



**POWER FACTOR 1.00**

**HARMONICS FILTERING**

**BALANCED PHASES**

**ZERO AMPS PER NEUTRAL**

**RESPONSE TIME 1 MS**

**COMMUNICATION AND MONITORING**

**Econelec+**

Filtro de ahorro y calidad de energía  
energy saving and quality system

QUALITY,  
EXPERIENCE,  
PROFESSIONAL SERVICE  
AND SOCIAL RESPONSIBILITY



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## POLLUTED NETWORKS

The technological advance has incorporated electronic elements with better performance and smaller size to the market. These devices use switching topologies and power semiconductors inside which work at high frequencies and allow large currents to be handled in very small sizes.

The great inconvenience that these devices present is derived from the use that said equipment makes of the power supply network, causing consumption of switched and non-linear loads that generate a high degree of electrical pollution.

We will therefore denominate electrical pollution to the totality of the circumstances involved in the high harmonic content of the sinusoid corresponding to the main frequency of an electrical installation, not forgetting other phenomena that we will enumerate later.

## MAIN DISTURBANCES INNER ELECTRICAL LOW VOLTAGE NETWORKS

Poor wave quality, in an electrical installation, is usually generated from the charges to the supply and not in the opposite direction as it may seem. Harmonic generating loads cause a disturbed current with respect to the voltage sinusoid.

Due to the impedances of the connections, this current causes disturbed voltage drops along the entire route from the transformation centers (TC) to the loads. In certain cases, the disturbances may reach the distribution company and the rest of the subscribers connected to the same TC.

In International Standards IEC-61000, IEEE-519-2014 and UNE EN-50160: 2011, they are mainly identified as disturbances: Conducted Disturbances, Flicker, Frequency Drift, Harmonic Distortion Rate, Fast Voltage Variation, Voltage Gaps, Imbalances and others.

It is established that the maximum levels allowed for Harmonic Tension are the following:

Order	Maximum relative amplitude
H	UH
3	5 %
5	6%
7	5%
9	1,5%
11	3,5%
13	3%

## GENERATING SOURCES OF DISTURBANCES

As mentioned before, power electronic is increasingly present in common use equipment, both by industries and by different sectors of society. The following harmonic generators stand out mainly:

Data processing equipment, servers, uninterruptible power supplies (UPS), rectifiers, battery chargers, switching power supplies, starters and variable speed drives, inverter air conditioning systems, LED lamps, arc welding equipment, motors with brushes collectors, electro medicine equipment, electromagnetic ballasts, etc.

Special mention should be made of the effect of harmonics on transformers and wires. In the transformers, important losses in the iron are produced, which transforms in heating, losses, degradations of the insulators and an increase of the electrical consumption.

As for the wires in an installation with harmonics, they must be oversized, which implies a very important extra cost, in addition to vibrations, overloads, losses, premature aging and instability of the electrical system and errors in the measuring equipment.

The Power Marketer Companies strongly penalize in many countries of the world for the generation of harmonics in addition to the increase in consumption in kWh produced by waves other than the fundamental one.

Extremely serious can also be the consequences produced by harmonics in breakers and other protective elements with untimely triggering and extreme heating.

## POWER FACTOR CORRECTION

The existence of circulating reactive energy in the facilities produces several negative phenomena that will be eliminated by **ECONELEC+**, such as: overheating in wires, reduction of useful power of the transformers, losses due to Joule effect and high penalties in the Electricity Bill. These penalties can lead to increases in the electricity cost that can be a tremendous economic burden for customer income accounts.

