



Automation for a Changing World

Delta Power Quality Solutions



www.deltaww.com

 **DELTA**
Smarter. Greener. Together.



Smarter. Greener. Together.

Who We Are

- A global leader in power and thermal management technology with world-class customers in several industries.
- A leading brand of smart automation and energy management solutions for smart factories, industrial processes, data centers, telecom networks, green buildings and more.
- Our mission is “To provide innovative, clean and energy-efficient solutions for a better tomorrow”

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 industries such as food, textiles, chemicals, electronics, and plastics; automation equipment used in the pharmaceutical and printing industries; 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.

Table of Contents

Power Quality Overview 03

Static Var Generator 05 **SVG2000 Series**

System Structure

Applications

Features

Model Name

Active Power Filter 07 **APF2000 Series**

System Structure

Applications

Regulation Standards

Model Name

Features

Active Front End 11 **AFE2000 Series**

Features

Applications

Regulation Standards

Model Name

Power Regenerative Unit 13 **REG2000 Series**

Features

Applications

Regulation Standards

Model Name



Power Quality Overview

Delta's power quality solutions can greatly improve the power quality of systems and equipment for more stable and effective operations. In addition, Delta offers power regeneration functions for power reuse 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 operations can 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, and all the factors mentioned 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.

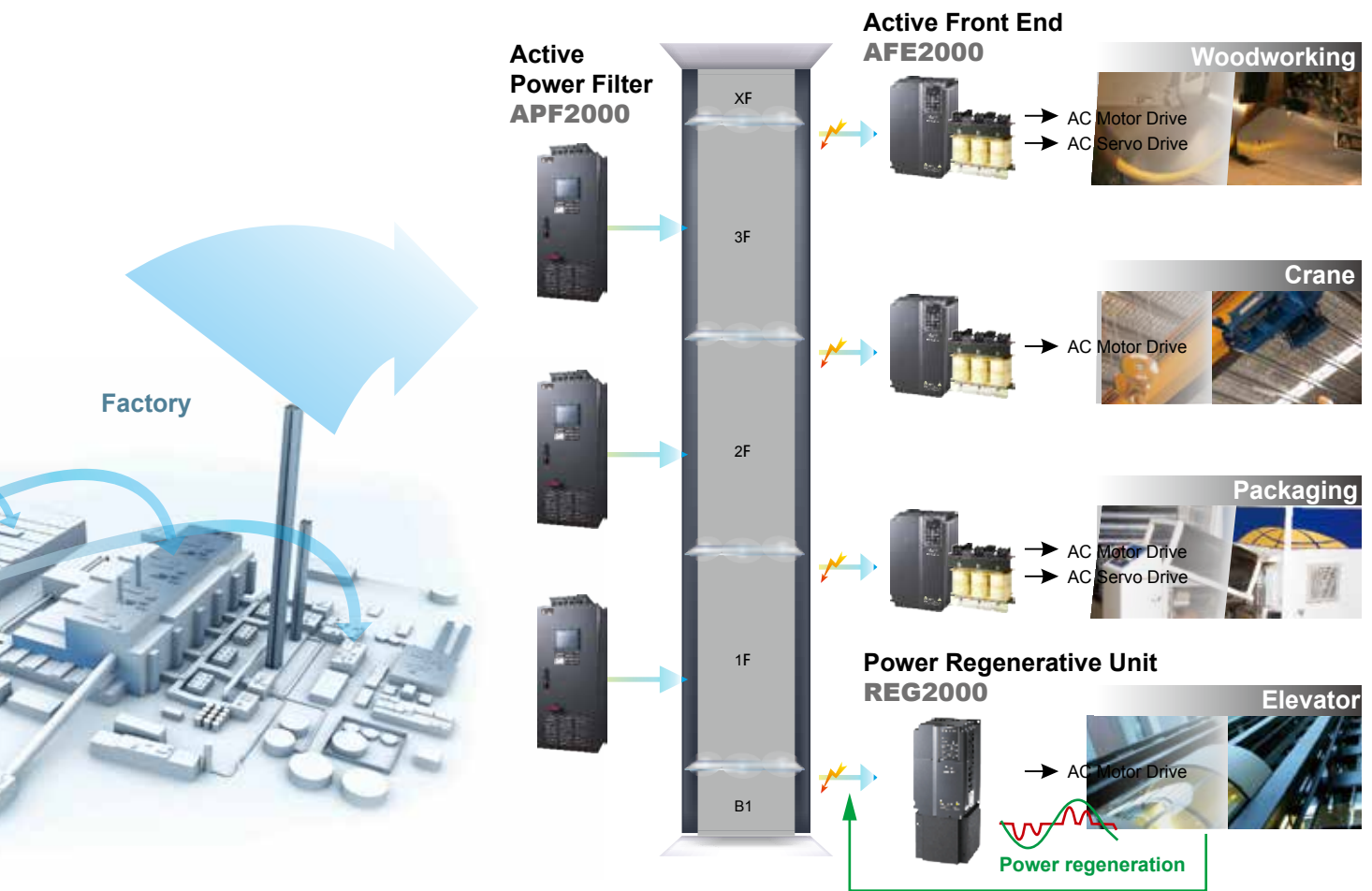


Power Grid



Static Var Generator
SVG2000

 Power Factor	 Load Balance	 Harmonics Suppression	 Power Regeneration
SVG2000 	APF2000 	AFE2000 	REG2000 
<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 • Mechanical industries • Transportation • 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 and 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

