ECOSTAB
VOLTAGE OPTIMISERS

IREM Ecostab 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 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..




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 AC 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.

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.

IREM PROPOSAL

Voltage optimisation is a term given to the systematic controlled reduction in the voltages received by an energy consumer to reduce energy use, power demand and reactive power demand. While some voltage "optimisation" devices have a fixed voltage adjustment, others electronically regulate the voltage automatically. Voltage optimisation systems are typically installed in series to the electrical mains of a building, allowing all its electrical equipment to benefit from an optimised supply.

Overvoltage leads to sites using more electricity than needed, and as a result incurring higher electricity bills. The overvoltage is not only costly but can also be detrimental to equipment. Excess voltage produces additional noise, heat and vibration, causing stress on internal parts, especially to motors which are vulnerable to overheating and wear out more quickly. IREM Ecostab voltage optimisation system ensures that a building only receives and pays for the voltage that it actually needs, and no more, optimizes power quality and generates energy savings .

IREM Ecostab Voltage Optimisers are available in power rating from 8 to 2800 kVA, single-phase and three-phase versions.

VOLTAGE OPTIMISATION (VO):

The average voltage supply from many national grids around the world is often higher than the ideal operating voltage for most electrical equipment like lighting and motors. 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. Sites fitted with a voltage optimisation system often achieve reductions in the region of 5 to 15% for energy consumption, costs and therefore carbon emissions!

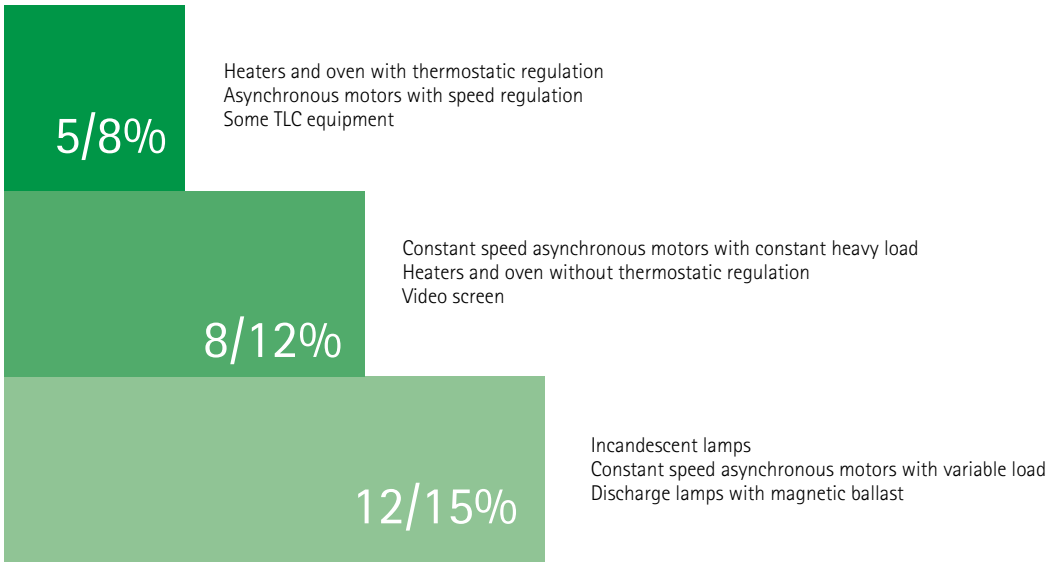
The first step to evaluate the profitability of installing a voltage optimiser is to monitor and know your present incoming voltage levels, the IREM Energy Saving Meter allows you to determine this.

IREM Ecostab Voltage Optimisers of "B" series are fitted with 2 digital network analysers. These multimeters display all the electrical parameters measured, voltage, current, frequency, power, power factor, THD, etc. from the input mains and at the optimiser output. These multimeters have:

- ✔ Graphic LCD display 128x80 pixel, backlit
- ✔ 4 keys for display and setting
- ✔ quick and easy navigation
- ✔ texts for measurements, settings and messages in 5 languages
- ✔ true RMS measurements (TRMS)
- ✔ seamless data acquisition
- ✔ high accuracy.

