ENERGY SAVING
THROUGH ENERGY EFFICIENCY

The term Energy Saving includes various techniques aimed at reducing the consumption of energy necessary to carry out human activites.

Energy Saving can be achieved both by reducing energy processes so that less work is done, and by optimizing these processes so that, for the same work, less energy is required.

This last way is that of Energy Efficiency.

The term Energy Efficiency indicates the ability of a physical system to obtain a given result by using less energy than other systems called less efficient, generally increasing its efficiency and allowing therefore energy saving and a reduction in operating costs.

"Energy Efficiency" indicates the ability to be able to "do more with less", adopting the best technologies/techniques available on the market and a more conscious and responsible behavior towards energy uses. This therefore implies a more rational use of energy, eliminating waste due to operation and sub-optimal management of simple and complex systems.

The increase in energy efficiency is achieved by implementing forms of intervention that include technological improvements, optimization of energy management and diversification of energy supply. Wastes and energy losses represent the hidden "deposit" we have and that energy efficiency allows us to recover and valorise in order to obtain substantial economic, environmental and social advantages.

For these reasons, energy efficiency is the essential component of a virtuous energy strategy aimed at achieving a safer, more competitive and more sustainable low-energy economy.

Energy efficiency = "Do more with less"

Energy Efficiency
for the environment:

< CO2

Greater energy efficiency makes it possible to use less fossil fuels and therefore to reduce the level of greenhouse gas emissions, which contribute to global warming.

Energy Efficiency
for companies:

< OPERATING COSTS

With the increase in energy efficiency it is possible to reduce the energy expenditure of companies that can reinvest the money saved on core business activities to increase competitiveness on the market.

Energy Efficiency
for the future:

> AVAILABLE ENERGY

Energy Efficiency is the most universally available energy source. The most convenient and cleanest energy is energy that must not be produced or used.

VOLTAGE OPTIMIZATION

The average voltage value of the distribution networks is often greater than the ideal operating value for most electrical equipment.

For example, a 230 V linear load used with a 240 V power supply, absorbs 4.3% current more and it consumes 9% more electricity than the 230 V power supply.

A common but wrong belief relating to voltage optimization is that, reducing the voltage, leads to an increase in the current and, therefore, absorbed power remains unchanged.

This is true for certain types of loads, called constant power; however, most sites have a variety of loads that will benefit to a greater or lesser extent from energy savings by considering the whole site as a single unit.

Voltage optimization is a technique of energy efficiency which, by operating through the systematic and controlled reduction of the network voltage, allows to reduce the absorption from the active and reactive power network.

While some voltage "optimization" devices have fixed voltage regulation, others regulate the voltage automatically electronically. Voltage optimization systems are usually installed in series with a building's electrical network, allowing all installed electrical equipment to benefit from an optimized power supply. High voltage values lead to higher energy consumption than necessary and, consequently, higher electrical costs.

High voltage values are not only expensive, but can also be harmful to equipment. Excessive supply voltage produces noise, heat and further vibrations that stress internal components, in particular motors that are sensitive to overheating and wear out more quickly. The IREM Ecostab – Ecobuck voltage optimization system ensures that a user receives and pays only for the voltage actually needed and no more, they optimize power quality and generate energy savings.

ENERGY SAVING

ECOSTAB - ECOBUCK
VOLTAGE OPTIMISERS

IREM Ecostab - Ecobuck Voltage Optimiser is a product dedicated to Power Quality and Energy Saving.
Voltage optimization is an energy-saving technology that, by operating through systematic and controlled reduction of the grid voltage, reduces the absorption of active and reactive power from the network.
The average voltage value of the distribution networks is often higher than the ideal operating value for most electrical equipment. Ecostab - Ecobuck is the Energy Economizer which, by exploiting the principle of voltage optimization, increases the level of power quality and produces energy savings measured and quantified according to the international reference standard.

APPLICATION FIELDS

The average voltage supply from many national grids around the world is often higher than the ideal operating voltage for most electrical equipment.

For example, a 230V linear appliance used on a 240V supply will take 4.3% more current and will consume almost 9% more electricity than at 230V.