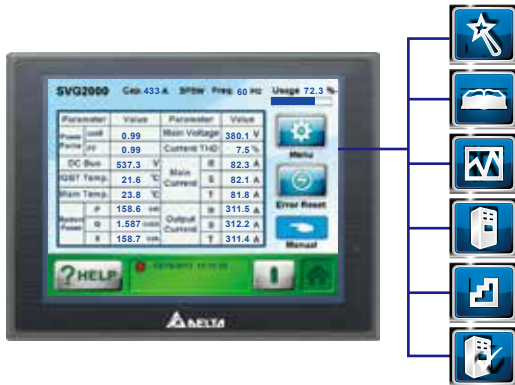
Improved load balance ensures system reliability, and prevents overheating and equipment damage

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:

Rectifier and 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

- **Power Factor Improvement**

Continuously outputs and compensates reactive power to assure power factor remains above 0.99, and compensation performance is 1.2 times better than traditional compensators

- **Harmonic Suppression**

Compensates the required amount of reactive current and achieves high order harmonics suppression in real-time

- **Fast Response**

Fast calculation capability provides fast analysis and response (cycle response time <20ms and dynamic response time < 500 μs)

- **Avoids Abnormal Low Voltage in Grid**

After compensating reactive current, the mains voltage can be effectively supported

- **Modular Design for Easy Maintenance**

No need for a huge amount of reactors and capacitors, saving installation space by 20~30%; modular design allows easy maintenance; special ventilation path avoids interference for other products, easy to assemble

- **High Operation Efficiency and Low Power Loss**

Adopts new electronic component design that provides efficiency of more than 96% and low power loss

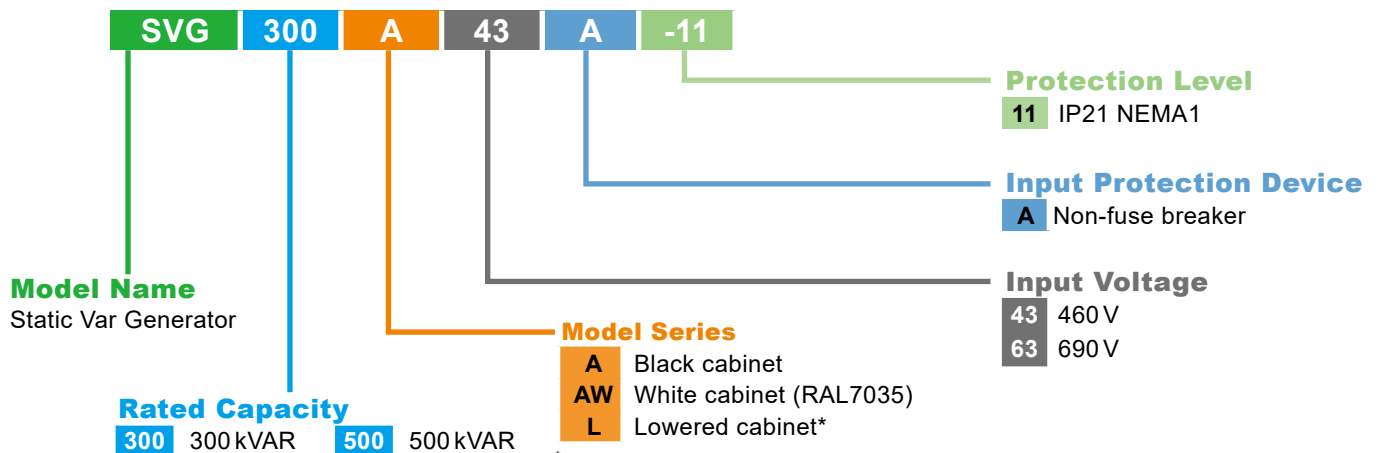
- **High Reliability and Safety**

Robust design for power systems eliminates resonance problems and amplified harmonic current / voltage, extending component life cycles and protecting the system

- **Certified NEBS GR63 CORE (Zone 4) standard by Taiwan's National Center for Research on Earthquake Engineering**



Model Name

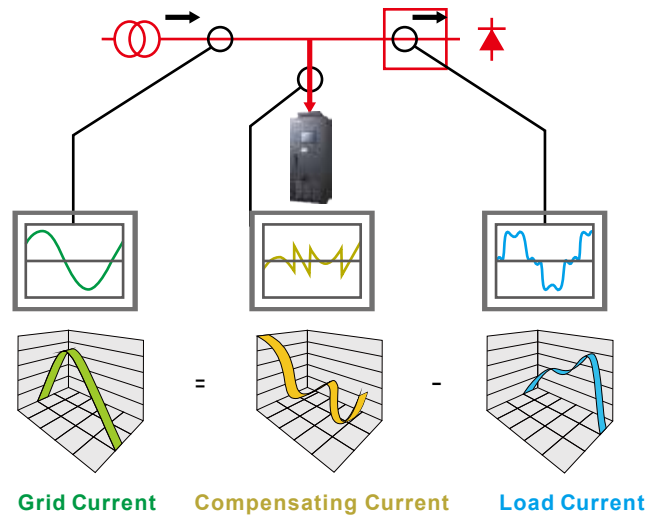


* With no CE / UL, please contact Delta or distributors in your region for purchase details.

