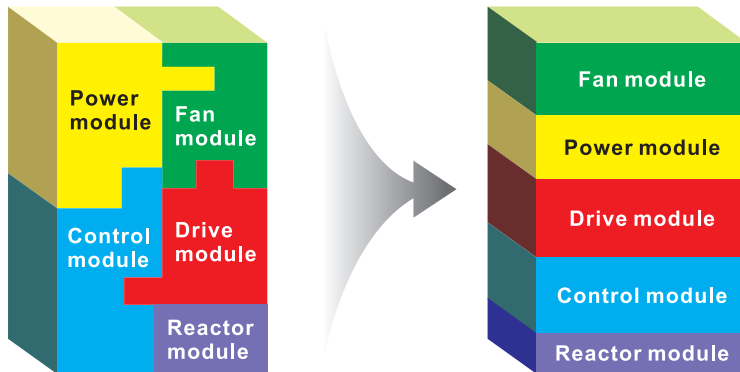
Function \ Mode	Harmonics Compensation	Reactive Power Compensation & Power Factor Correction	Load Balance
Harmonics & Power Factor			
Harmonics			
Power Factor			

* Compensation priority: ■ > ■ > ■ ; No Compensation: ■



Advanced Modular Design

- Safe, reliable, saves manpower



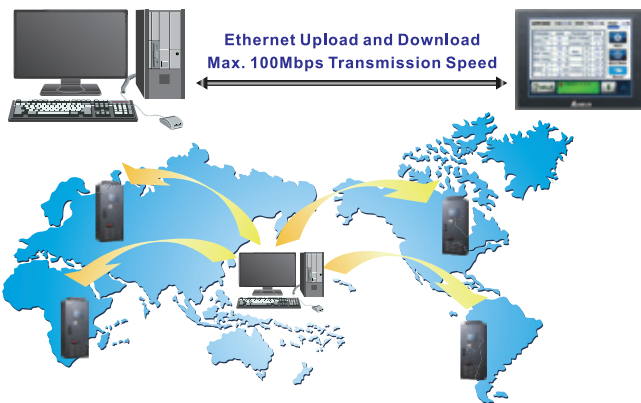
High-speed Network, Remote Monitoring and Control

- Provides diversified communication network and optional fieldbus card
- Built-in RS-485 protocol
- Advanced network functions

- MODBUS TCP



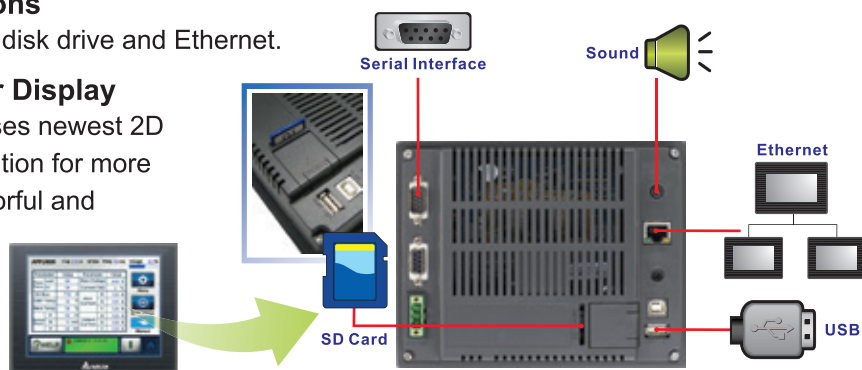
- CANopen (DS301)



Remote monitoring and control, no matter where you are.

Excellent Operation Interface

- **Diversified Extension Options**
Supports RS-232/422/485 USB disk drive and Ethernet.
- **High Quality and Full-Color Display**
65,536 color TFT LCD panel, uses newest 2D drawing technology. High resolution for more realistic images and a more colorful and vivid display.