IREM voltage optimizers are used in various sectors:

- ✔ Industries
- ✔ Services
- ✔ Hotels
- ✔ Catering and Restaurants

IREM PROPOSAL

Sites equipped with an IREM Ecostab - Ecobuck voltage optimization system often obtain reductions of 5 to 15% in energy consumption, costs and, therefore, in carbon dioxide emissions!

The first step to evaluate the opportunity to install a network optimizer is to monitor and know the input voltage levels: the IREM Ecometer Energy Saving Meter allows you to determine the parameters.

The values displayed are calculated with the method recommended by the VDE-AR-E 2055-1 standard. The savings displayed guaranteeing the precision of the metrological chain of measuring instruments.

The IREM Ecostab - Ecobuck Voltage Optimisers are equipped with 2 digital network analyzers and an additional display that shows the energy savings achieved. These multimeters display all the electrical parameters, such as voltage, current, frequency, power, power factor, total harmonic distortion etc., measured from the mains input, to the economizer output. These multimeters are characterized by:

- ✔ 128x80 pixel LCD graphic display, backlit;
- ✔ 4 keys for display and programming;
- ✔ Simple and fast navigation;
- ✔ Texts for measurements, programming and messages in 5 languages;
- ✔ True RMS Measurements (TRMS);
- ✔ Continuous data acquisition;
- ✔ High accuracy.

POWER SUPPLY AND PROFESSIONAL USERS

A common misconception about VO is that a reduction in voltage will result in an increase in current and therefore power consumed will remain constant. This is true for certain fixed-power loads, however most sites have a diversity of loads that will benefit to a greater or lesser extent with energy savings aggregating across a site as a whole. The benefit to typical equipment at three phase sites is discussed below.

THREE PHASE MOTORS: The three-phase induction motor is one of the most common types of three phase loads and is used in many items of equipment including refrigeration, pumps, compressors, fans, air conditioning, conveyor drives and lifting systems. Overvoltage results in flux saturation of the iron core, wasting energy through eddy currents, increased hysteresis losses.

The drawing of excessive current results in excess heat output from copper losses. The additional stress of overvoltage on motors will decrease motor lifetime. Avoiding overvoltage high enough to cause saturation does not reduce the motors running efficiency therefore substantial energy savings can be made through reducing iron and copper losses. However, motors designed for the nominal voltage (e.g. 400V Ph-Ph or 230V Ph-N) should be able to cope with normal variation in voltage within the supply limits (+/-10%) without saturation, so these motors are unlikely to be running in saturation, so savings are small.

Reducing voltage to an induction motor will slightly affect the motor speed as slip will increase, but speed is mainly a function of the supply frequency and the number of poles. Motor efficiency is optimum at reasonable load (typically 75%) and at the designed voltage, and will fall off slightly with small variations either side of this voltage. Larger variations affect efficiency more. Very lightly loaded motors with loading of around 25% and small motors benefit most from reducing voltage. Motors driven by variable speed drives will use the same power as before, but may draw more current. It should be noted that with reduced stored energy in the DC Bus capacitors, they may be more vulnerable to power dips.

SWITCHED MODE POWER SUPPLIES: Switched mode power supplies will use the same power as before, but will draw a slightly greater current to achieve this, with slightly increased cable losses, and slight risk of the increased current tripping MCBs.

LIGHTING: When lighting loads are in use for a high proportion of the time, energy savings on lighting equipment is extremely valuable. When voltage is reduced, incandescent lighting will see a large decrease in power drawn, as well as large decrease in light output and an increase in lifetime. Other types of lighting can also benefit from improved power quality, including systems with resistive or reactive ballasts. Fluorescent and discharge lighting is more efficient than incandescent lighting.

Fluorescent lighting with conventional magnetic ballasts will see a reduced power consumption but also a reduced lumen output from the lamp.

Fluorescent lamps on modern electronic ballasts will use approximately the same power and give the same light.