APF2000 Series

The Delta Active Power Filter APF2000 Series is a power filter device that can monitor load current and filter harmonics in real-time to maintain a linear current. Using a current transformer to monitor the real-time load current, the APF2000 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

Flexible Control Panel

- 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
- Monitoring, control, and management via Ethernet

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*

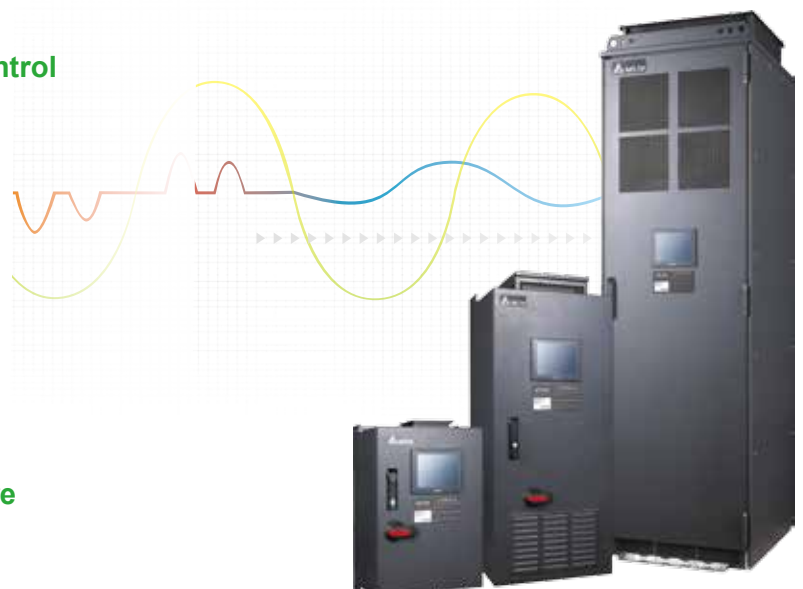
*Optional insulation fuse switch or non-fuse breaker

Optimized Ventilation Design

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

Modularized Hardware Design

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

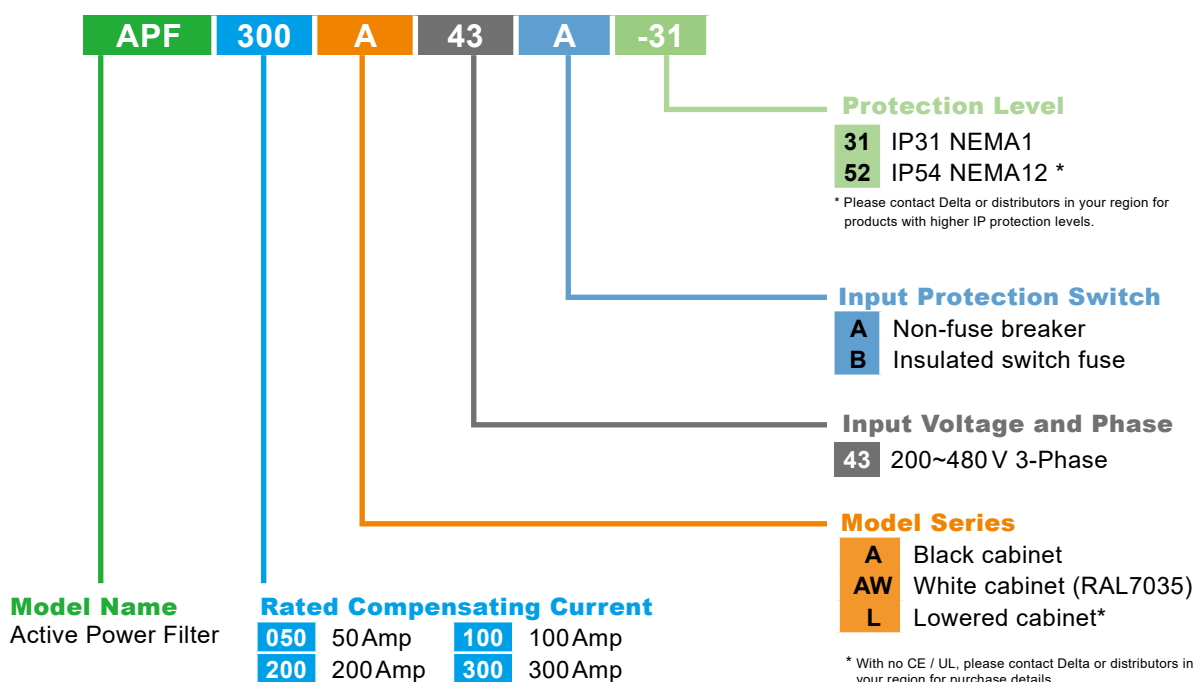


Applications

- 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:**
 Rectifier and 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