The great novelty of **ECONELEC+** regarding traditional reactive compensation systems are:

- ▶ Cos phi compensation, instantaneous and per phase
- ▶ Minimal maintenance because electromechanical components are not available
- ▶ Resonance with the harmonics of the installation is not generated
- ▶ Compensation of both inductive and capacitive reactive
- ▶ Longer life expectancy than an Automatic Capacitor Bank
- ▶ Compatible with any level of harmonics in the installation

# OPERATING PRINCIPLE OF ECONELEC+

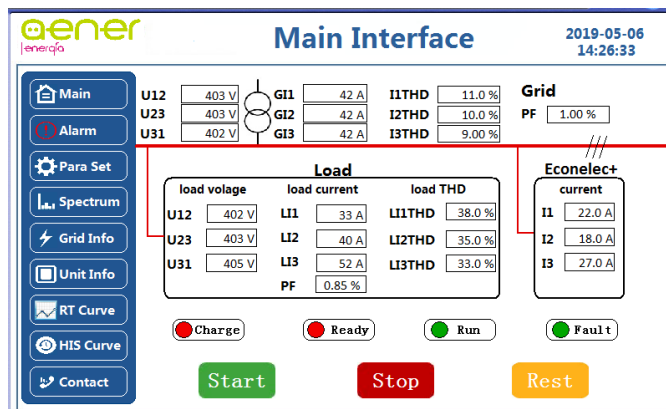
When the load generates inductive or capacitive current, the wave is delayed or advanced, **ECONELEC+** generates a new one making the current and voltage phase angle almost the same.

The use of impedances and automated electronic capacitors allow the waves are synchronized in real time producing:

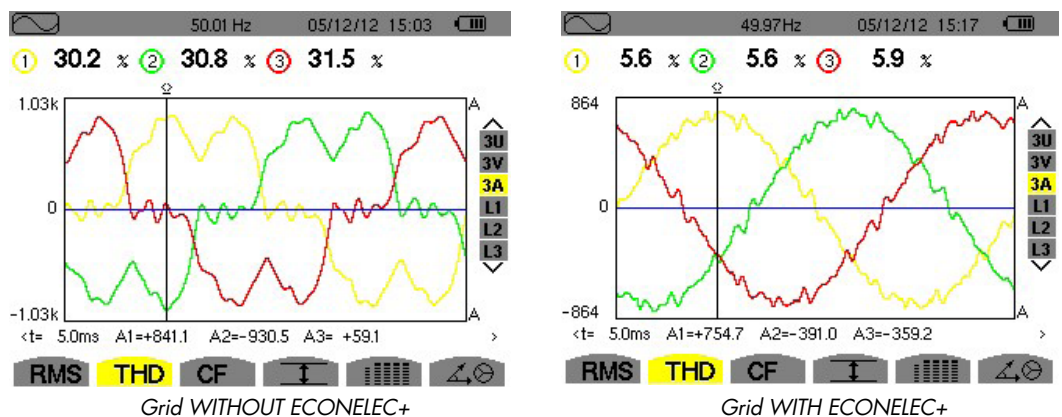
- ▶ Inductive/Capacitive Reactive Energy Elimination
- ▶ Harmonics Filtering
- ▶ Balanced Phases
- ▶ Elimination of current circulation through the neutral
- ▶ Flicker reduction in installation / Microcuts

An intuitive touch screen will make it easier for us to move through all the data that the equipment will provide us both on the Grid side and on the Load side. We will check the improvements achieved by **ECONELEC+** on the equipment's own screen. The different programming options available will allow to configure **ECONELEC+** to achieve maximum performance in each installation.