AFE2000 Series

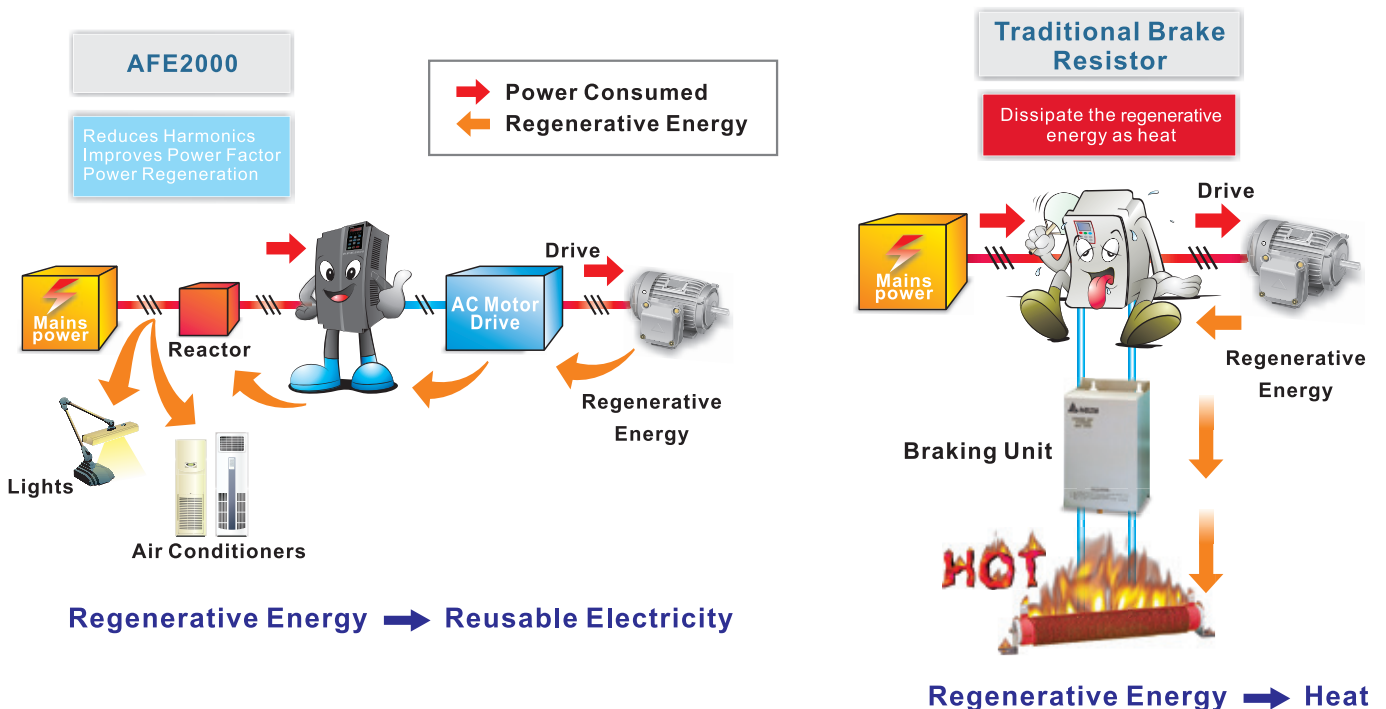
Features

- Replaces traditional brake resistors to reduce heat generation
- Clear energy savings: more than 95% of the regenerative energy is converted into electricity and supplied back to the mains
- Full-load operation: input-side current THD lower than 5% and power factor up to 99%
- AC motor drives with AFE2000: provides 4-quadrant operation with variable frequencies
- Constant DC bus voltage: unaffected by mains voltage fluctuations