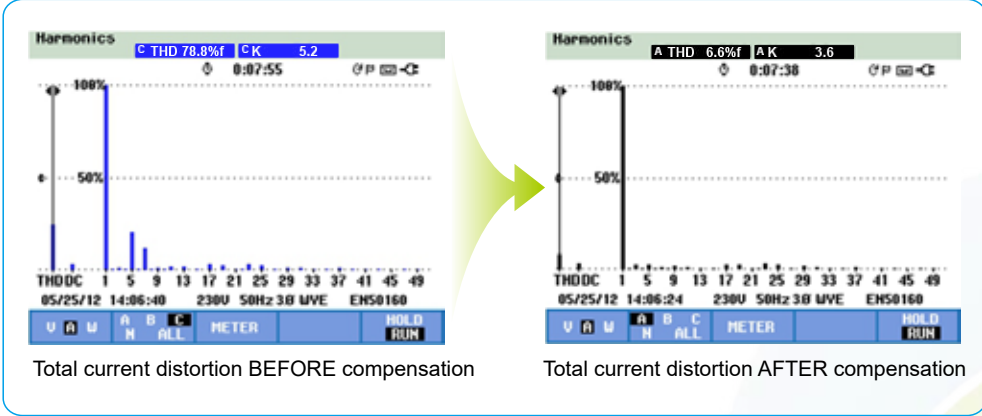
Model Name



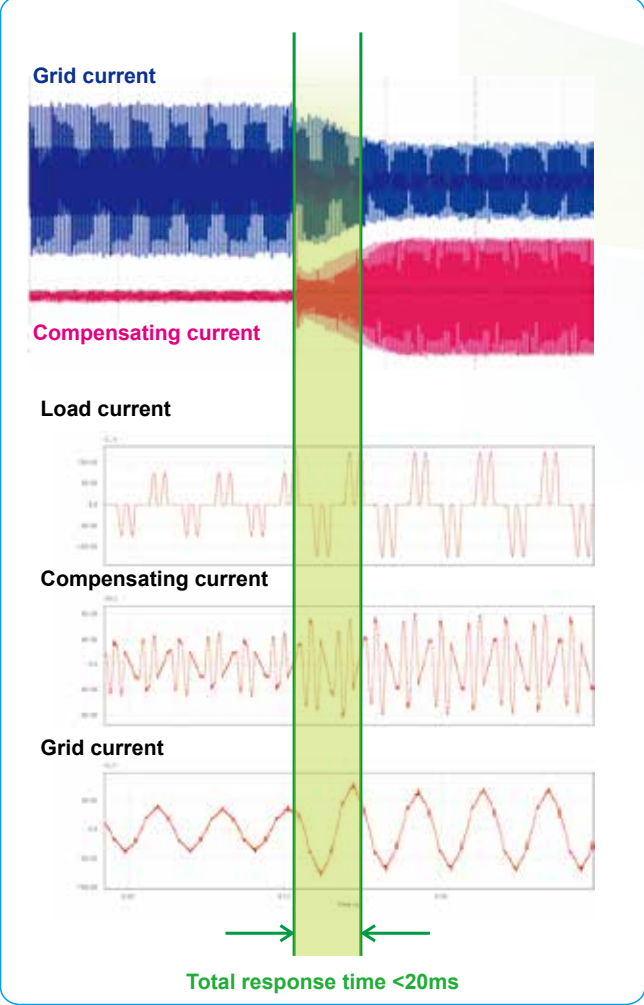
* With no CE / UL, please contact Delta or distributors in your region for purchase details.

APF2000 Features

Excellent Filtering Results



Real-time Response and Current Compensation



Compensation to Current, Harmonics and Power Factor

Features	Harmonics Compensation	Reactive Power Compensation	Note
Full Compensation	█	█	Under all operation modes, the "Unbalanced Compensation" functions compensate unbalanced loads*1
Harmonic Compensation	█	█	
Reactive Power Compensation	█	█	

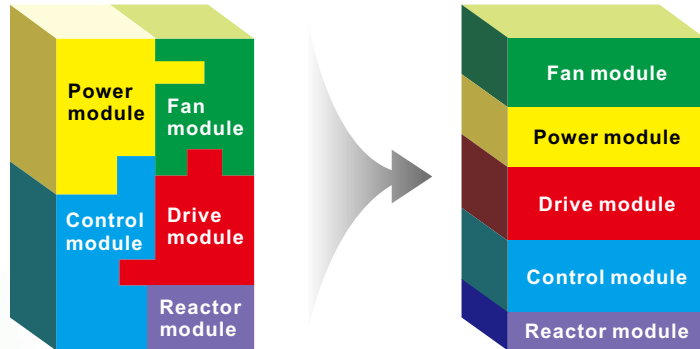
Compensation priority: █ > █ ; No Compensation: █

*1 Verified derating ratio for different unbalanced loads. Please contact technical engineers of Delta or distributors in your region.



Advanced Modular Design

- Safe, reliable, labor-saving



High-speed Network, Remote Monitoring and Control

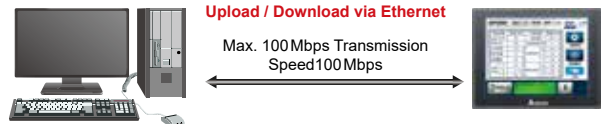
- Built-in RS-485 protocol
- Provides diversified communication network and optional fieldbus card



CANopen (DS301)

DeviceNet

MODBUS TCP



Remote monitoring and control anywhere, anytime!

