Three -Phase PFC Rectifier with Phase - Modular Y-Rectifier for LED Lamp

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Abstract— The paper was to study ac/dc three phase PFC rectifier for LED lamp. The performance normally of the rectifier having is current low quality and low power factor and high total harmonics distortion current. Therefore, the objectives in this a paper going to improving power factor and reduce harmonics current. In this paper to propose power factor correction (PFC) with phase-modular Y-rectifier, boost type converter circuit using by one cycle control (OCC). For high performance method and tested of the result for realize that can solve power factor and reduce harmonic current. The research papers, conclusions for study and evaluate the circuit can be operation and suitable for use with LED 50 W (LED lamp). The data collected by MATLAB Simulation are used in comparison with the experimental tester of results.

Keyword- LED Lamp, Phase-Modular Y-Rectifier, Harmonics reduction, Power factor correction, Switch-mode rectifiers (SMRs), Improved power quality converters (IPQCs).

I. INTRODUCTION

In 1990's ultra-bright LEDs using Aluminium Indium Gallium Phosphide (AlInGaP) to produce orange-red, orange, and yellow and presently green light has become available. The first significant blue LEDs also appeared at the start of the 1990's, once again using Silicon Carbide - a throwback to the earliest semiconductor light sources, although like their yellow Russian ancestors the light output was very dim by today's standards. Ultra bright blue Gallium Nitride (GaN) LEDs arrived in the mid-1990s, with Indium Gallium Nitride (InGaN) LEDs producing high-intensity blue and green shortly thereafter (e.g. [1]-[3]). In Fig 1, shows the current range of LED, which can take many forms and depending on the manufacturer. The package tube LED (LED package) Surface Mouth Type rated 50 watt, 30 volt level rang and the current rating of the LED about of current use 20-50 mA , 50-150mA and current 150mA-1000mA.

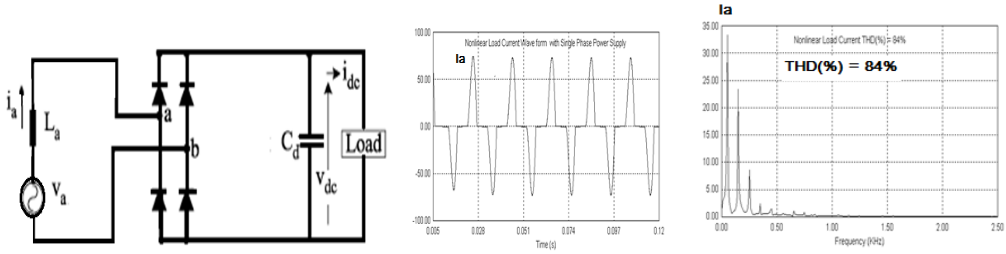
Fig.1 Example, the current range of LED on type of production.

In a theoretical case where output current can be estimated as clean DC current. The diode bridge connects the capacitor to the AC source when the voltage is near the peak, resulting in an abridged sinusoidal shaped current wave with current only flowing for about 1 to 2ms every half cycle. To deal with this type of nonlinear load the term “apparent power factor” evolved. The inclusion of the word “apparent” implies a nonlinear load and hence a non-sinusoidal current. the harmonic current frequencies of a single phase and three phase rectifier are n times the fundamental frequency (50 or 60 Hz). The current wave shape is not a pure sinusoid. Harmonic currents and voltages are created by non-linear loads connected on the power distribution system. Harmonic distortion is a form of pollution in the electric plant that can cause problems if the sum of the harmonic currents increases above certain limits. The input current is now in phase with input voltage and the converter looks like a resistor from the AC power line. For example, “the Apparent Power Factor must be > 0.9 for loads >50% of full load rating”. This is usually expressed as limits for odd harmonics (e.g. 1st, 3rd, 5th, 7th, etc.). This approach does not need any qualifying minimum percentage load and is more relevant to the electric utility as their main interest is to ensure that a particular installation can safely supply any current a load may demand. Regulatory specifications, such as EN61000-3-2/EN61000-4-7 utilize this method. As was shown in Fig. 2 and Fig.3, Depicts the effects of this circuit with the same power being delivered to a power factor corrected supply for a non-PFC unit.

