

# **Dynaspede Integrated Systems Limited**

## **Product Manual**

**SAVELEC**

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## ***SAVELEC***

### **Technical Details of *SAVELEC***

*SAVELEC* is a power conditioning equipment for the electrical utility systems beyond the distribution board. Essentially it is a Power Quality Equipment suitable for Small Commercial Establishments, Restaurants, Small Industries, Homes,& apartments. The equipment is connected after the meter and is provided with an input MCB for protection.

### **Principle of Operation**

The *SAVELEC* Conditioner Saver is a three in one concept having the following features

- a) Regulation Of voltage
- b) Improvement of Power Factor
- c) Works as De-tuned Filter
- d) Conditions the voltage wave form by smoothening the crest factor.

The equipment has multi tapped Inductances and Multiple capacitances. The inductance values are selected in such a manner that the waveform of voltage is smoothened at the input side to the load. The capacitances are also chosen to meet the requirement of the current waveform and the phase angle differences.

A powerful Micro controller senses and compares the different aspects of the waveform and accordingly initiates the correction factor in the Inductances and Capacitances. The low voltage Variable reactance and variable capacitance provides the correct matching impedance for the load circuit thereby improving overall efficiency.

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Thus, a combined voltage profile correction and localized dynamic capacitive compensation results in an overall reduction in the current usage, thereby reducing the input power and this gives the savings.

Optimal input power is achieved by the optimization of Voltage, current, and power factor depending upon the load. Appropriate correction as mentioned above using a micro controller ensures that the inherent system losses are reduced. Apart from above, the equipment has an optional facility to adjust the output of the devices (lights/fans/single phase loads/single phase heater) using an RTC (Real time clock) with timed operation or timed output control. For e.g., Dimming/speed reduction/slow heating, all can be implemented and substantial saving in Electric Energy can be obtained. The RTC with its Switching components will ensure that the equipment delivers a pre-set out put depending upon the time of use.

The Inductances and the capacitances are switched in / out using the high break relays and these functions are activated by the micro controller based on the input data received from the C.T's/ P.T's and Hall sensors.

Indication of voltages/ Currents is available by means of the respective voltmeter / Ammeter. Optionally Energy Meters are also provided.

## **Product Details and Construction.**

The equipment has been modularly constructed with a sleek aesthetically designed cabinet and wall mountable inserts. The modular construction enables the equipment to be mounted on the wall with minimum space and with cable entry from the top. The equipment has the following dimensions

Single phase - 3.5 kVA & 5 kVA

Single phase - 7.5 kVA & 9 kVA

Three phase - 10.5 kVA

Three phase - 15 kVA

Three Phase - 22.5 kVA

Three Phase - 27 kVA

The single-phase units when connected in Tandem form a three-phase unit. Only that the Cabinet is more complete and encompassing. The cabinet has provision for split opening and half way hinges such that maintenance and fault correction are simplified and made easy.

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## Benefits of SAVELEC

- a) Saves on Electricity Consumption To the extent of 20% -25% in Lighting Circuits
- b) Saves on Consumption of Electricity in Mixed Loads (Single phase A/c, heater, Lighting & Fans) –12 to 18%.
- c) Uses the Principle of smoothening the Crest Factor and the Power Factor
- d) Eliminates the need of stabilizers in the circuit & Surge Protectors
- e) Increases the life of appliances and the light fittings and tubes/bulbs.
- f) Guards against variations in the voltages (Other similar devices are only simple auto transformers and hence no automatic regulation)
- g) Tested and certified by reputed Indian Laboratories and International Laboratory.
- h) Wide Dealer network and a good service network.
- i) Warranty and Complete back up support.

SAVELEC is line voltage and current correction equipment, which is connected in Series & Parallel mode with the incoming electrical circuit at the distribution Junctions of three-phase circuit to single phase circuit. The function of the equipment is to smoothen the voltage wave form of the supply and to supply localized VAr compensation to maintain the power factor near to load close to unity. The VAr sensing mechanism in the equipment senses both the amplitude and phase angle of the voltage and current wave form and accordingly gives the signal to the micro controller, which then decides the component of correction. The components of correction in this equipment are the multi-tap inductances with different values and multiple capacitances with different values.