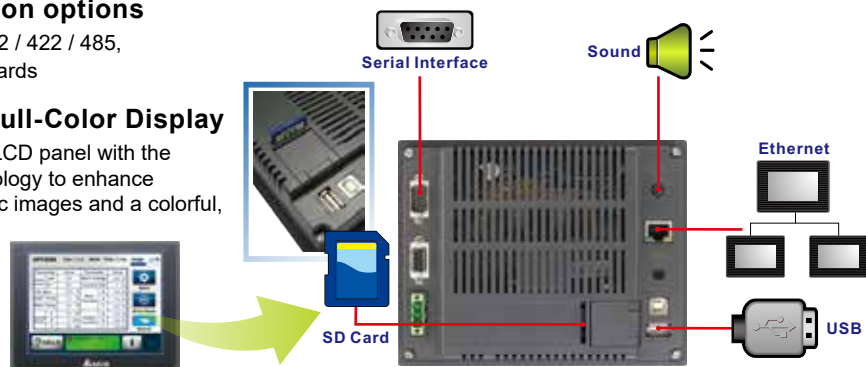
Excellent Operation Interface

- Diversified extension options

Supports Ethernet, RS-232 / 422 / 485, USB disk drives and SD cards

- High Quality and Full-Color Display

Adopts 65,536 color TFT LCD panel with the newest 2D drawing technology to enhance resolution for more realistic images and a colorful, vivid display



AFE2000 Series

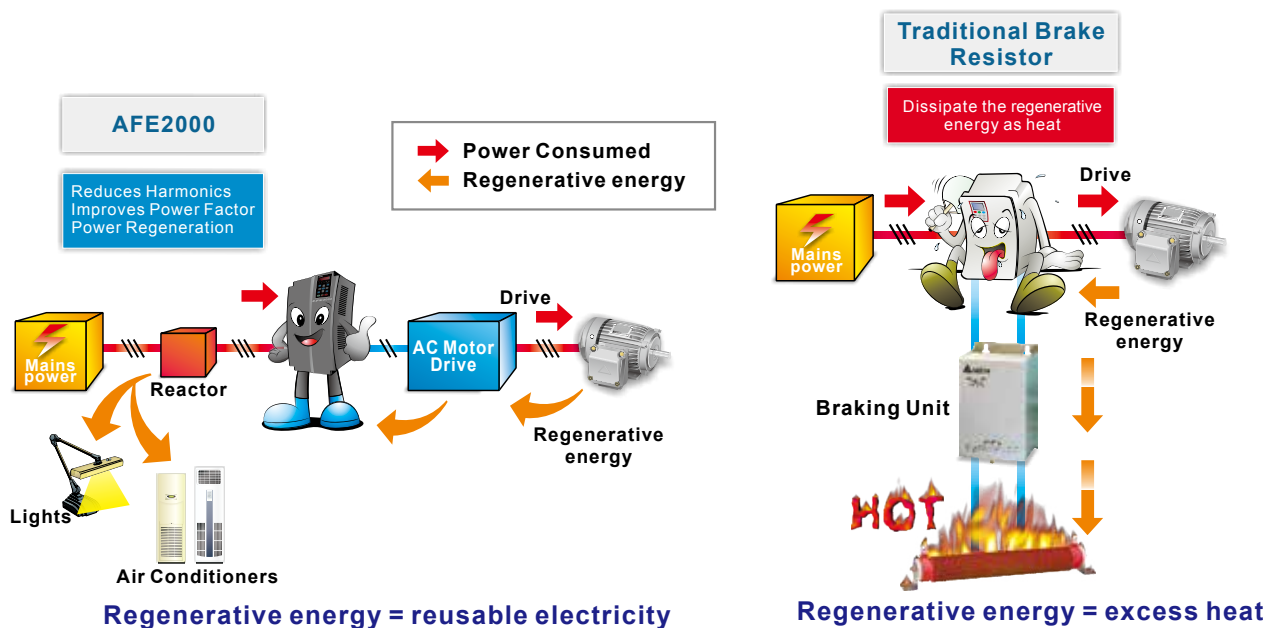
Features

- Replaces traditional brake resistor to reduce heat energy
- 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: supports 4-quadrant operation with variable frequencies and adjustable system
- Constant DC bus voltage: unaffected by mains voltage fluctuations

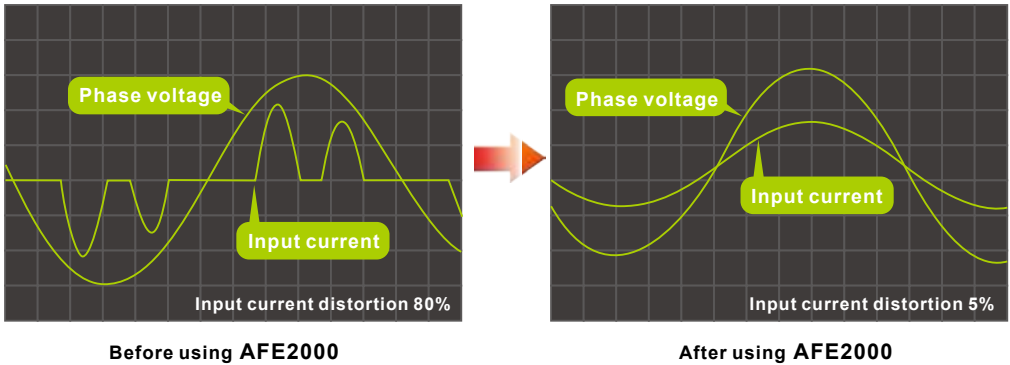
Applications

- Large-inertia loads: centrifuge equipment, dewatering machines and roving machines
- 4-quadrant loads: elevators, cranes and pumpjacks (oil extraction machines)
- Quick braking: machine tools, bag making machines, auto storage and retrieval systems, and lathes
- Long-term energy feedback: wind power, water power, steel printing and paper making machinery (winding equipment)
- Improves power quality for industries such as semiconductor and panel industries