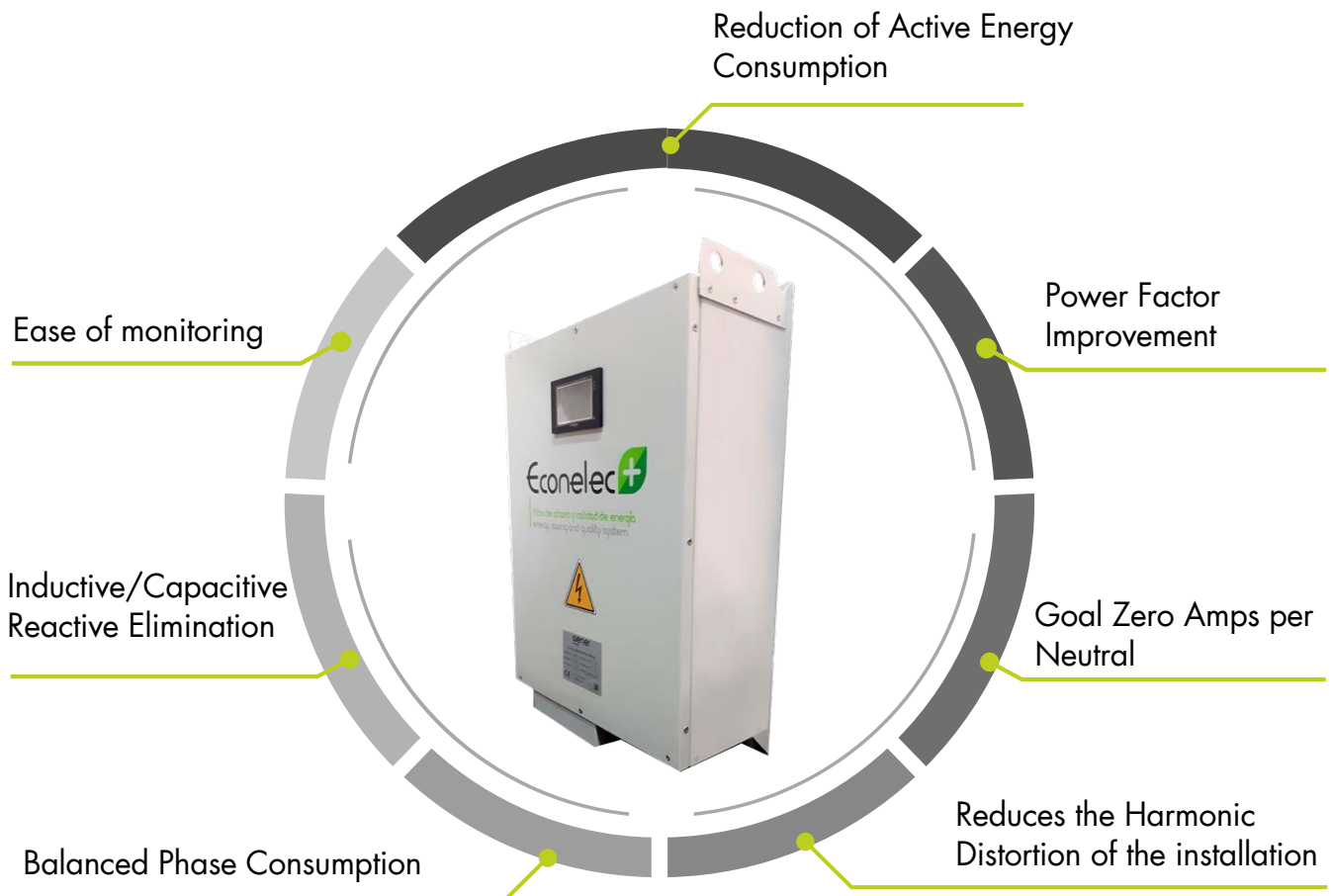
**ECONELEC+** uses state-of-the-art semiconductors for switching reactors and internal capacitors so the equipment must maintain very good temperature conditions. It should never be installed in places with more than 30°C of room temperature.



We can note numerical data, bar graphs, trend curves and alarm records.



# NETWORK QUALITY IMPROVEMENTS AND SAVINGS GENERATED BY INSTALLING ECONELEC+



- ▶ Reduction of Apparent Power
- ▶ Elimination of instabilities in the electrical system
- ▶ Reduction of losses due to the Joule Effect
- ▶ Extension of the useful life of loads
- ▶ Reduction of losses in transformers
- ▶ Increased efficiency of recipients (loads)
- ▶ Reduction of Maximum Demand Power
- ▶ Eliminates mistakes in measuring equipment
- ▶ Reduction of stress in voltage and current
- ▶ Improvement of the voltage and current waveform
- ▶ Reduction of vibrations and overloads
- ▶ Ease of compliance with regulations and standards
- ▶ Reduction of untimely triggering of protections devices

# ECONELEC+

## ENERGY SAVING AND QUALITY SYSTEM

- ▶ **ELIMINATES INDUCTIVE AND CAPACITIVE REACTIVE ENERGY CONSUMED**
- ▶ **REDUCE CONSUMPTION BETWEEN 5% AND 25%**
- ▶ **FILTERS UP TO 90% THDI HARMONICS**
- ▶ **BALANCES PHASES**
- ▶ **CLEANS THE NEUTRAL**
- ▶ **OPEN AND INTUITIVE MONITORING AND PROGRAMMING**

The Energy Saving and Quality System ECONELEC+ is a fundamental technological advance in AENER ENERGIA S.L. over our patented **ECONELEC®**.