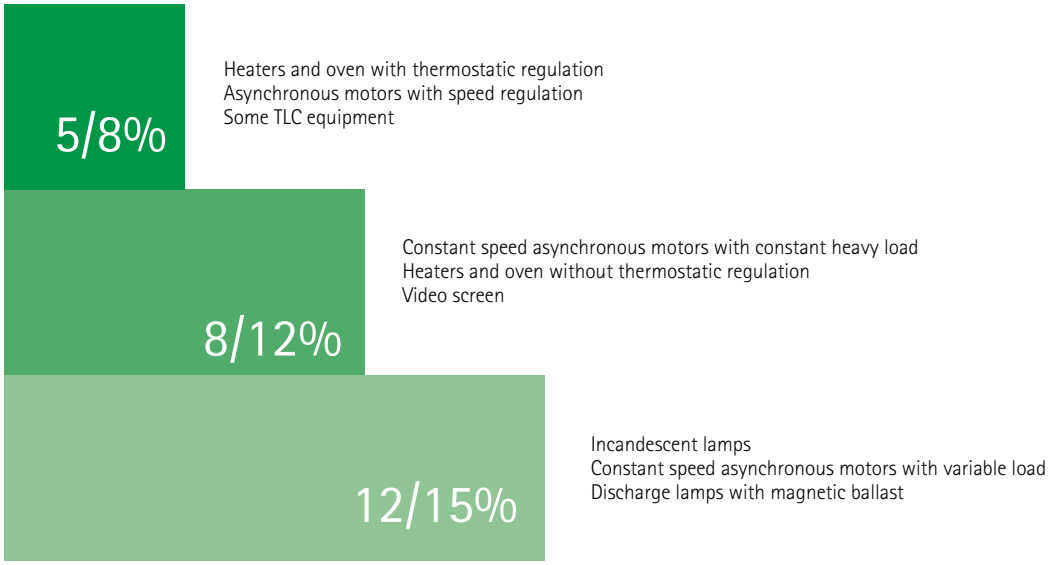
L'assorbimento della stessa potenza con una tensione ridotta implica un incremento di corrente e quindi maggiori perdite nei cavi.

To provide the same wattage at the reduced voltage will require a greater current and increase cable losses.

Lighting controllers and ballasts are responsible for generating high levels of harmonic distortion, which can be filtered with some types of voltage optimiser, therefore reducing the need for lighting controllers. A common concern is that some lighting will fail to strike at lower voltages. This should not occur since the aim of VO is not simply to reduce the voltage as far as possible, but rather to bring it to the service level voltage at which it was designed to operate most efficiently.

HEATING: Heaters will consume less power, but give out less heat. Thermostatically controlled space or water heaters will consume less power while running, but will have to run for longer in each hour to produce the required output, resulting in no saving.

SAVING AND RETURN ON INVESTMENT



There are many factors which contribute to save energy, optimizing the power quality and to reduce the payback period:

a. Mains voltage which is not always close to rated value. Voltage is usually higher late at night: 10% higher than the rated value is a common condition. This level is often exceeded when the user is located near an electric substation. Saving increases to approximately 20% when the voltage exceeds 10% of the rated value;

b. Type of powered device. Some devices allow higher saving than others and some electric devices do not provide any significant saving at all;

c. Device use. The best results are obtained by using Ecostab - Ecobuck in connection to motors with stall torque often lower than the maximum deliverable torque;

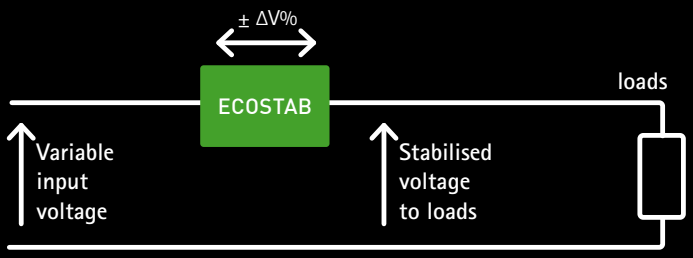
d. Overall consumption of devices powered by the voltage optimizer. The higher the power of the Ecostab - Ecobuck voltage optimiser, the shorter its payback period.

Since not all the appliances and loads ensure the same energy saving, a careful analysis on their use is necessary to predict potential energy saving.

