

Dynaspede Integrated Systems Limited

Product Manual

PCS

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PCS, Power Conditioner Saver.

Most problems associated with the increased billing of electricity can be attributed to the deficiency in the supply quality or the incorrect application of electric power. In order to support customers with a ready energy saving proposition, we have developed conditioning equipment with power ratings from 30 kVA to 60 kVA for the use in the three phase to single phase distribution systems.

The PCS is a dynamic and intelligent power optimization device which has the following principles of operation.

Principle of Operation.

Our Power Conditioner Savers PCS is broadly designed on the following concepts to ensure that there is a step less variation of output voltage depending upon the time of operation and peak hour loading.

This is to ensure that there are no surges/ transients created by the frequent switching operations of high power contactors to cut in / out the transformer taps, which is a major reason for failures in lamp circuit & the fittings, thus reducing the life of equipment.

Moreover, the frequent ON / OFF within the discharge time can create over voltages due to Higher RRRV (Rate of Rise Of Restriking Voltage).

The unit has sensors, which captures the Voltage and current Waveform and identifies the crest factor and the power factor of the waveform. This is to essentially determine the throughput power into the end use device. The street

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light lamps having linear characteristics has a proportional V/I characteristic at near unity power factor. In effect the power flow at optimum will be achieved by getting the system to behave as closely as D.C equivalent Impedance.

For this purpose, our PCS has individual phase wise reactive power management, wherein single-phase capacitances are added and deleted by an intelligent microprocessor / micro controller based system. It is also ensured that the system is immune to EMI/EMC and will not mal operate under unbalance conditions, voltage sags & swells and under normal operating circumstances in a street light system. Adequate precautions are also taken for correctly choosing either RISC / C-MOS processors for noise immunity.

The PCS series also has varying line inductances /suitable low loss transformers and the shunt capacitances on each phase individually to ensure the impedance is close to D.C equivalent and the voltage is optimized to its near luminous peak efficiency. It is also ensured that only single phase switched Capacitors with Var sensing is incorporated to avoid severe unbalance in reactive currents as in Delta circuits.

The saver unit has multi - tap inductances, control transformers and phase wise multiple capacitances, to be dynamically varied by a suitable C-MOS/RISC based Micro processor/ controller and the input /output characteristics checked for the waveform such that the whole operation is a closed loop function.

The PCS saver also regulates the system voltage and also provides the surge impedance to reduce the transients and surges in the supply system making it an effective protection against lamp failures and electrical system break downs.

The PCS is operated using smooth varying mechanisms and is fully compensated for the reactive requirements, in such a manner that the characteristics of the voltage wave form and the current wave form are nearly in phase and the amplitude is adjusted for appropriate Power Quality.

This ensures that the reactive loading and the current levels are minimized at the incoming circuit, thereby improving the system voltage and the utility side power factor. Losses in the circuit are considerably reduced due to the above.

Timer Control

Apart from the smooth control as above, the street light system adopts versatile timer control using another microprocessor and real time clock. (RTC). This module functions as a watchdog circuit with a battery back up in such a manner, that even when the mains power is off, the RTC programme is in place. A hand held portable programmer is used to site programme the switching sequence of the variable transformer for voltage control of the unit with respect to time. During the off peak hours, i.e. from 2300 hrs to 0500 hrs the System Voltages are

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generally high and at this time the traffic and movement on the road is low. The luminous intensity of the street lighting can be reduced by 30% to 40 % at this of night and considerable energy can be conserved due to the above - up to 40%.

The time scheduled switching sequence can be integrated with the main controller and can be formed as a single control working in tandem.

Construction

Construction:

Our PCS is housed in an outdoor/indoor mountable cabinet manufactured with 14swg/16swg CRCA steel Sheet .The cabinet has all the controls, switches, & protective devices mounted on the inner door structure. The cabinet also has an external lockable double door arrangement with a glass/ transparent window for seeing the multi- function meter / Energy Meter (optional). The complete cabinet is powder coated with Siemens Grey colour conforming to shade 631 of IS.5

In the case of Street Light Installations, the cabinet / panel is mounted on an angle iron frame and is to be fixed to the footpath with mortar / concrete adjacent to the mini pillar/pillars housing the main controls of the reference street lights cluster. The height of the frame is minimum 450 mm from the ground level, to protect the equipment from normal flooding due to rainwater.

In the case of Indoor installations, the equipment has to be installed over a grouted Channel with necessary cabling from the bottom entry. The back & side clearances shall be sufficient for working space in the case of any maintenance.

The incoming cable from the mini pillar to our PCS is adequately rated and suitable for bottom entry through incoming fuses. The out going cable is routed through an MCB, which is rated at 1.3 times the line current. The cable connection is also properly lugged to have minimum contact resistance.

Measurement & Monitoring. (optional)

The measurement and monitoring is being done through a Multi- function meter, which continuously displays the following parameters.

All the three phase currents, I_r , I_y , I_b

All three phase voltages V_{rn} , V_{yn} , V_{bn}

All three phase volt-amperes KVA_r , KVA_b , KVA_y , Summated KVA

All three Phase Power KW_r , KW_y , KW_b , Summated KW.

All phase power factor and summated power factor,

Frequency of supply,

Reactive Volt-amperes of all phases

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Energy supplied through the unit, KWH

The unit has an RS-232 port, which can be connected to any down loading Terminal and can be down loaded. It is also possible to network the meter to any RF or other communication medium for remote reading using appropriate modems.

The unit will be the measuring and monitoring device for all the load side consumptions.

Power Factor Correction

The power factor of the light system is normally low and as an ageing factor, the old lamps and fittings (ballast, capacitor, igniters) tend to become less operationally efficient and consequent to this the current loading of the circuit goes high.