IREM Ecostab Voltage Optimisers of "S" series, besides the standard equipment of the "B" series, are fitted with an additional display showing the energy saving achieved by the VO. The values displayed are calculated according to the method recommended by the VDE-AR-E 2055-1 Standard. The saving is displayed ensuring the accuracy of the metrological chain of measuring instruments.

SAVING AND RETURN ON INVESTMENT



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

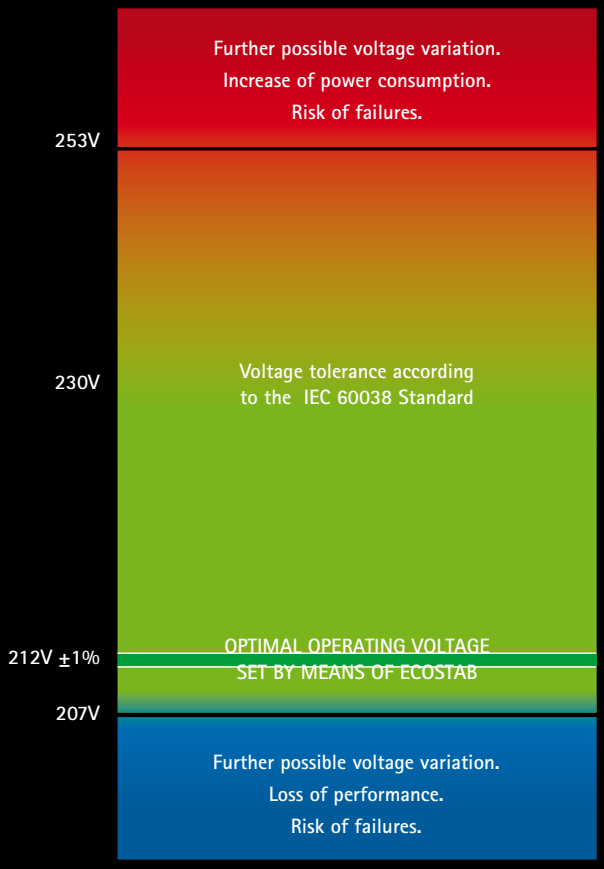
a. Mains voltage which is not always close to rated value. Voltage is usually higher late at night: 10% higher than the rated value is a common condition. This level is often exceeded when the user is located near an electric substation. Saving increases to approximately 20% when the voltage exceeds 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 in connection to motors with stall torque often lower than the maximum deliverable torque.
d. Overall consumption of devices powered by the voltage optimiser. The higher the power of the Ecostab 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 voltage optimisers to some devices to optimise the investment.

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

HIGHLIGHTS



By means of potentiometers the OPTIMAL OPERATING VOLTAGE can be set according to the peculiar features of the connected loads. The minimum stabilised voltage is 207V.

The dwindling fossil fuel reserves, the need to reduce carbon dioxide emissions and lower availability of financial resources has spurred energy production from renewable sources and strongly boosted the development of technology for optimising (limiting) electricity consumption.

Ecostab voltage optimisers are the ideal solution to optimize power quality and generate energy saving. IREM Ecostab voltage optimisers comply with the requirements of IEC 60038 for electric equipment operating tolerances and supply an operating voltage which minimises consumption without impairing performance and extends the useful life.

IEC 60038 establishes that the electric equipment must be able to work correctly at an input voltage within ±10% of the nominal value, that is from 253V to 207V for single-phase devices and from 440V to 360V for three-phase devices.

This is an essential feature for all electric devices because energy producers establish that the supplied voltage may vary within these limits contractually.

As a consequence, if a load is supplied at a value close to the lower operating tolerance limit (-10%) also when the mains voltage assumes the higher value established by contract (+10%), the difference between 253V and 207V in absolute terms is 18%.

This power supply difference allows to:

a. obtain a significant saving of energy;