- **Replace traditional brake resistors with the AFE2000 to convert regenerative energy (excess heat) into reusable electricity**

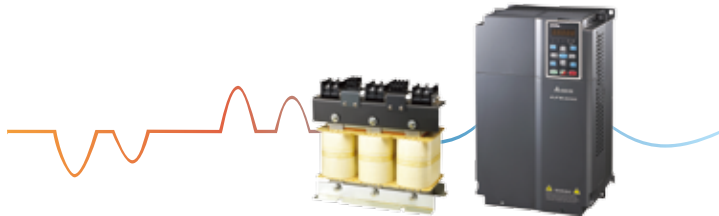


- Improves power factor, lowers harmonic distortion, and decreases energy consumption to reduce energy costs



Regulation Standards

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



Model Name

AFE2000

AFE **075** **A** **4** **3** **A**

Model Name
Active Front End

Rated Compensating Capacity

0.75	7.5 kW	185	18.5 kW	450	45 kW
110	11 kW	220	22 kW	750	75 kW
150	15 kW	300	30 kW		

Version Type

A Standard

Phase

3 3 phase

Input Voltage

2 230 V
4 460 V

Series
A Series

LC Filters and Energy Storage Accessories

AF-RC **075** **A** **4**

Model Name

AF-RC AFE Standard Reactor
AF-LC LC Filter

Power Range

0.75	7.5 kW	185	18.5 kW	450	45 kW
110	11 kW	220	22 kW	750	75 kW
150	15 kW	300	30 kW		

Input Voltage

2 230 V
4 460 V

Series
A Series

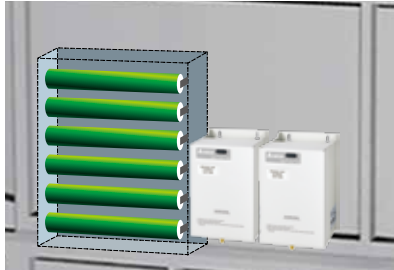
REG2000 Series

Features

- Compact design with reactor included, easy to wire and easy to install

Traditional solution

AC motor drive (55kW / 400V) + Brake Unit + Brake Resistor

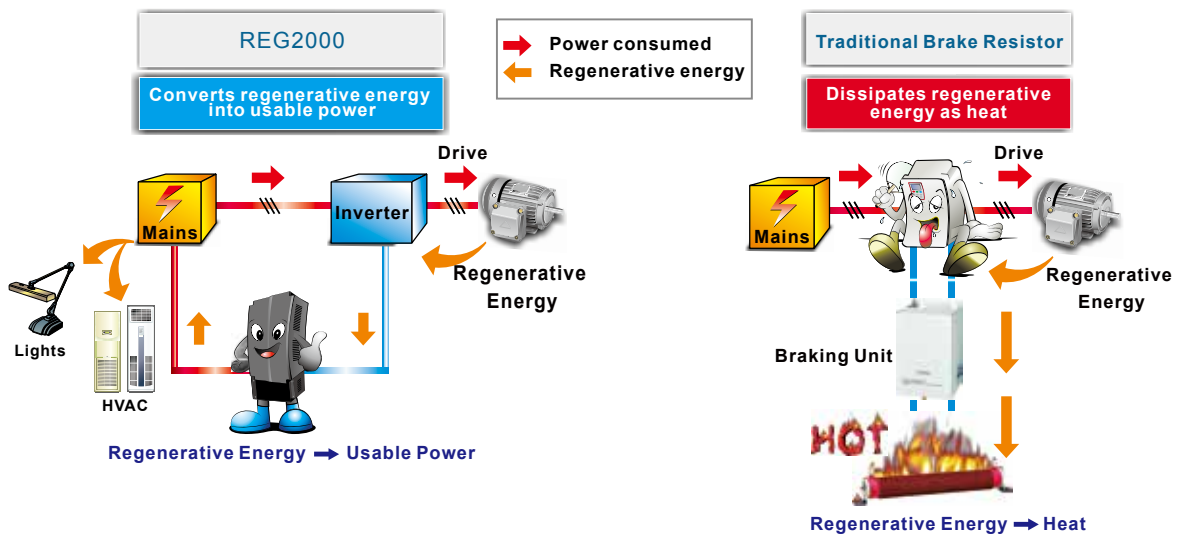


Delta solution

AC motor drive (55kW / 400V) + Delta REG2000



- Outstanding energy-saving results with more than 95% power regeneration efficiency
- Replaces traditional brake resistors to reduce heat generation



- Improves motor braking capability from 125% (when using brake resistor) to 150%
- Supports RS-485 (MODBUS) communication to allow real-time monitoring of kWh and cost
- High application flexibility, compatible with all kinds of AC motor drives and servo systems in the market
- Supports parallel connection* to expand total capacity for different application needs
- Optional communication cards*: MODBUS TCP, EtherNet/IP, CANopen, PROFIBUS DP and DeviceNet

*Please contact Delta for more information.