In order to keep the line healthy in any electrical system, and to reduce the losses, it is imperative to keep the individual phase power factor to near unity-0.97 to 0.99lag. For this purpose, our saver has a mechanism to sense / identify the individual phase reactive power requirement and accordingly switch in the requisite capacitance - from 1kVAr/phase to 10 kVAr/ phase in stages, using highly reliable high break relays. Our units do not have any leading power factor in the system, which can cause voltage imbalance and increase the waveform distortions. Voltage imbalances and waveform distortions are detrimental not only to the life of lamps but also increase the losses.

By the use of energy saving PCS, the luminous intensity will not drop below the acceptable visibility levels. Accordingly the lux levels will not drop below 10- 20 % even during the voltage-clipping period between 2300 hrs and 0500 hrs.

Our PCS has the following features:

- Auto switch ON/OFF of phase wise capacitance
- Individual phase sensing and correction
- Individual phase current & voltage data acquisition
- Improvement of the power quality in the load side
- Adjustable threshold VAR values for load under varying load patterns
- Minimizes the system losses
- Reduces the neutral current and incoming power.

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Protection:

The PCS is provided with incoming fuses rated at 1.3 times the line current. The output is protected with an MCB. Necessary isolation is also provided for the control circuits and the RTC from the system surges.

Equipment Applications.

As can be seen from the features above, the equipment can be applied where linear appliances and devices are predominantly used, especially for the lighting circuits, fans and other single-phase devices. The load decides these equipment ratings and the range varies from 30 kVA 3- phase to 60 KVA 3- phase.

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 18%-25% 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.

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., and for offices, theatres, shopping malls, big showrooms, railways, restaurants, govt. buildings and other similar applications.

The range and capacity are indicated as under.

Three Phase

30 kVA	36kVA	45 kVA	54 kVA
shops /lighting/small offices/Street Lights, Offices sub-stations, govt. buildings	Showrooms Common area Lighting/Shops Street Lights / Malls/ Offices Govt .Departments	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 30-32 amps @230 volts Line- Neutral	Line Currents Between 35-38 Amps @230 volts line to neutral	Line Currents between 40-48 Amps @230volts Line To neutral	Line Currents between 55-65 amps @230 volts Line To Neutral

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Monthly Elec. Bill-Rs.10000	Monthly Elec Bill -Rs- 15000-23250	Monthly Elec.Bill-Rs.25000-30600	Monthly Elec. BillRs.39000-50000
Lighting Load 36 amps	Lights+fan 40 Amps	Lights+Fan+others 48 amps	Lights+Fan+Others 60 amps.
15%-18% savings in KWHUnits 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
Benefits Life of Lights& Other devices will increase	Benefits Life of Lights& Other devices will increase	Benefits Life of Lights& Other devices will increase	Benefits Life of Lights& Other devices will increase

Potential customers for PCS

The major customers for the PCS model are

- Banks & offices
- Corporate Office Buildings
- Information Technology Companies
- BPO's , Hotels & Hospitals
- Airports
- Shopping Malls
- Jewellery & Textile Showrooms
- Telephone Exchange buildings, base stations and cyber cafés.
- Municipal corporations & Municipalities.

PCS is normally recommended for discerning customers who want power quality along with Power savings and who can afford to pay a higher price for the better quality. It must be ensured that the customers are informed about the specification of the equipment and its features and facilities such that there is no over expectation or under performance for the customer.

The following Conditions of supply and type of applications shall be informed to the customer prior to the sales.

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- 1.0 Input supply voltage shall be in the range of rated voltage of 230 +/- the variation specified.
- 2.0 There shall not be excessive unbalance in the load- single phasing and loading of one phase getting excess.
- 3.0 The loads connected to the system operate at 230 volts phase to neutral.
- 4.0 There are no major motor (3-phase) loads connected to the power conditioner.
- 5.0 Proper cabling and terminations are provided for the electrical system

Specification for PCS.

SPECIFICATION OF PCS

Sl. No.	Items of Work	
	Input Voltage	415 Volts + 15% - 20%, 3 Phase
	Input Frequency	50HZ +/- 2.5%
	PCS Efficiency	99.5%
	TRANSIT RESPONSE	
	For 50% Load Change	+/- 5% of Nominal Value
	For 100% Load Change	+/- 10% of the Nominal Value
	PROTECTION	
	Output Short Circuit	Provided
	Output Overload	Provided
	METERING	
	Input Volt Meter	Available
	Input Ammeter	Available
	Operating Environment Temperature	0 – 50 Degree Centigrade
	Relative Humidity	95% No Condensing
	PCS bypass	Switch provided
	Built-in Manual Bypass Switch	Available
	Overload Changeover	Available
	DESIGN PRINCIPLES	
	➤ Components used for conditioning	Inductances(3 – 4 stages per Phase) & Mullti tap capacitors(2 – 3 stages per Phase)
	➤ Inductor Details	M4 core, low flux density, low loss inductance from 0.5mh to 4 mh
	➤ Capacitance	1 KVAR/230V per phase to 10 KVAR/230V per phase(depending on sizing of equipment)
	➤ Type of Controller	Micro Controller

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➤	Variation in Capacitor	Capacitors are variable on a phase wise manner for smooth compensation to ensure min. reactive power.
➤	C.Ts	High accuracy (class 0.5 to class 1) tape wound C.Ts with CT ratio / or / depending on site requirements.
➤	Sensing	Hall sensors for current sensing.
➤	Protections	Overload changeover to direct and protection provided.
➤	Crest Factor / Voltage Control	Using Variacs and motorized mechanism.
➤	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 a detuned filter for all higher order harmonics.
➤	Firmware	Advanced algorithm for reactive power compensation and synchronized dynamic wave form correction software inbuilt.