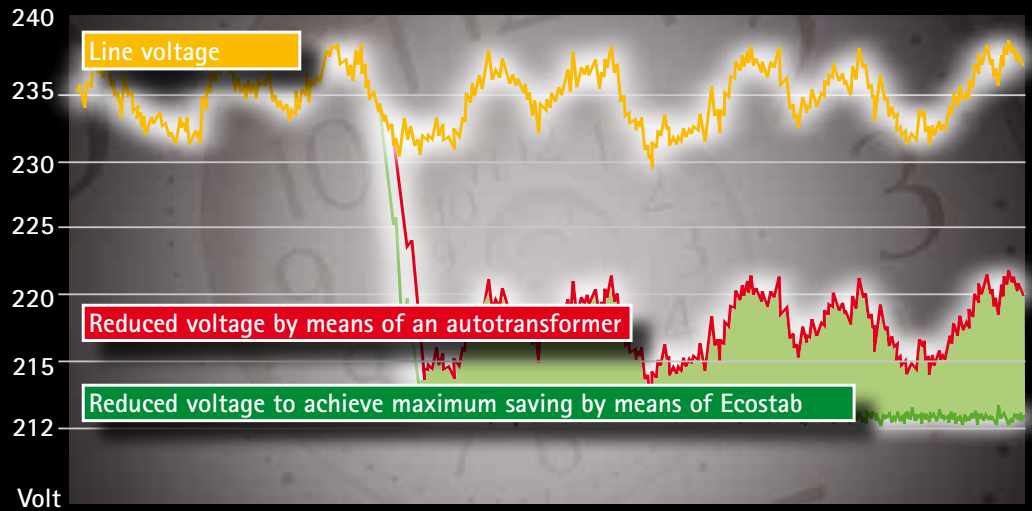
b. extend the working life of electric equipment. Ecostab voltage optimisers prevent devices from being powered at higher values than the rated voltage. For example, it is a known fact that the life of sodium bulbs is reduced by 50% when they are powered at a voltage 10% higher than their rated value;

c. secure a significant reduction of carbon dioxide emissions. This corresponds to approximately 630 g for every saved kWh of energy.

Ecostab voltage optimisers deliver a stabilised voltage which can be set to the minimum tolerance established in IEC 60038, i.e. -8% (212V), therefore within the tolerance prescribed by IEC STANDARD 60038 i.e. -10% (207V). This value is guaranteed also in presence of significant mains voltage variations. Interestingly, these devices are also excellent mains voltage stabilisers.

✔ Standard single-phase models can deliver a variable voltage from 230V to 212V with input voltage between 207-253V range.

✔ Standard three-phase models can deliver a variable voltage from 368/212V to 400/230V with input voltage between 360/207V and 440/253V.



Voltage supply	*Average voltage V*	*Average power kW*	*Saving kW*	*Saving %*
Line voltage	234	159	0	0
Reduced voltage by means of an autotransformer	217	146	13	8.2
Reduced voltage by means of Ecostab	212	142	16,5	10,4

Voltage optimisers capable of broader input voltage variations may be built on demand. These may be needed because voltage may sometimes exceed the 10% tolerance specified in the supply contract.

Automatic voltage stabilisation is a key function that sets Ecostab voltage optimisers apart from simple autotransformers, which also reduce voltage but cannot guarantee certain savings due to the continuous voltage variations of the mains.

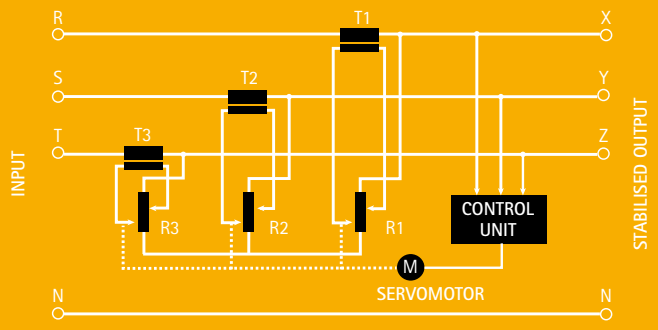
In order to prevent the delivered voltage from dropping excessively low as a consequence of mains fluctuations, autotransformers can never provide maximum savings.

The following diagram shows three different power supply possibilities with average absorbed power and saving for an electric motor.

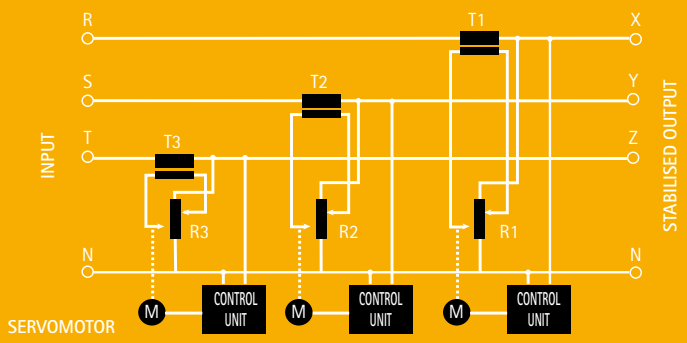
The area included between the red and the green lines represents the maximum saving achievable by Ecostab voltage optimiser compared to the autotransformer economisers.