This paper to propose Y-Rectifier in a three phase star connection technique based power LED driver topology. The three phase balance phase current AC/DC rectifier with the control can make it the input line current of power converter with the unity power factor, and the current waveform distortion results increase of the lower harmonics distortion.

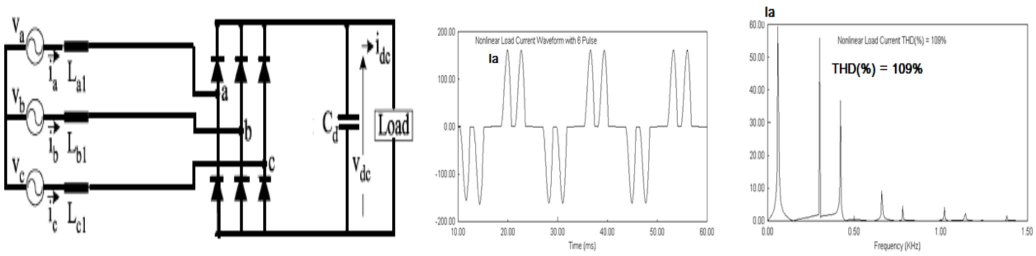
II. POWER FACTOR AND THD

Conventionally, ac–dc converters, which are also called rectifiers, are developed using diodes and thyristors to provide controlled and uncontrolled dc power with unidirectional and bidirectional power flow. They have the demerits of poor power quality in terms of injected current harmonics, caused voltage distortion and poor power factor at input ac mains and slow varying rippled dc output at load end, low efficiency and large size of ac and dc filters.



(a) (b) (c)

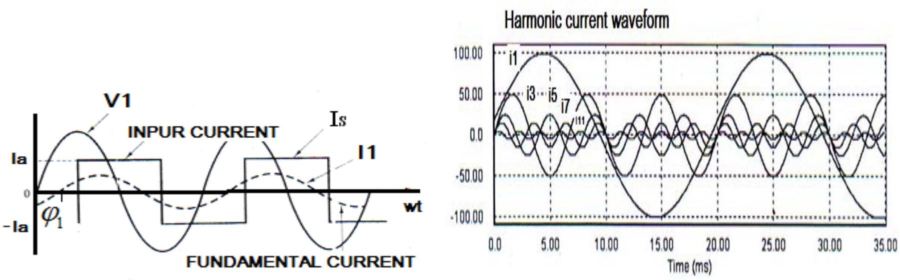
Fig. 2, Depicts the effects of current quality this circuit with the single phase rectifies (4 - pulses) being delivered to a power factor corrected supply for a non-PFC unit.



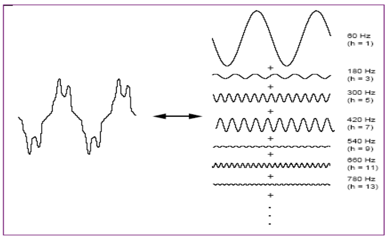
(a) (b) (c)

Fig. 3, Depicts the effects of current quality this circuit with the three phase rectifies (6 - pulses) being delivered to a power factor corrected supply for a non-PFC unit.

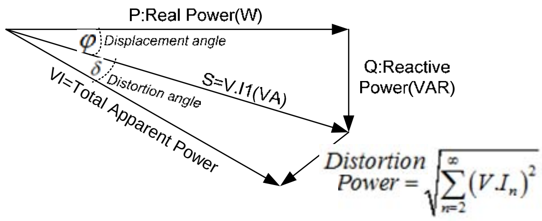
In Fig 2(c), shows the harmonic content of the current waveform is percentage of total harmonic distortion (%THDi) approximately 84%. The capacitor (Cd) will only charge when Vs(V) is greater than its stored voltage ,meaning that a non-PFC circuit will only charge (Cd) a small percentage of overall cycle time. After 90 degrees (Fig.2(b)),the half cycle from the bridge drops below the capacitor voltage (Cd),which back biases the bride, inhibiting current flow into the capacitor (via Vs). In Fig 3(c), shows the harmonic content of the current waveform is percentage of total harmonic distortion (%THDi) approximately 109%. The Power Quality (PQ) in electrical systems is regulated by IEC and EN standards, used as reference by the utilities (e.g. [4]-[6]). Therefore, a good understanding of the LEDs harmonic production characteristics becomes necessary. Many studies about the PQ issues related to the lighting devices have been addressed to analyze these problems as in [7]. The new breed of rectifiers has been developed using new solid state self-commutating devices such as gate turn-off thyristors (GTO), MOSFETs, insulated gate bipolar transistor (IGBTs),etc., even some of which have either not been thought or not possible to be developed earlier using diodes and thyristors. Such pieces of equipment are generally known as converter, but specifically named as switch-mode rectifiers (SMRs), power-factor correctors (PFCs), PWM rectifiers converter, multilevel rectifiers, etc.