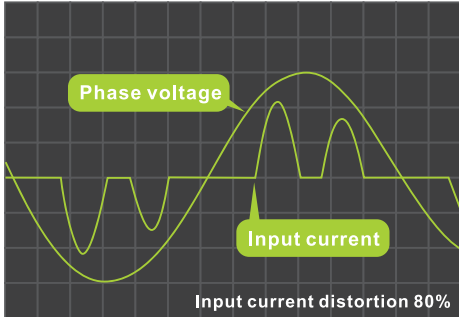
Applications

- **Large-inertia load applications:** Centrifuge equipment, dewatering machine and roving machine
- **4-quadrant load applications:** Elevators, cranes and pumpjack (oil extraction machine)
- **Quick braking applications:**
Machine tool, bag making machine, auto storage and retrieval system, and lathe
- **Long-term energy feedback applications:**
Wind power, water power, steel printing and paper making machinery (winding equipment)
- **Strict power quality applications:**
Semiconductor and panel industry

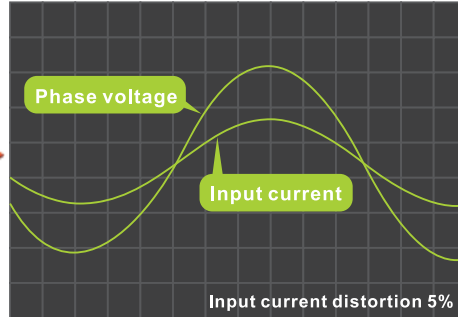
- **Replace traditional brake resistors with the AFE2000 to convert regenerative energy into reusable electricity.**



- Improve power factor, harmonic suppression, and lower energy consumption to reduce energy costs.