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.



Escalators



Elevators



Tension Controls



Hoists



Centrifuge Equipment



Press Machines



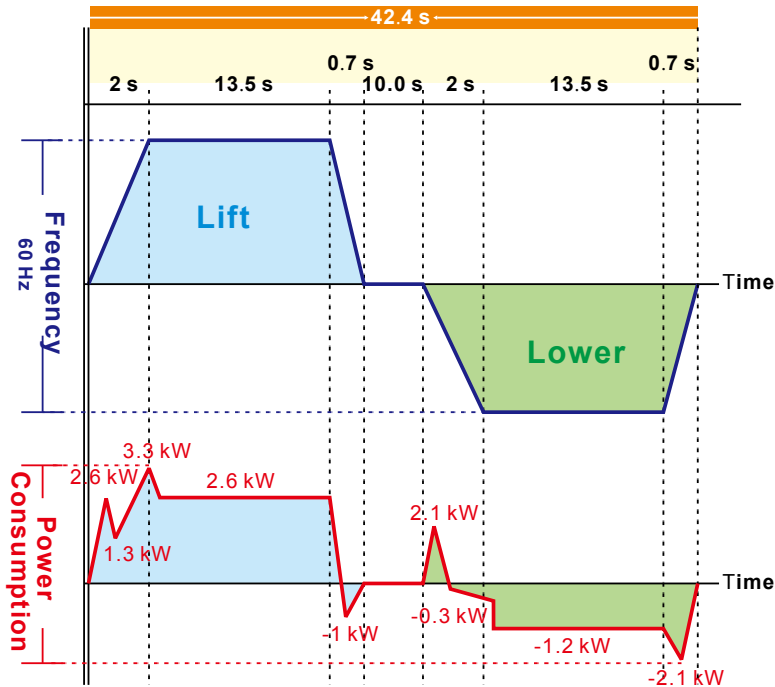
Industrial Laundries



Machine Tools

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 NTD 3.5.

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:

$$\frac{12 \text{ (hr)} \times 60 \text{ (min)} \times 60 \text{ (sec)}}{42.4 \text{ (sec)}} = 1019 \text{ cycles}$$

Performance using Delta's REG2000:

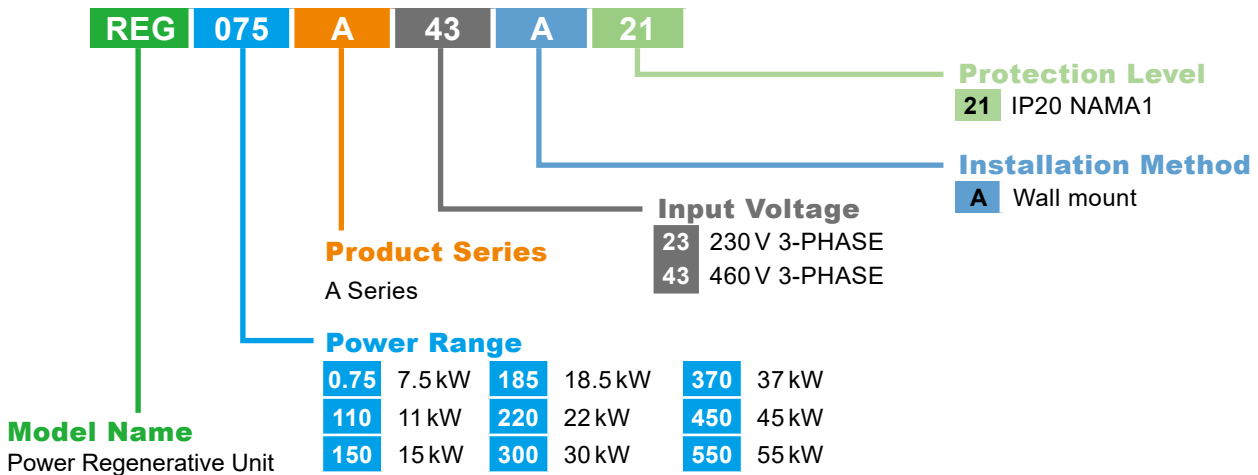
- Energy savings: $\frac{28}{87} \times 100\% = 32\%$

- 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



EMI Filter Specifications

230 V	REG EMI Filter	460 V	REG EMI Filter
REG075A23A-21 / REG110A23A-21	RG-EF110A2	REG075A43A-21 / REG110A43A-21 / REG150A43A-21	RG-EF150A4
REG150A23A-21 / REG185A23A-21 / REG220A23A-21	RG-EF220A2	REG185A43A-21 / REG220A43A-21 / REG300A43A-21	RG-EF300A4
REG300A23A-21 / REG370A23A-21	RG-EF370A2	REG370A43A-21 / REG450A43A-21 / REG550A43A-21	RG-EF550A4



Smarter. Greener. Together.

Industrial Automation Headquarters

Delta Electronics, Inc.