The replacement of electromechanical components with electronics and the technical determination of our RDI Department have led us to have a device that includes up to 5 fundamental functions in Energy Quality and that make it one of the most leading equipment in Europe.

Its two main goals are to improve the conditions of electrical installations (Network Quality) and achieve a significant reduction in customers' electricity bill (Energy Saving).

**ECONELEC+** contributes efficiently to the care of our planet. The improvement of the network quality helps in reducing the CO<sub>2</sub> emissions emitted to the environment.

**ECONELEC+** is connected in parallel and is conceived to be installed in Main and Secondary Switchboards or Mixed Systems with our **ECONELEC®**. Our Engineering Department will provide the best solutions to customers to achieve the best technical and economic results.

By installing **ECONELEC+**, our customers will achieve a very fast investment recovery and a great total saving thanks to its 20 years of life expectancy, complying with the required maintenance and temperature conditions. Maintenance is simple because it does not incorporate mobile electromechanical elements.

It can be installed in any industry, local, commerce, hospital, restaurant, supermarket, shopping center, sports stadium,... which meet the technical safety conditions required by current regulations.





CODE	POWER (KW)	VOLTAGE (V)	DIMENSIONS (mm)
PEATR0045004005W	45	400	760 x 505 x 220
PEATR0075004005W	75	400	760 x 505 x 220
PEATR0150004005W	150	400	760 x 505 x 280



CODE	POWER (KW)	VOLTAGE (V)	DIMENSIONS (mm)
PEATR0300004005	300	400	2100 x 600 x 1000
PEATR0450004005	450	400	2100 x 600 x 1000
PEATR0600004005	600	400	2100 x 600 x 1000
PEATR0750004005	750	400	2100 x 1200 x 1000
PEATR0900004005	900	400	2100 x 1200 x 1000

Other power ratings or voltages upon request

## REAL-TIME VISUALIZATION OF ELECTRICAL QUALITY PARAMETERS



**ECONELEC+** incorporates a touch screen that allows access to the different screens intuitively.

The large number of possible combinations of visualization of the GRID and LOAD parameters allows us to check the improvements that the equipment is producing in the installation without using external network analyzers.

RATED VOLTAGE	400 V (others upon request)
VOLTAGE RANGE	-20 + 15%
FREQUENCY	50/60 Hz $\pm$ 5%
PHASES	Three-phase / Three-phase+ N
RESPONSE TIME	1 ms
PARALLEL OPERATION	Unlimited (max 6 modules for one control)
OVERLOAD CAPABILITY	110% during 1 minute
EFFICIENCY	$\geq$ 97,5%
CONSUMPTION	0.5 - 1% of Power
C.T. LOCATION	Grid / Loads (configurable)
FUNCTIONS	Reactive Power, Harmonics, Unbalance, Neutral, Saving Energy
HARMONICS	Filtering capacity up to 90% and up to order 13° (on demand up to order 50°)
POWER FACTOR	-1.00 / +1.00
COMMUNICATION	Modbus, TCP/IP, IEC61850 (others upon request)
COLOR	RAL 7035 (others upon request)
COOLING	Forced air (variable fan speed acc. to IGBT temperature)
NOISE	$\leq$ 70 dB(A)
PROTECTION CLASS	IP 21 acc. to IEC529
INSTALLATION LOCATION	Indoor
ALTITUDE	1500 m (power derating in case of limit exceeded)
RELATIVE HUMIDITY	Max 95%, non-condensing
STORAGE TEMPERATURE	-25° + 75°C
MAX ENVIRONMENT TEMPERATURE	35°C
APPLIED STANDARDS	EN50178, EN61000-6-2, EN61000-6-4



## Certificate Functionality

PRODUCT:  
Energy Saving System ECONELEC® TR4001 and TR4002 series.