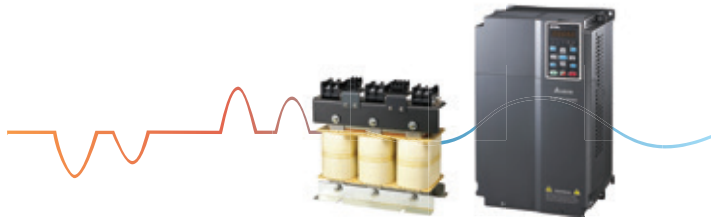
Before using AFE2000



After using AFE2000

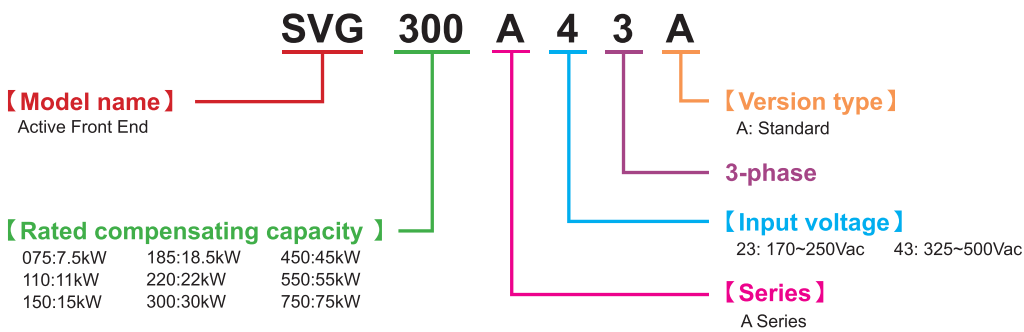
Regulation Standards

- IEEE519-1992
- IEC/EN61000-3-12
- IEC/EN61000-3-4
- IEC/EN61000-3-2

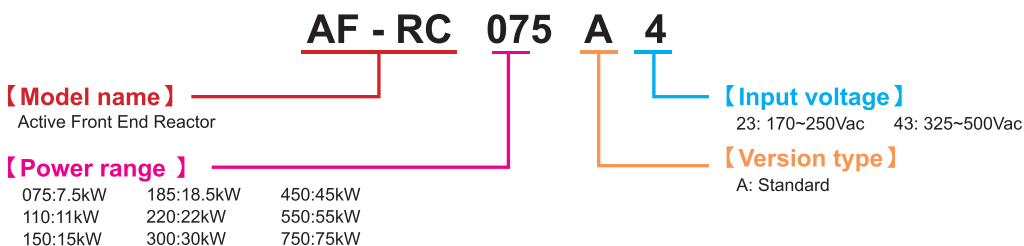


Model Name

AFE2000



Reactor



REG2000 Series

Features

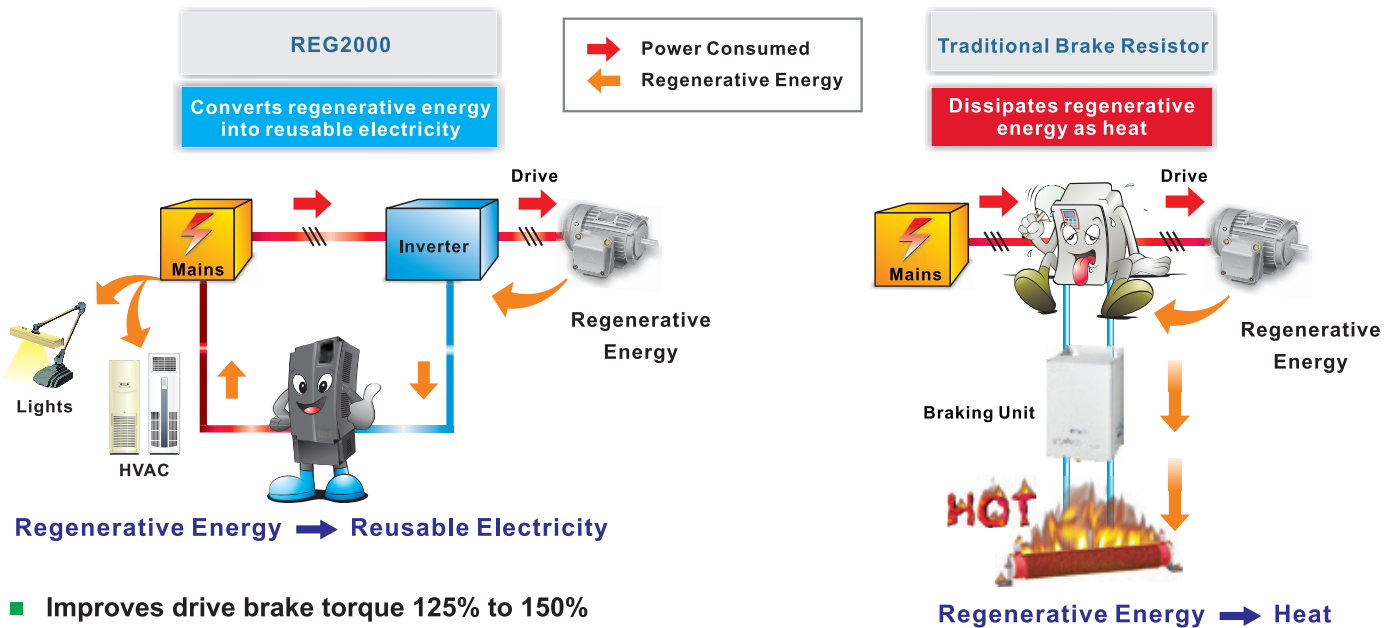
- Lower harmonics and high power factor using sinewave PWM control
- Compact design with reactor included and easy installation needs only 5 wires of connection

Regular solution
Inverter (55kW/400V) + Brake Unit + Brake Resistor

Delta solution
Inverter (55kW/400V) + Delta REG2000



- Replaces traditional brake resistor providing reduced heat generation and more than 95% power regeneration efficiency



- Improves drive brake torque 125% to 150%
- MODBUS 485 communication to real-time monitor kWh and cost
- High flexibility, compatible with other inverters and servo drives
- Parallel connections* for large power applications
- More option cards* available upon purchase: MODBUS TCP, CANopen (DS301), PROFIBUS, DeviceNet, EtherNet/IP