Sometimes, it may be advantageous to limit the use of Ecostab - Ecobuck voltage optimisers to some devices to optimise the investment.

Thanks to the energy saved and the optimized power quality, the cost of the voltage optimizer will be usually paid off in a period ranging from 1 to 5 years.

ECOSTAB



ECOSTAB is a voltage stabilizer designed for Energy Saving and capable of improving Power Quality in all mains voltage conditions.

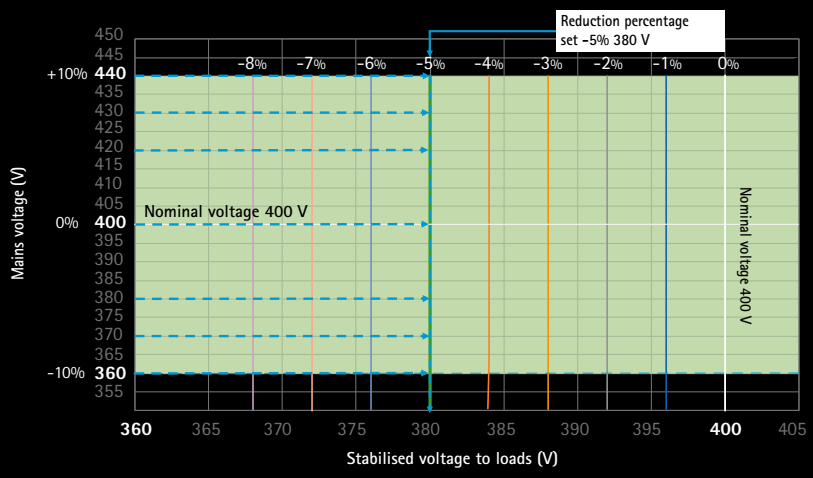
Ecostab supplies the load with a stable voltage having a value less than or equal to the nominal mains voltage.

The voltage with which the load is powered can be set through a potentiometer between the nominal value and -8%.

Ecostab is able to increase or reduce the voltage of the electrical distribution network in order to provide the loads with an optimal voltage, which can be set to a desired value and kept stable.

The desired value is linearly adjustable between a minimum value of 368V (-8%) and a maximum value of 400V (± 0%).

In the entire range of variation of the mains voltage allowed by the standard (± 10% of the nominal value of 400V) the load is always powered by the Ecostab at the desired voltage, kept stable at ± 1%.

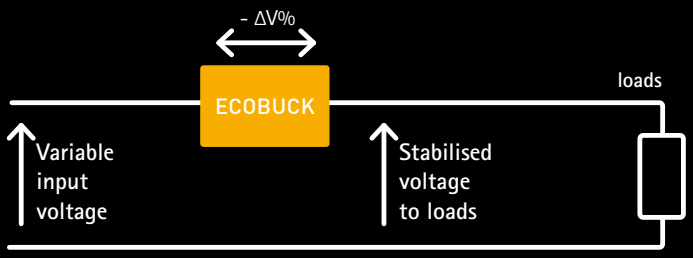


The variations of the mains voltage both in excess and in default are compensated and the supply voltage to the load is kept stable at the set value.

For example, if you want to select a supply voltage to the load of 380V equal to -5% of the nominal voltage of 400V, the selected voltage value is kept constant within the entire range of the input variation between 360V and 440V.

HIGHLIGHTS

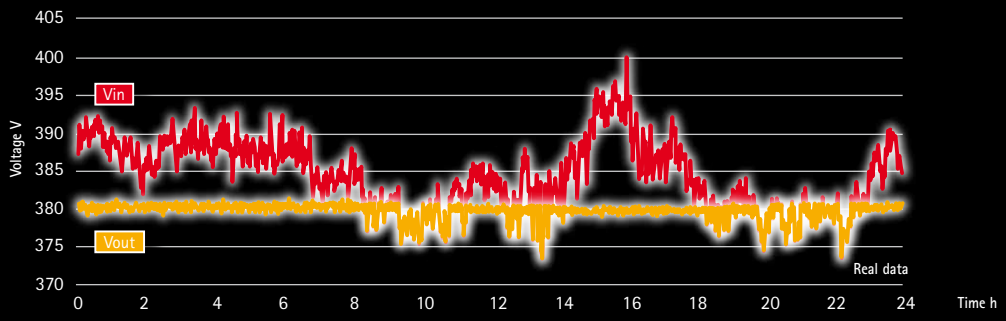
ECOBUCK



ECOBUCK is a voltage stabilizer designed specifically for Energy Saving and capable of improving Power Quality in certain mains voltage conditions.