(a) (b)



(c)



(d)

Fig. 4, Example, Harmonics with significant any amplitude in the AC side voltage waveform (a) shows input current and fundamental of current (n =1), (b) and (c) shows detail harmonic current waveform n = 1,3,5,7,11 and (d) show phases of diagram power harmonic.

A power quality analysis has been performed to compare the different luminaries behavior. The absorbed apparent power is decomposed in four different parts, as described as in [7] with regards to the single-phase case (shows in Fig.2 and Fig.4). The RMS values of voltage and current are decomposed, respectively, where subscript 1 refer to the fundamental harmonic as:

$$V(t) = V_{DC} + \sum_{n=1}^{\infty} a_n \cos n\omega t + \sum_{n=1}^{\infty} b_n \sin n\omega t \tag{1}$$

$$I(t) = I_{DC} + \sum_{n=1}^{\infty} a_n \cos n\omega t + \sum_{n=1}^{\infty} b_n \sin n\omega t \tag{2}$$

$$V = \left(V_1^2 + V_2^2 + V_3^2 + V_4^2 + ...Vn^n\right)^{1/2} \tag{3}$$

$$I = \left(I_1^2 + I_2^2 + I_3^2 + I_4^2 + ...In^n\right)^{1/2} \tag{4}$$

The dimensionless index of the total harmonic distortion (THD) present and it is defined, The total harmonic distortion of a signal is for current and voltage respectively, as in [7]:

$$THD_V = \frac{\left(V_2^2 + V_3^2 + V_4^2 + ...Vn^n\right)^{1/2}}{V_1} \tag{5}$$

$$THD_i = \frac{\left(I_2^2 + I_3^2 + I_4^2 + ...In^n\right)^{1/2}}{I_1} \tag{6}$$

The apparent power is decomposed into fundamental apparent power(*S1*),current distortion power *(DI)*,voltage distortion power *(DV)*, and harmonic apparent power *(SH)* as in [7]:

$$S_1 = V_1.I_1 \,,\, P_1 = V_1.I_1 \cos\varphi_1 \,,\;\; Q_1 = V_1.I_1 \sin\varphi_1 \tag{7}$$

$$D_I = V_1.\left(I_2^2 + I_3^2 + I_4^2 + ...In^n\right)^{1/2} \tag{8}$$

$$D_V = \left(V_2^2 + V_3^2 + V_4^2 + ...Vn^n\right)^{1/2}.I_1 \tag{9}$$

$$S_H = \left(V_2^2 + V_3^2 + V_4^2 + ...Vn^n\right)^{1/2}.\left(I_2^2 + I_3^2 + I_4^2 + ...In^n\right)^{1/2} \tag{10}$$

Combining them Eq(7),Eq(8),Eq(9),Eq(10) consist of, Current distortion power, voltage distortion power and harmonic apparent power are related to the voltage and/or current distortion., it is possible to define the non-fundamental apparent power *SN* defined by reference [7]:

$$S_n = \left(D_I^2 + D_V^2 + S_H^2\right)^{1/2} \tag{11}$$

The active power is defined as the mean value over the investigated period of the instantaneous power, with regard to energy conversion defined by reference [7]:

$$P = \frac{1}{T}\int_{\tau}^{\tau+T} V(t).i(t).dt \tag{12}$$

The finally, power factor correction is simply defind as the ratio of active power(P) and apparent power (S), with regard to energy conversion defined as:

$$PF = \frac{P_{RMS}}{S_{RMS}} \tag{13}$$

The power factor (PF) represents the ratio of the average power converted by the device, the active power (P) and the maximum average power that may be converted the apparent power (S) considering the same RMS values of voltage and current. In this context, PF can be considered as an indicator of the quality in the energy conversion. PF values close to "1" indicate that the net transfer of energy to the load is the main energy process, while PF values close to "0" characterize devices in which the energy exchange between load and grid, characterized by a nil net energy flow in a period, is the main energy process. In any way, the PF is not a measure of the efficiency of the device: PF indicates the ratio between the active power and the maximum active power that could be produced by the same RMS voltage and current, while the efficiency is the ratio between the output and input power of the device and it is a measure of the power losses into the device. It is important to underline that the only way to increase the power factor by using passive devices is to place a reactive element (usually a capacitor) in parallel with the load. Indeed, in the case of distorted load, the capacitor can compensate only the reactive power (Q).Moreover, capacitor acts like a high pass filter for the harmonic currents, require quirking oversizing. Finally, parallel resonance with the line inductance can cause high voltage distortion. Discover and explore the generally ac-dc converter power supply for LED light, In Fig.5, Show diagram Fly back-based LED driver topology are widely used in low power (< 100W) LED lighting applications primarily because of their low cost, simplicity (low part count), and acceptable performance. At higher power levels, however, these topologies become impractical, forcing designers to increase the complexity of their designs (e.g., increasing switch count), as in reference [8].

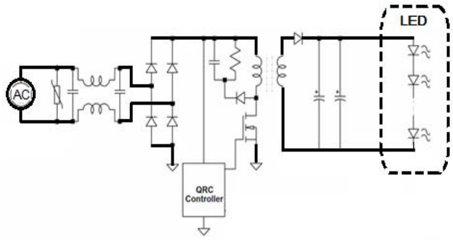
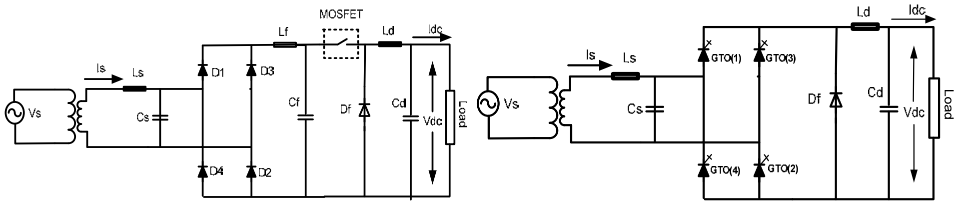


Fig.5. Fly back-based LED driver topology are widely used in low power (< 100W) LED

III. UNIDIRECTIONAL CONVERTERS

A. Single phase Unidirectional Buck Converters

The basic circuits of this topology are shown in Fig. 6. It is a combination of diode rectifier with step-down chopper with input and output filters. Its performance is improved using a ripple filter at dc output for reducing harmonics in ac mains and ripples at dc output voltage. Nowadays, it is also developed using a diode rectifier with filter and various combinations of dc–dc converter with and without high-frequency transformer isolation. Fig. 5(a) - (b), shows one of such circuit using full-bridge dc–dc converter with MOSFET and GTO based semi converter. It has the features of high power factor, low harmonic current in the ac mains, and meets the requirement of varying controllable output dc voltage. These converters also provide very fast response compared to conventional semi converter resulting in reduced size of ac and dc filters less stress on load and other components. It is used in the small-rating dc motor speed control, battery charging, isolated regulated dc supply, as in (e.g. [9],[15]-[17]).



(a) (b)

Fig. 6. (a) Unidirectional buck converter with input ac filter and dc filter (b) GTO bridge-based unidirectional buck converter with input ac filter.