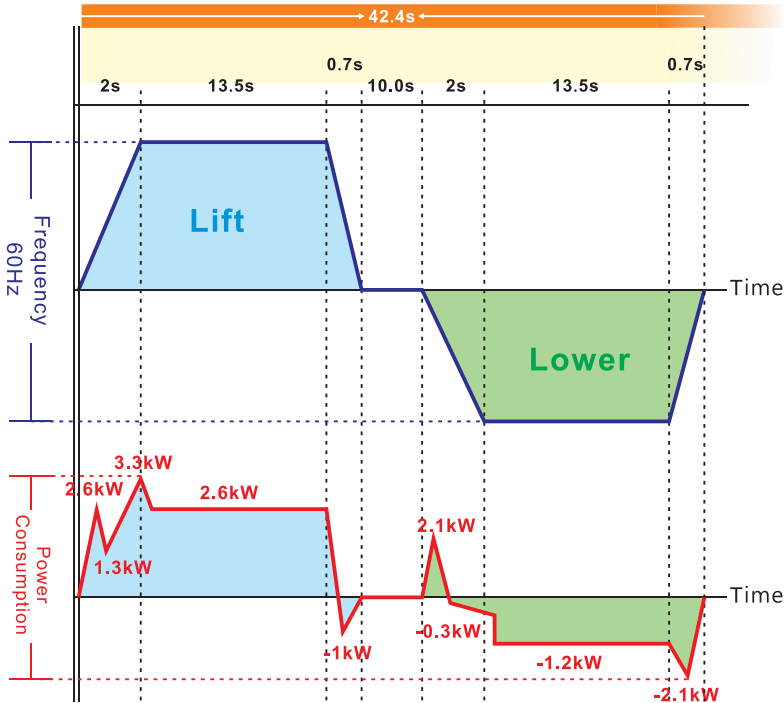
*Please contact Delta Industrial Automation

Applications

- **Large-inertia load applications:** Centrifuge equipment, industrial laundries, roving machines and more
- **4-quadrant load applications:** Elevators, cranes, pumpjacks and more
- **Quick braking applications:** Machine tools, bag making machines, auto storage and retrieval systems, press machines and more
- **Long-term energy feedback applications:** Printing machines, escalators and more

Application Example

Examples of REG2000 application for hoist and elevator systems. The energy saving results are measured using a power meter.



Hoist

This hoist system works 12 hours a day and 265 days a year. Each cycle takes 42.4 seconds and the cost for 1 kWh is NT 3.5 dollars.

- Hoist system: 5.5kw motor + REG2000
- Hoist capacity: 10 tons
- Host speed: 3.6m/min
- Loads: 3 tons
- Cycle: 5 times

REG2000	+Whr	87.088
	-Whr	-28.89
Brake Resistor	-Whr	86.033
	-Whr	0

- Average savings per cycle : $\frac{28.89}{5} = 5.778\text{Whr}$
- Operation time per cycle: 42.4 sec
- Operation/day: $\frac{12(\text{hr}) \times 60(\text{min}) \times 60(\text{sec})}{42.4(\text{sec})} = 1019 \text{ cycles}$

Delta's REG2000 offers

- Energy saved: $\frac{28}{87} \times 100\% = 32\%$
- Annual savings: $\frac{5.778}{1000} (\text{kWhr/cycle}) \times 1019 (\text{cycle/day}) \times 265 \text{ days} \times \text{NTD } 3.5 = \text{NTD } 5461 \text{ (USD } 183)$

Model Name

REG 075 A 43 A -21

[Model name]
Power Regenerative Unit

[Power range]
075:7.5kW 185:18.5kW 370:37kW
110:11kW 220:22kW 450:45kW
150:15kW 300:30kW 550:55kW

[Series]
A Series

[Protection level]
21: IP20 NEMA1

[Installation]
A: Wall mount

[Input voltage]
23: 200~240Vac 43: 380~480Vac





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