The Ecobuck supplies the load with a stable voltage having a lower value or at the limit equal to the nominal mains voltage.

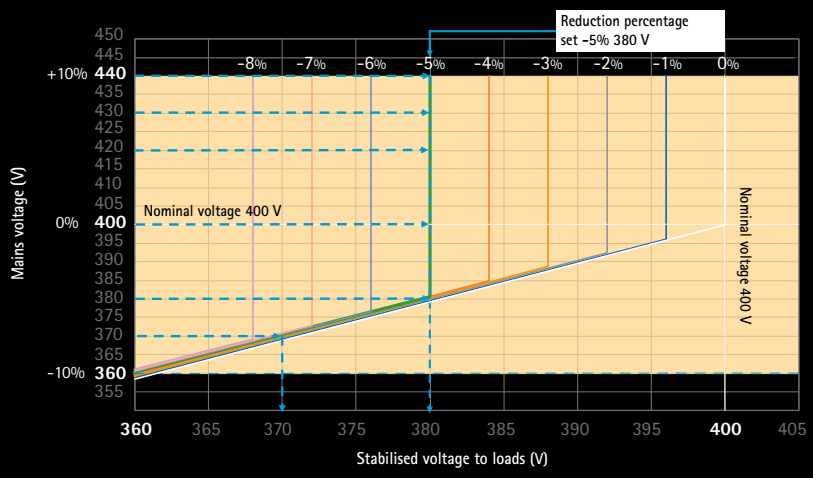
The voltage with which the load is powered can be set through a potentiometer between the nominal value and -8%.



Ecobuck is able to reduce the voltage of the electrical distribution network in order to provide the loads with an optimal voltage, at a value lower than the nominal mains value.

The behavior of the Ecobuck differs from that of the Ecostab only when the mains voltage is less than the desired voltage.

In conditions of voltage lower than the desired value, the Ecobuck does not worsen the supply conditions, simply the load is powered at the voltage it would be powered on if there was no Ecobuck.

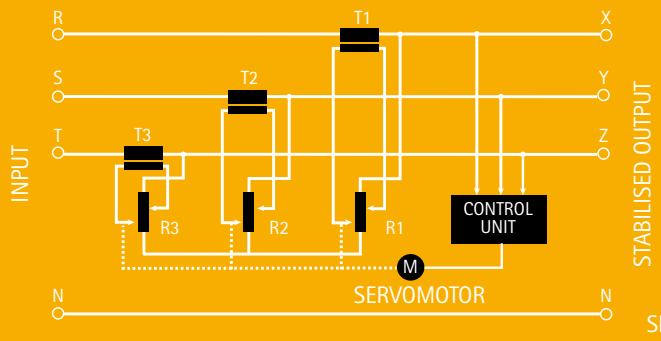


The electric user is powered by the Ecobuck with a stabilized voltage when the mains voltage is greater than the output voltage set on the Ecobuck itself. When the voltage of the electrical network is lower than the set voltage value, the Ecobuck does not make any corrections, consequently the load is powered by the mains voltage. For example, if you want to select a supply voltage of 380V equal to -5% of the nominal voltage of 400V, the selected voltage value is kept constant in the range of the input voltage variation between 380V and 440V.