SCOPE OF APPLICATION:  
400V Three-phase networks. Industrial frequency 50 Hz.

POWER:  
The entire product range from 10 up to 600 kW.

VERIFIED RESULTS:

- Ability to eliminate reactive energy used in a facility.
- Ability to reduce energy consumption by an average installation between 5% and 20% of the total.
- Ability to reduce the quarter-hourly maximum power measured by maximum demand meter, between 3% and 10%.
- Ability to decrease the voltage harmonic distortion (THD) in the load.
- Ability to improve waveform voltage facility.
- Ability to reduce losses due to voltage drops in electric wires.

The Energy Saving System ECONELEC®, designed and manufactured in Spain by AENER ENERGIA, has been tested in the laboratory, to verify the compliance with product specifications for which it was designed.

Verification date: May 21, 2014.

Carlos Rodriguez  
Doctor Industrial Engineer  
Department of Electronic Technology



### TEST Certificate / Certificado de Ensayos

Nº 2218/0509-CER

SGS Tecnos, S.A.U. Electrical Test Laboratory accredited for Safety Testing of Equipment ISM (Industrial, Scientific, Medical), HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES and for ELECTROMAGNETIC COMPATIBILITY (EMC) testing / Laboratorio de Ensayos Eléctricos acreditado para Ensayos de Seguridad de equipos ICM (Industrial, Científico, Médico) ELECTRODOMESTICOS Y APARATOS SIMILARES y para ensayos "CEM" (Compatibilidad Electromagnética)

CERTIFIES that a sample of the products / CERTIFICA que una muestra de los productos:

Sample tested / Muestra ensayada:	HARMONICS FILTER ENERGY SAVING ECONELEC S - 1000KW/ FILTRO ECONOMIZADOR DE ENERGIA ECONELEC S - 1000KW
Trademark/Marca:	ECONELEC
Model teste/Modelo ensayado:	TR4002
Serial N°/N° de Serie:	EE180358
Rating/Características eléctricas:	400 V 3-N; 50 Hz; 700 kW
Applicant/Solicitante:	AENER ENERGIA, S.L.
Address/Dirección:	C/ Dehesa Vieja, 2. Nave 8 28062 (Madrid) SPAIN

Were tested and found to BE IN CONFORMITY with the requirements established in the following Standards / Fue ensayado y encontrado CONFORME con los requerimientos establecidos en las siguientes Normas:

- Relatives to the Directive 2006/42/EC / Relativos a la Directiva 2006/42/CE:
  - Clause 18 "Tests and Verification" of Standard / Apartado 18 "Ensayos y Verificación" de la Norma: UNE-EN 60204-1:2007 + A1:2009 Official Spanish version of corresponding European EN Standard EN60204-1:08 + A1: 09 adopting the International IEC Standard IEC60204-1: 2005 + A1: 08 / Versión oficial Española de la correspondiente Norma Europea EN 60204-1:08 + A1:09 adoptando la Norma Internacional IEC 60204-1:2005 +A1:08
- Relatives to the EMC Directive 2014/30/EU / Relativos a la Directiva de EMC 2014/30/EU:
  - UNE-EN 61000-6-4:2007+A1:2011 (Conducted and radiated emissions) / (Emisión conducida y radiada)  
Official Spanish version of corresponding European EN Standard EN 61000-6-4: 2007 + A1: 2011 adopting the International Standard IEC61000-6-4:2008 + A1:2010 / Versión oficial Española de la correspondiente Norma Europea EN61000-6-4:2007 + A1:2011 adoptando la Norma Internacional IEC 61000-6-4:2008 +A1:2010

As shown in the results detailed on test reports / Como se muestra en los resultados detallados en los informes: Nº 2218/0509 and / y 2218/0509/1

Madrid, 17<sup>th</sup> of July of 2018 / 17 de Julio de 2018

SGS Tecnos, S.A.  
Laboratorio de Ensayos SAE

FERNANDO MONTES CLAVER  
Technical Manager of Testing Laboratory /  
Director Técnico del Laboratorio de Ensayos

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