VOLTAGE OPTIMISERS
OPERATING PRINCIPLE

ECOSTAB T WITH COMMON REGULATION OF THE 3 PHASES



ECOSTAB Y 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.

Fig. G

IP21

Fig. H

GENERAL FEATURES

POWER RANGE. From 8 to 2800 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 0.2% in any operating condition.

IMPEDANCE. The installation of an Ecostab voltage optimiser in a pre-existing plant does not require a new calculation of the protections because the internal impedance of the optimiser does not significantly affect the line impedance.

outdoor model

IP54

indoor model

OPERATING TEMPERATURE. Ecostab voltage optimisers are designed for operation at a maximum ambient temperature of 40°C in the 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 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, over/under voltage.

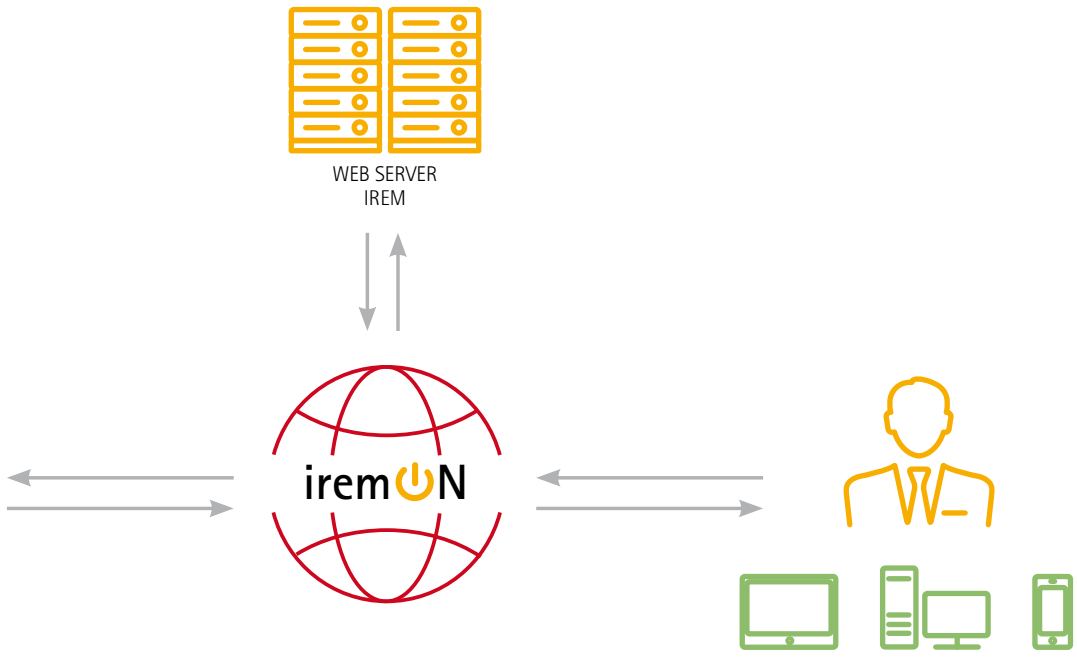
SPECIAL VERSIONS. Ecostab voltage optimisers can be equipped on demand with special fittings in separate cabinet, like e.g.: maintenance bypass, thermal magnetic circuit breakers, surge/lightning arresters, harmonic filters.

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

COMPLIANCE WITH STANDARDS. Ecostab 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.