A phase wise sensing and controlling design is adopted to give maximum flexibility to the operating loads, in terms of input current and voltages.

## Equipment Applications.

The equipment can be applied where normal single-phase appliances and devices are predominantly used, especially for the lighting circuits, fans and other single devices.

The inductances smoothen out the voltage waveform thereby reducing the crest factors to the ideal factor of 1.41 or near to that. This reduces the RMS effect of the voltage waveform and hence there is a power reduction. The performance of the devices is not significantly affected and there will be reduction of 15% -20% in the power consumption. This is supplemented by the improvement of load side power factor by dynamic reactive support at the distribution side of the panels.

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Generally these equipment are suggested for lighting loads, mixed loads (light & fan & single phase heaters/single phase appliances), and for street lighting/ yard Lighting applications.

The range and capacity of the SAVELEC Product is as under.

## Single Phase

1.0kVA	2.5kVA	3.5 kVA	5.0 kVA	7.5 kVA
Home/Lighting Hoardings Small shops /lighting	Home Lighting Hoardings Common area Lighting/Shops	Homes Shops Hoardings Flats/Aptmts.	Homes Shops Hoardings Flats/Aptmts Common Area Municipal Strt.Lighting	Homes Shops Flats/Aptmts Common Area Municipal Strt. Lighting
Line Current Between 3Amps-4 amps @230 volts	Line Currents Between 6-7 Amps @230 volts	Line Currents between 8-12 Amps @230volts	Line currents between 16- 20 amps @230 volts	Line Currents between 22-27 amps @230 volts
Monthly Elec. Bill-Rs.500- 1000	Monthly Elect Bill –Rs-750- 1250	Monthly Elec.Bill- Rs.1200-1600	Monthly Elec. Bill- Rs-1500- 2000	Monthly Elec. BillRs.1900-3000
Lighting Load 3-4 amps	Lights fan 7-8 Amps	Lights+Fan+others 10-14 amps	Lights+Fan +Others-16- 21amps	Lights+Fan+Others 23-27 amps.
15%-18% savings in KWH Units for the same load	15%-18% savings in KWH for the same load	15%-18% savings in kWh For the same load	15%-20% savings in kWh for the same load	15%-20 % savings in KWH for the same load
Min. 4-6 hours operation/day	Min 4-6 hours Operation/day	Min.4-6 hours Operation/day	Min.4-6 hours operation/day	Min. 4-6 hours Operation/day
<b>Benefits</b> Life of Lights& Other devices will increase	<b>Benefits</b> Life of Lights& Other devices will increase	<b>Benefits</b> Life of Lights& Other devices will increase	<b>Benefits</b> Life of Lights& Other devices will increase	<b>Benefits</b> Life of Lights& Other devices will increase

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## Three Phase

10.5kVA	15kVA	22.5 kVA	27 kVA
Home/Lighting Hoardings shops /lighting/small offices/Street Lights	Home Lighting Showrooms Common area Lighting/Shops Street Lights	Shops/ Show rooms/ Offices Restaurants/Petrol Station Lighting Flats/Aptmts-common load.	Show rooms/ Shops Flats/Aptmts Common Area/ Municipal Strt. Lighting Restaurants/Offices.
Line Current Between 11Amps-12 amps @230 volts Line- Neutral	Line Currents Between 16-18 Amps @230 volts line to neutral	Line Currents between 20-25 Amps @230volts Line To neutral	Line Currents between 25-28 amps @230 volts Line To Neutral
Monthly Elec. Bill-Rs.1500-2000	Monthly Elect Bill –Rs-2750-3250	Monthly Elec.Bill-Rs.3200-4600	Monthly Elec. BillRs.3900-5000
Lighting Load 13-14 amps	Lights+fan 16-18 Amps	Lights+Fan+others 20-25 amps	Lights+Fan+Others 23-28amps.
15%-18% savings in KWh Units for the same load	15%-18% savings in KWH for the same load	15%-18% savings in KWH For the same load	15%-20 % savings in KWH for the same load
Min. 4-6 hours operation/day	Min 4-6 hours Operation/day	Min.4-6 hours Operation/day	Min. 4-6 hours Operation/day
<b>Benefits</b> Life of Lights& Other devices will increase	<b>Benefits</b> Life of Lights& Other devices will increase	<b>Benefits</b> Life of Lights& Other devices will increase	<b>Benefits</b> Life of Lights& Other devices will increase