B. Single phase Unidirectional Boost Converters

As shows in Fig 7(a) and Fig.7 (b), Input ac mains and well-regulated and good quality dc output to feed loads ranging from fraction of Watt to several hundred kilowatts power ratings in large number of applications. The improved power quality converters (IPQCs) technology has been developed now at a reasonably matured level for ac–dc conversion with reduced harmonic currents, high power factor correction, low electromagnetic interference (EMI) and radio frequency interference (RFI). It has been revolutionized in the last couple of decade with varying configurations, control approaches, solid-state devices, circuit integration, varying magnetics, etc., for features such as boost, buck, buck–boost, and multilevel with unidirectional and bidirectional power flow, as in (e.g. [9],[18]-[29]).

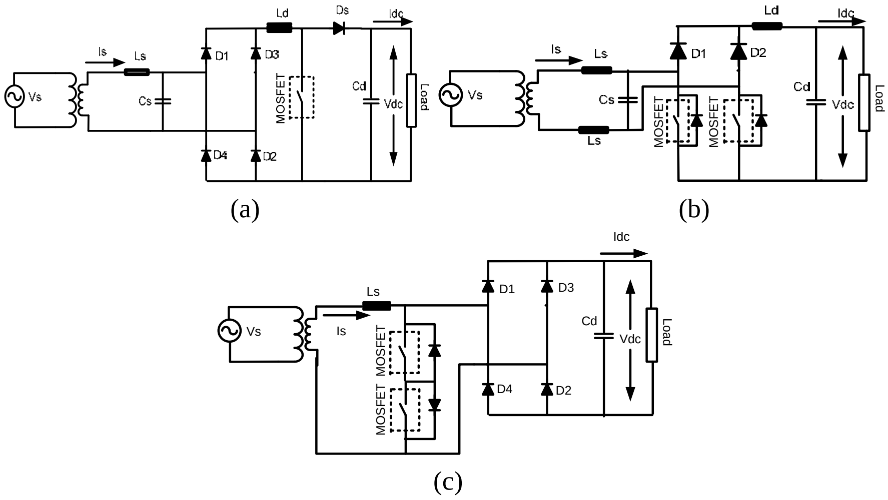


Fig. 7. (a) Unidirectional boost converter. (b) two-device unidirectional boost converter or bridgeless boost topology. (c) ac-switch two-device unidirectional boost converter.

C. Single phase Unidirectional Buck–Boost Converters

These converters are developed in both non isolated and isolated circuit configurations. Fig. 8(a)-(c) shows a few circuits of these converters. It is a combination of diode rectifier with buck–boost dc–dc converters. Since buck–boost converters are developed in non-isolated and isolated topologies, a large number of configurations is also reported, such as a combination of buck and boost, buck–boost non-isolated type, SEPIC isolated type, etc. These are now cascaded with a diode rectifier to improve power quality at the ac mains with required variable controllable output dc voltage to meet the need of specific applications, as in (e.g.[9],[30]-[34]).

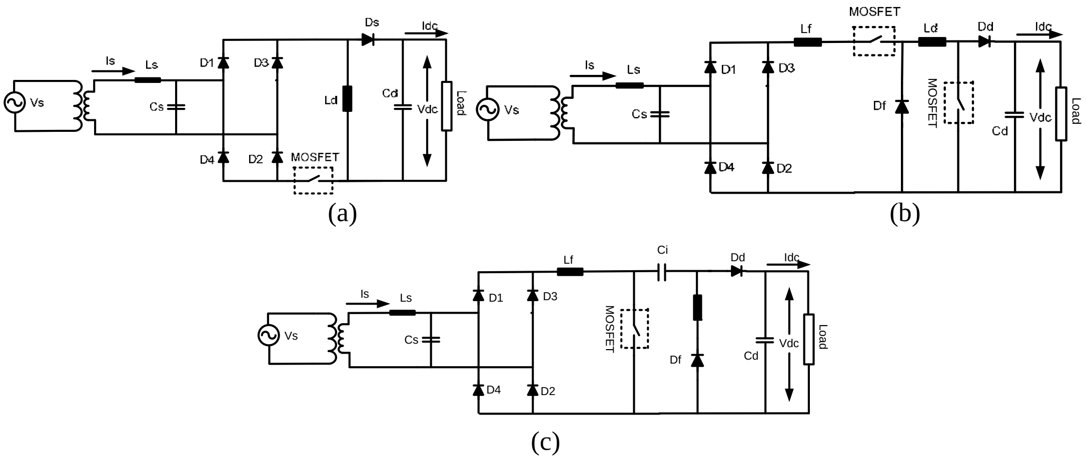


Fig. 8. (a) Single-device unidirectional buck-boots converter with input ac filter. (b) Cascaded unidirectional buck-boost converter with input ac filter. (c) SEPIC-derived unidirectional buck-boots converter with input ac filter.