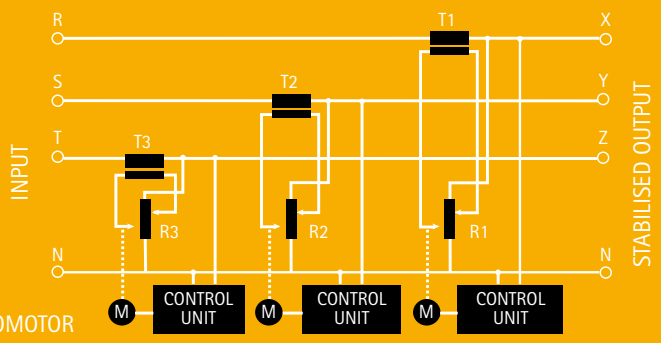
If the mains voltage drops to 375V, for example, the Ecobuck would deliver 375V to the load. As soon as the mains voltage returns to a value higher than the set value (for example 382V), the Ecobuck returns to operate by adjusting the voltage on the load.

VOLTAGE OPTIMISERS
OPERATING PRINCIPLE

ECOSTAB - ECOBUCK
T MODELS
WITH COMMON REGULATION OF THE 3 PHASES



ECOSTAB - ECOBUCK
Y MODELS
WITH INDEPENDENT REGULATION OF THE 3 PHASES



An electronic control circuit detects the voltage delivered by the voltage optimiser and compares it to a reference voltage. If the difference between the output voltage and the reference voltage exceeds the preset tolerance limits, an error signal is generated; this signal may be either negative or positive according to whether the output voltage is lower or higher than the preset value. This signal activates the servomotor which moves the mobile contacts (electrographite rollers / brushes) of the variable autotransformer thus changing the transformation ratio in order to supply the additive or subtractive voltage needed to restore the value within the predetermined limits to the primary winding of the series transformer. The root-mean-square value (RMS) of the output voltage is stabilised and consequently not affected by possible harmonic distortions present in the input mains. This regulation system has the advantage of not having mobile contacts in series to the power supply line.

Figure G

IP21

Figure H

GENERAL FEATURES

POWER RANGE. From 5 to 4000 kVA, in single-phase and three-phase version.

ACCURACY. ±1% RMS also in presence of high harmonic distortions.

OVERLOAD CAPACITY. 10 times the rated power for 10 ms, 5 times for 6 s, 2 times for one minute.

EFFICIENCY. Exceeding 98.5%.

POWER FACTOR AND LOAD VARIATION INSENSITIVITY. The accuracy and the regulation speed remain unaltered under any load condition (full load or no load, with inductive or capacitive loads).

FREQUENCY VARIATION INSENSITIVITY.

HARMONIC DISTORTIONS. The harmonic distortion is always maintained within 0.1% in any operating condition.

IMPEDANCE. The installation of an Ecostab - Ecobuck voltage optimiser in a pre-existing plant does not require a new calculation of the protections because the internal impedance of the optimiser ranging from 0.52 to 0.015 Ohm depending on models, does not significantly affect the line impedance.

OPERATING TEMPERATURE. Ecostab - Ecobuck voltage optimisers are designed for operation at a maximum ambient temperature of 40°C in the

Outdoor model

IP54

Indoor model

most demanding conditions: continuous duty, full load and minimum input voltage. Models suitable for higher temperatures are manufactured on request.

DEGREE OF PROTECTION. IP00, IP21, IP54 INDOOR and IP54 OUTDOOR.

COOLING SYSTEM. All IP21 models are designed for natural air convection – FAN-FREE.

IP54 models are cooled by fans or by air conditioning depending on the ambient conditions.

RELIABILITY. Ecostab - Ecobuck voltage optimisers use the same technology and the same components as Ministab and Sterostab voltage stabilisers, that IREM has been manufacturing for over 60 years. The MTBF exceeding 500,000 hours is the result of IREM continuous improvement in technical aspects and production process.

INSTALLATION. The voltage optimiser is installed after the energy counter and before the electric users.

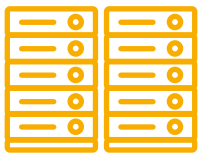
STANDARD FITTINGS. Digital network analyser / energy meter, pilot lamps, potentiometer, alarm indication and dry contacts for connection to an external device for protection against: overload and over/under voltage.