## Potential Clients

The potential areas are

### Category 1

Shops & Establishments

Showrooms

Restaurants

Clinics

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## **Category 2**

Petrol Pumps

Warehouses

Offices (Both Big and small)

BPO's and IT companies

Industries (for Yard / street lighting)

Hotels

Hospitals

Malls & Large shopping centers.

## **Category3**

Municipal Corporations & Municipalities – Street Lighting

Bus stations, Electricity Sub- Stations

Govt. Buildings and Establishments

## **Category4**

Homes /Apartments.

## **Guide lines on applications.**

### **Category 1& Category 4**

In the case of category 1 of customers and category 4 of customers, the sizing of the equipment can be done by a simple measurement of current and calculating the total load, connected to the distribution board after the Utility Meter. Using a small clamp on current meter the line current can be measured with the load switches on, where the SAVELEC is going to be connected. Based on this current, the appropriate sizing of SAVELEC can be chosen.

The nature and type of load also determines and influences the quantum of savings that can be achieved by the equipment when connected in tandem with the load. Therefore it is essential that no 3- phase motor load be connected to the equipment whereby the duty of the equipment will go up and the desired savings also will not be available.

It is considered that the operating voltage of the power system available at the distribution board is the rated voltage (230 volts @50Hz), and any change in the same can also have a bearing on the savings. In the case of SAVELEC being applied to very low voltage (severe under voltage), distribution network, and then the SAVELEC improves the system voltage to make the system healthy. Under this situation, there will not be any major savings in Electricity.

Unbalance between Phases and consequent high neutral current has to be checked. In the case of heavy unbalance, the customer has to be informed to balance the phases, to the extent practically possible. Small reactive unbalances of current will be taken care by the SAVELEC equipment.

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## Category2

In the case of consumers under this category, the normal connected loads will be upwards of 100kw, and majority of them will come under the H.T (High Tension) Consumer Tariff. In this category itself, there will be different Tariff consumers such as Commercial, educational, Charity Institutions, Hospitals, Govt. Consumers social service Institutions, & Industrial Consumers, where, there will be different Electricity and Demand charges. The commercial consumers pay the highest and hence will find the energy solutions more attractive.

For these consumers' correct measurement and assessment of loads, loading pattern and usage data are required to appropriately make suggestion of the products. Depending on the loads- FTL's, CFL's, HID's, Spot lamps and other fancy luminaries/ HPSV lamps, will need to be looked as different category of loads, since each one of the has a different starting current requirement and operating power factors

Accordingly, the first step is to take readings by our own engineers/ Dealer/ Distributor engineers for which the cost of measurement to be charged from customer (Cost recovery only). In case the customer needs detailed study and assessment of his loads and wishes to engage a consultancy, then the matter to be referred to The Energy Audit Division Of the company. In such cases, the EAD will give specific suggestion with saving potential and payback.

Alternatively, after the preliminary measurements are taken and based on the site survey, the marketing person can inform the Engg. And Designs with readings and appropriate suggestion of the schemes for verification and ensure correctness of his suggestions.

Major aspects such as unbalance in loads and high neutral currents and high harmonic content are to be checked before suggestion/installation of the equipment.

## Category 3

In the case of all the consumers belonging to this category, the approach has to be carried out as a consultancy organization and build up projects for energy efficiency on department basis and on important building basis. In govt. buildings normally there are power quality issues, and electrical safety issues, which are to be addressed prior to suggesting equipment to safeguard the equipment and the down stream load.

Following crucial aspects shall be checked and confirmed prior to suggestion of equipment.