ECOSTAB
remote control system



ECOSTAB S

SINGLE PHASE M AND THREE-PHASE T / Y

ECOSTAB M2.S SINGLE-PHASE 230V 50/60HZ VOLTAGE OPTIMISERS - IP21 INDOOR MODELS

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 T3.S THREE-PHASE 400V 50/60HZ VOLTAGE OPTIMISERS - IP21 INDOOR MODELS

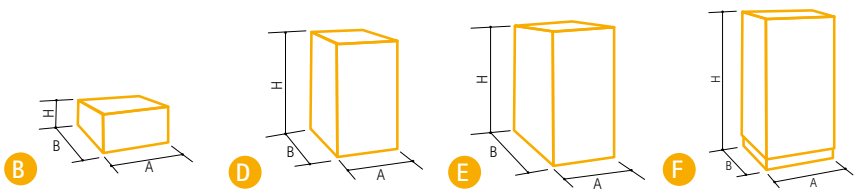
Model	Rated power (KVA)	Rated current (Ampere)	Input voltage variation (±%)	Output regulation range (%)	Response time (ms/V)	Output accuracy (±%)	Dimensions (mm) a x b x h	Net weight (kg)	Figure
T308EJ20S	20	29	±10%	0 to -8%	23	±1%	800x450x400	120	B
T310AJ50S	50	72			14		650x650x1300	250	F
T312AJ70S	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 Y3.S THREE-PHASE + N 400V 50/60HZ VOLTAGE OPTIMISERS - IP21 INDOOR MODELS

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		1100x1270x1800	1360	J
Y320AJ800S	800	1155			18		1100x1270x1900	1770	
Y320AJ1000S	1000	1443			18		1100x1270x1900	1850	
Y322AJ1250S	1250	1804			26		2130x1350x2150	2700	K
Y323AJ1600S	1600	2309			18			3100	
Y324AJ2000S	2000	2887			17			3400	
Y326AJ2300S	2300	3320			18		3 cabinets 1100x1270x1900	3800	3 x J
Y328AJ2500S	2500	3608			24			5200	
Y330AJ2800S	2800	4041			26			5700	

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

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.



ECOSTAB B

SINGLE PHASE M AND THREE-PHASE T / Y

ECOSTAB M2.B SINGLE-PHASE 230V 50/60HZ VOLTAGE OPTIMISERS - IP21 INDOOR MODELS

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
M208EJ8B	8	35	±10%	0 to -8%	21	±1%	600x350x290	45	A
M210EJ12B	12	52			21		800x450x400	65	B
M211EJ20B	20	87			22			80	
M212EJ25B	25	109			27			120	

ECOSTAB T3.B THREE-PHASE 400V 50/60HZ VOLTAGE OPTIMISERS - IP21 INDOOR MODELS

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
T308EJ20B	20	29	±10%	0 to -8%	23	±1%	800x450x400	120	B
T310AJ50B	50	72			14		650x650x1300	250	F
T312AJ70B	70	101			16			280	
T314AJ100B	100	144			17			360	
T315AJ150B	150	217			24		650x650x1800	420	G
T316AJ200B	200	289			17		1100x650x1800	630	H
T318AJ300B	300	433			23			790	
T319AJ400B	400	577			29		1100x900x1900	1150	I
T319AJ500B	500	722			29			1200	

ECOSTAB Y3.B THREE-PHASE + N 400V 50/60HZ VOLTAGE OPTIMISERS - IP21 INDOOR MODELS

Y308EJ20B	20	29	±10%	0 to -8%	13	±1%	350x580x890	120	D
Y310EJ40B	40	58			12		450x800x1200	210	E
Y311EJ60B	60	87			16			240	
Y312EJ80B	80	115			19			290	
Y313AJ100B	100	144			17		650x650x1800	480	G
Y314AJ150B	150	217			27		1100x650x1800	620	H
Y316AJ200B	200	289			19			650	
Y317AJ300B	300	433			22			750	
Y318AJ400B	400	577			16		1100x900x1900	1100	I
Y319AJ600B	600	866			17		1100x1270x1800	1360	J
Y320AJ800B	800	1155			18		1100x1270x1900	1770	
Y320AJ1000B	1000	1443			18		1100x1270x1900	1850	
Y322AJ1250B	1250	1804			26		2130x1350x2150	2700	K
Y323AJ1600B	1600	2309			18			3100	
Y324AJ2000B	2000	2887			17			3400	
Y326AJ2300B	2300	3320			18		3 cabinets 1100x1270x1900	3800	3 x J
Y328AJ2500B	2500	3608			24			5200	
Y330AJ2800B	2800	4041			26			5700	

Fittings: Potentiometer to adjust the stabilised output voltage
Digital network analyser and energy meter
Alarm indication and dry contacts for connection to an external device for protection against: overload, over/under voltage
Pilot lamps

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.