SPECIAL VERSIONS. Ecostab - Ecobuck voltage optimisers can be equipped on demand with special fittings in separate cabinet, like e.g.: maintenance bypass, thermal magnetic circuit breakers, surge/lightning arresters, harmonic filters.

REMOTE CONTROL. Ecostab - Ecobuck voltage optimisers can be equipped with an optional monitoring system permitting the remote control via ETHERNET, INTERNET, GSM/GPRS.

COMPLIANCE WITH STANDARDS. Ecostab - Ecobuck voltage optimisers comply with the following Directives:

- ✔ Electro Magnetic Compatibility 2014/30/UE and following amendments.
- ✔ Low Voltage Electrical Equipment 2014/35/UE and following amendments.



WEB SERVER
IREM

ECOSTAB
remote control system

ECOSTAB

ECOSTAB M SINGLE-PHASE 230V 50/60HZ VOLTAGE OPTIMISERS - IP21 INDOOR VERSION

Model	Rated power (KVA)	Rated current (Ampere)	Input voltage variation (±%)	Output regulation range (%)	Response time (ms/V)	Output accuracy (±%)	Dimensions (mm) a x b x h	Net weight (kg)	Figure
M208EJ8S	8	35	±10%	0 to -8%	21	±1%	600x350x290	45	A
M210EJ12S	12	52			21		800x450x400	65	B
M211EJ20S	20	87			22			80	
M212EJ25S	25	109			27			120	

ECOSTAB T THREE-PHASE 400V 50/60HZ VOLTAGE OPTIMISERS - IP21 INDOOR VERSION

T308EJ20S	20	29	±10%	0 to -8%	23	±1%	800x450x400	120	B
T310AJ50S	50	72			14		650x650x1300	250	F
T312AJ70S	70	101			16			280	
T314AJ100S	100	144			17			360	
T315AJ150S	150	217			24		650x650x1800	420	G
T316AJ200S	200	289			17		1100x650x1800	630	H
T318AJ300S	300	433			23			790	
T319AJ400S	400	577			29		1100x900x1900	1150	I
T320AJ500S	500	722			29			1200	

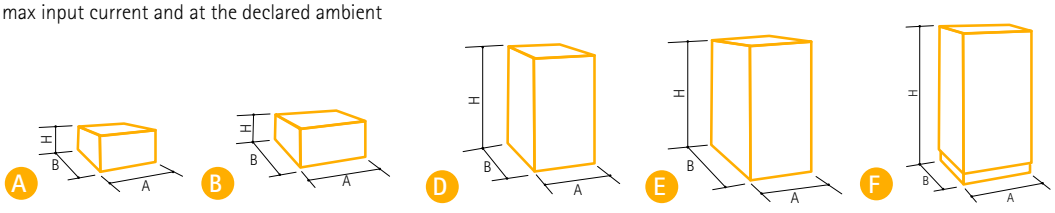
ECOSTAB Y THREE-PHASE 400V + N 50/60HZ VOLTAGE OPTIMISERS - IP21 INDOOR VERSION

Y308EJ20S	20	29	±10%	0 to -8%	13	±1%	350x580x890	120	D
Y310EJ40S	40	58			12		450x800x1200	210	E
Y311EJ60S	60	87			16			250	
Y312EJ80S	80	115			19			290	
Y313AJ100S	100	144			17		650x650x1800	480	G
Y314AJ150S	150	217			27		1100x650x1800	620	H
Y316AJ200S	200	289			19			650	
Y317AJ300S	300	433			22			750	
Y318AJ400S	400	577			16		1100x900x1900	1100	I
Y319AJ600S	600	866			17		1100x1300x1800	1360	J
Y320AJ800S	800	1155			18		1100x1300x1900	1770	
Y320AJ1000S	1000	1443			18		1100x1300x1900	1850	
Y322AJ1250S	1250	1804			26		2150x1350x2150	2700	K
Y323AJ1600S	1600	2309			18			3100	
Y324AJ2000S	2000	2887			17			3400	
Y326AJ2300S	2300	3320			18		3 cabinets 1100x1300x1900	3800	3 x J
Y328AJ2500S	2500	3608			24			5200	
Y330AJ2800S	2800	4041			26			5700	