Taoyuan Technology Center
No.18, Xinglong Rd., Taoyuan District,
Taoyuan City 33068, Taiwan
TEL: 886-3-362-6301 / FAX: 886-3-371-6301

Asia

Delta Electronics (Shanghai) Co., Ltd.

No.182 Minyu Rd., Pudong Shanghai, P.R.C.
Post code : 201209
TEL: 86-21-6872-3988 / FAX: 86-21-6872-3996
Customer Service: 400-820-9595

Delta Electronics (Japan), Inc.

Tokyo Office
Industrial Automation Sales Department
2-1-14 Shibadaimon, Minato-ku
Tokyo, Japan 105-0012
TEL: 81-3-5733-1155 / FAX: 81-3-5733-1255

Delta Electronics (Korea), Inc.

Seoul Office
1511, 219, Gasan Digital 1-Ro., Geumcheon-gu,
Seoul, 08501 South Korea
TEL: 82-2-515-5305 / FAX: 82-2-515-5302

Delta Energy Systems (Singapore) Pte Ltd.

4 Kaki Bukit Avenue 1, #05-04, Singapore 417939
TEL: 65-6747-5155 / FAX: 65-6744-9228

Delta Electronics (India) Pvt. Ltd.

Plot No.43, Sector 35, HSIIDC Gurgaon,
PIN 122001, Haryana, India
TEL: 91-124-4874900 / FAX : 91-124-4874945

Delta Electronics (Thailand) PCL.

909 Soi 9, Moo 4, Bangpoo Industrial Estate (E.P.Z),
Pattana 1 Rd., T.Phraksa, A.Muang,
Samutprakarn 10280, Thailand
TEL: 66-2709-2800 / FAX : 662-709-2827

Delta Electronics (Australia) Pty Ltd.

Unit 20-21/45 Normanby Rd., Notting Hill Vic 3168, Australia
TEL: 61-3-9543-3720

Americas

Delta Electronics (Americas) Ltd.

Raleigh Office
P.O. Box 12173, 5101 Davis Drive,
Research Triangle Park, NC 27709, U.S.A.
TEL: 1-919-767-3813 / FAX: 1-919-767-3969

Delta Electronics Brazil

São Paulo Sales Office
Rua Itapeva, 26 - 3º, andar Edifício Itapeva,
One - Bela Vista 01332-000 - São Paulo - SP - Brazil
TEL: 55-12-3932-2300 / FAX: 55-12-3932-237

Delta Electronics International Mexico S.A. de C.V.

Mexico Office
Gustavo Baz No. 309 Edificio E PB 103
Colonia La Loma, CP 54060
Tlalnepantla, Estado de México
TEL: 52-55-3603-9200

EMEA

Headquarters: Delta Electronics (Netherlands) B.V.

Sales: Sales.IA.EMEA@deltaww.com
Marketing: Marketing.IA.EMEA@deltaww.com
Technical Support: iatechnicalsupport@deltaww.com
Customer Support: Customer-Support@deltaww.com
Service: Service.IA.emea@deltaww.com
TEL: +31(0)40 800 3900

BENELUX: Delta Electronics (Netherlands) B.V.

De Witbogt 20, 5652 AG Eindhoven, The Netherlands
Mail: Sales.IA.Benelux@deltaww.com
TEL: +31(0)40 800 3900

DACH: Delta Electronics (Netherlands) B.V.

Coesterweg 45, D-59494 Soest, Germany
Mail: Sales.IA.DACH@deltaww.com
TEL: +49(0)2921 987 0

France: Delta Electronics (France) S.A.

ZI du bois Challand 2, 15 rue des Pyrénées,
Lisses, 91090 Evry Cedex, France
Mail: Sales.IA.FR@deltaww.com
TEL: +33(0)1 69 77 82 60

Iberia: Delta Electronics Solutions (Spain) S.L.U

Ctra. De Villaverde a Vallecas, 265 1º Dcha Ed.
Hormigueras – P.I. de Vallecas 28031 Madrid
TEL: +34(0)91 223 74 20

Carrer Llacuna 166, 08018 Barcelona, Spain

Mail: Sales.IA.Iberia@deltaww.com

Italy: Delta Electronics (Italy) S.r.l.

Via Meda 2-22060 Novedrate(CO)
Piazza Grazioli 18 00186 Roma Italy
Mail: Sales.IA.Italy@deltaww.com
TEL: +39 039 8900365

Russia: Delta Energy System LLC

Vereyskaya Plaza II, office 112 Vereyskaya str.
17 121357 Moscow Russia
Mail: Sales.IA.RU@deltaww.com
TEL: +7 495 644 3240

Turkey: Delta Greentech Elektronik San. Ltd. Sti. (Turkey)

Şerifaii Mah. Hendem Cad. Kule Sok. No:16-A
34775 Ümraniye – İstanbul
Mail: Sales.IA.Turkey@deltaww.com
TEL: + 90 216 499 9910

GCC: Delta Energy Systems AG (Dubai BR)

P.O. Box 185668, Gate 7, 3rd Floor, Hamarain Centre
Dubai, United Arab Emirates
Mail: Sales.IA.MEA@deltaww.com
TEL: +971(0)4 2690148

Egypt + North Africa: Delta Electronics

Unit 318, 3rd Floor, Trivium Business Complex, North 90 street,
New Cairo, Cairo, Egypt
Mail: Sales.IA.MEA@deltaww.com