- a) Permanent Under voltage - <220volts
- b) Very high unbalance in currents

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- c) Improper earthing
- d) Improper back up protection,
- e) Unsafe electrical installation (open wires/burnt cut outs etc)

In such cases, the customer shall be informed to correct the anomalies/ deficiencies prior to the equipment installations.

## **Functioning of the equipment.**

The SAVELEC comprises of 4 major functional segments.

1. Input measurements & Sensing section
2. Control Section
3. Switching Section
4. Reactive Power Control Section.

The input measurements section comprises of the high accuracy current transformers and the potential / control transformers. These sense the currents and voltages in the circuit to the load and also measure the phase angle of the waveforms. These data with appropriate coding is then fed to the control section where a micro controller estimates the correction to be carried out.

The control Section comprises of the necessary micro controller and the comparators and the different logic circuits, which, after proper estimation, based on the input parameters, gives command to the switching section for switching ON necessary stage of the inductance transformer.

The switching section comprises of the relay module, which switches On/ Off, the various stages of the inductive transformer, in accordance with the variation in the input voltage and the phase angle.

The reactive Power Control Section supplies the necessary VAR to the load side, which effectively reduces the input current and reduces the phase angle difference with the voltage waveform. In effect the Reactive power control section ensures that there is minimum drawl of reactive energy from the grid. This also ensures that the  $I^2R$  losses are reduced.

## **Features of the Equipment.**

- 1.0 Conditioning of the voltage wave form - As explained earlier, the equipment has inductances which smoothens the voltage wave form and supplies necessary VAR to the loads.
- 2.0 The equipment regulates the voltage in a small range such that severe under voltage doesn't harm the equipment.
- 3.0 The power factor is improved on load side in a phase wise manner such that the losses are reduced.
- 4.0 Reduces the reactive unbalances in a star connected network where the distribution takes place between the phase and the neutral.
- 5.0 All the power elements (Inductances& capacitances) are controlled in a phase wise manner, which gives correction on each phase.

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- 6.0 The equipment is provided with an overload bye-pass feature whereby the series elements are bye passed in the event of an overload. This is carried out using an additional current sensor and a control circuit to initiate the switching On & switching Off of the respective phase overload relays. (Standard feature.) When the equipment is in bye-pass operation mode, there will not be any saving in electricity.
- 7.0 The equipment is modular in Construction whereby it is very easy to replace faulty components and modules.
- 8.0 The equipment is suitable for wall mounting.
- 9.0 The wiring and the control circuits are assembled in such a manner that any fault can be immediately located and isolated.
- 10.0 Meters such as ammeters and voltmeters, and an optional energy meter ( at extra cost) is provided along with the equipment.

## Optional Features

- 1.0 A real time clock with time-based switch can be provided for fixed time operation of the device. This facility can be used for street lighting and other similar application for availing off-peak dimming.
- 2.0 The control module can be interfaced with a remote switch (on/off) using GSM (For this, additional GSM transceivers to be ordered extra).
- 3.0 Additional power monitoring and data logging instrument can be added to facilitate monitoring the various trends and estimate the savings/ evaluate the performance/load data (extra cost).
- 4.0 An optional web enabled communication port can be provided to the control module enabling remote down load and remote programming of the equipment. Any other custom requirement can be introduced provided the requirement is Substantial and worth the development.

## Specification Of SAVELEC

S.no	Parameters	Specifications
	Input Voltage	415 Volts + 15 % -20 % ,3 Phase
	Input Frequency	50 Hz + / - 2.5 %
	Efficiency	97%
	<b>TRANSIT RESPONSE</b>	
	For 50% Load Change	+/- 5% Nominal Value
	For 100% Load Change	+ / - 10% of the Nominal Value
	<b>PROTECTION</b>	
	Output Overload	Provided
	<b>METERING</b>	
	Input Volt Meter	Available
	Input Ammeter	Available
	Operating Environment Temperature	0- 50 Degree Centigrade