Standard fittings:
- Potentiometer to adjust the stabilised output voltage
- Digital network analyser and energy meter
- Display and storage of saving data in absolute value and %
- Communication port: ETHERNET, USB
- Alarm indication and dry contacts for connection to an external device for protection against: overload, over/under voltage
- Pilot lamps

Optional fittings:
- Polycarbonate screen for IP2x protection at open doors (for "AJ" models in cabinet)
- Class II or Class I+II surge arresters
- Connection to the iremON remote service

IREM voltage optimisers are designed to deliver the declared power permanently (24/7) under the worst operating conditions, i.e. at full load, at minimum input voltage and max input current and at the declared ambient temperature.



ECOBUCK

ECOBUCK M SINGLE-PHASE 230V 50/60HZ VOLTAGE OPTIMISERS - IP21 INDOOR VERSION

Model	Rated power (kVA)	Rated current (Ampere)	Input voltage variation (±%)	Output regulation range (%)	Response time (ms/V)	Output accuracy (±%)	Dimensions (mm) a x b x h	Net weight (kg)	Figure
M204EJB5S	5	22	+10% -8%	0 to -8%	42	±1%	450x560x430	45	A
M206EJB10S	10	43			42			65	
M208EJB15S	15	65			44		450x560x600	80	B
M210EJB30S	30	130			54			120	

ECOBUCK T THREE-PHASE 400V 50/60HZ VOLTAGE OPTIMISERS - IP21 INDOOR VERSION

T304EJB15S	15	22	+10 -8%	0 to -8%	46	±1%	450x560x600	80	B
T306EJB30S	30	43			28			110	
T308EJB45S	45	65			32			135	
T310AJB100S	100	144			34		650x650x1300	360	F
T312AJB150S	150	217			48		650x650x1800	400	G
T314AJB200S	200	289			34		1100x650x1800	450	H
T315AJB300S	300	433			46			790	
T316AJB400S	400	577			58			850	
T318AJB600S	600	866			58		1100x900x1900	980	I
T319AJB800S	800	1155			58		1100x1300x1800	1350	J

ECOBUCK Y THREE-PHASE 400V + N 50/60HZ VOLTAGE OPTIMISERS - IP21 INDOOR VERSION

Y304EJB15S	15	22	+10 -8%	0 to -8%	26	±1%	350x580x890	150	D
Y306EJB30S	30	43			24			210	
Y308EJB45S	45	65			26		450x800x1200	240	E
Y310EJB80S	80	115			24			290	
Y311EJB120S	100	173			32		650x650x1800	480	G
Y312EJB160S	150	231			40		1100x650x1800	560	H
Y313AJB200S	200	289			34			630	
Y314AJB300S	300	433			54			780	
Y316AJB400S	400	577			38		1100x900x1900	1100	I
Y317AJB600S	600	866			44			1360	
Y318AJB800S	800	1155			32		1100x1300x1900	1770	J
Y319AJB1000S	1000	1443			34		1100x1300x1900	1850	J
Y319AJB1250S	1250	1804			34		1500x1350x2150	2700	K
Y320AJB1600S	1600	2309			36		2150x1350x2150	3100	L
Y320AJB2000S	2000	2887			36		2150x1350x2150	3400	L
Y322AJB2500S	2500	3608			52		3 cabinets 1100x1300x1900	4600	3 x J
Y323AJB3200S	3200	4619			36			5200	
Y324AJB4000S	4000	5774			34			6000	

Standard fittings: Potentiometer to adjust the stabilised output voltage
Digital network analyser and energy meter
Display and storage of saving data in absolute value and %
Communication port: ETHERNET, USB
Alarm indication and dry contacts for connection to an external device for protection against: overload, over/under voltage
Pilot lamps

Optional fittings: Polycarbonate screen for IP2x protection at open doors (for "AJB" models in cabinet)
Class II or Class I+II surge arresters
Connection to the iremON remote service

IREM voltage optimisers are designed to deliver the declared power permanently (24/7) under the worst operating conditions, i.e. at full load, at minimum input voltage and max input current and at the declared ambient temperature.