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	Relative Humidity	95% No Condensing
	PCS by pass	Switch Provided
	Built – in Manual Bypass Switch	Available
	Overload Change over	Available
	<b>DESIGN PRINCIPLES</b>	
	Components used for conditioning	Inductances (3 – 4 stages per phase) & Multi tap capacitors (2-3stages per phase)
	Inductor Details	M4 Core, low flux density, low loss Inductances from 0.5 mh to 4 mh
	Capacitance	1 KVAR/230 V per phase to 3 KVAR /230 V per phase (depending on sizing of equipment)-(30 mf to 56 mf)
	Type of controller	Micro Controller
	Variation in Capacitor	Capacitors are variable on a phase wise manner for smooth compensation to ensure min, reactive power.
	C.Ts	High accuracy (class 1) tape wound C.Ts with CT ratio / or /depending on site requirements.
	Protections	Overload changeover to direct and protection provided.
	Crest Factor/Voltage Control	Heavy duty high brake relays
	Current / P.F Control	By varying the phase wise capacitance using appropriate relay switching.
	Dimensions	Will be sent as and when required.
	Weight	Will be sent as and when required.
	Harmonic reduction	The unit acts as detuned filter for all higher order harmonics.
	Firmware	Advanced algorithm for reactive power compensation and synchronized dynamic wave form correction software inbuilt.
	Protection against surges	The induction reduces the passage of surge through equipment

## Instruction for usages of the Equipment.

### a) Choosing the right application

The equipment can be used for various types of loads as mentioned in chapter 1. Accordingly please choose the application. In the case of Simple lighting loads, the equipment sizing can be close to the load current that is

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expected to be handled by the equipment. For e.g. 13 amps per phase Fluorescent lamp load can be handled by 10.5-kVA 3- phase equipment. In such case, the capacity utilization of the equipment is near to its rated capacity.

In the case of a mixed load like lights and single phase air conditioners, the rating of the equipment shall be 20% more than the connected load, since the starting current of the A/C is almost 3-4 times the normal running current. In such cases the overload bye-pass shall act only after the starting current has come to the steady state value.

In the case of Window a/c loads, existing Stabilizers if any shall be disconnected prior to our equipment installation.

In the case of Electric heaters combined in the load, the settings of the equipment has to be adjusted in such a manner that the equipment capacity is 15% more than the full load to take care of abnormal voltage dip on full resistive loads..

## **b) Installation Environment.**

The equipment installation area is a critically important aspect when comes to performance of the equipment. The equipment shall not be exposed to unduly dusty and humid environments, which can create problems for the control modules. The place of installation shall be adequately ventilated and shall be having temperatures less than 40 degrees. Exhaust fan provision shall be available in the installation area/ room.

In the case of installation in hazardous areas, special equipment construction is required and this will call for special designs, and hence cost. These are the mines, petroleum/petrochemical industry, fertilizer industry, and class 100- clean room environments.

We can supply equipment designed specially for these environments, which are not standard.

## **c) Out door application.**

Unless otherwise specified, all our equipment are basically designed and manufactured for indoor applications. On specific Enquiry or orders, the out door equipment can be supplied and this will entail extra cost. The customer shall arrange all the fixing arrangements.

## **d) Electrical distribution System**

Prior to the proposal / installation, it is better to visit the site of customers. The place identified for the installation of the equipment shall be having sufficient space to move around the equipment and to open the doors (both front & rear). The equipment connection to the customer's mains shall be done through well-lugged connection with minimum contact resistance. The electrical wiring shall be checked such that sufficient current carrying capacity

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exists. The customers DB shall be properly identifiable, and shall not have open wires and cut outs, and loose joints.

All stabilizers connected to other appliances shall be disconnected and removed prior to connection of our equipment.

## **e) Harmonic Currents & Voltages**

The equipment mentioned herein is suitable for operation under normal electrical conditions with THD (I) and THD (V) not exceeding 10%. However the equipment will not add any additional distortions. It is advisable to install Tuned Harmonic filters in circuits where the THD (I) & THD (V) exceed 15%. We can design such filters for the clients.

After the installation of our equipment, it is advisable to recommend the clients, not to add capacitors indiscriminately, which can cause probable resonance conditions.