D. Three phase Unidirectional Buck Converters

Example Several topologies, in the literature with using single device and two devices shows in Fig.9(a)-(b),three device and six devices not to shows in Fig.9, are report in literature to improve the power factor and reduce the harmonic currents at input ac mains and well regulated filtered output dc voltage, as in [10].

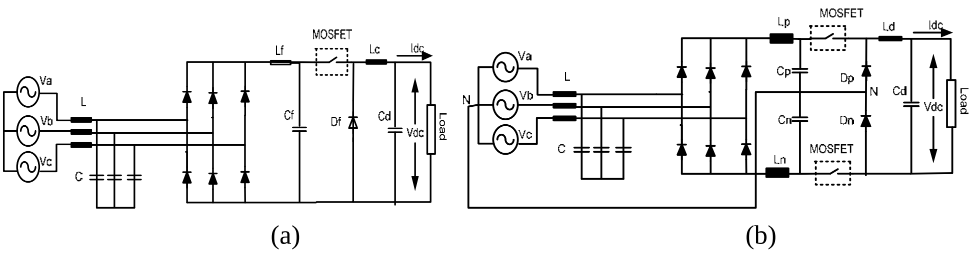


Fig. 9. (a) Three-phase single-device unidirectional buck converter with input ac filter. (b) Three-phase two-device unidirectional buck converter with input ac filter.

E. Three phase Unidirectional Boost Converters

There is wide variety of configurations with for example Several topologies, in the literature with using single device and two devices shows and six devices as shows in Fig.10(a)-(c), for two device using zigzag injection transformer and three devices (Vienna rectifier) not to shows in Fig.10, are report in literature to improve the power factor and reduce the harmonic currents at input ac mains and well regulated filtered output dc voltage, as in [10].

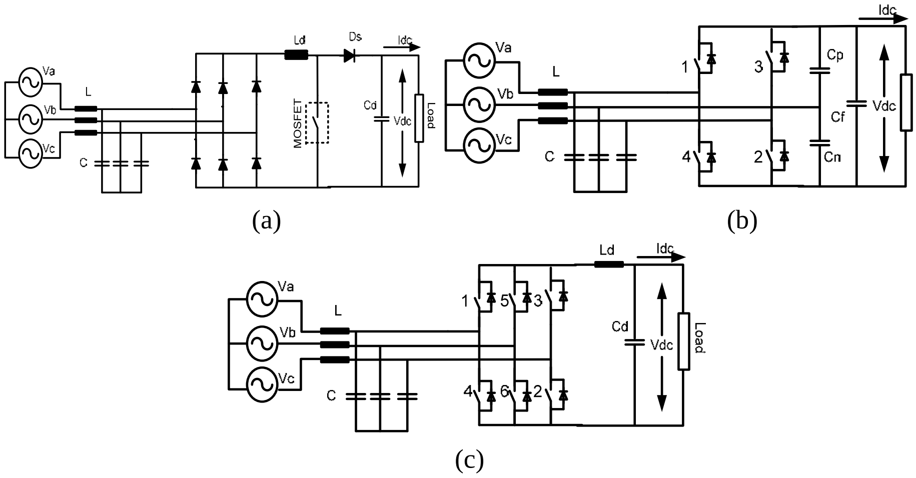


Fig. 10. (a) Three-phase one-device unidirectional boost converter with input ac filter. (b) Three-phase four-device unidirectional boost converter with input ac filter. (c) Three-phase six-device unidirectional boost converter (VSI-bridge)with input ac filter.

Although active PFC can be achieved by any basic topology, the buck converter, boost converter and buck-boots converter is the most popular topology used in PFC applications, for the following reasons: The line voltage varies from zero to some peak value typically, hence; a step up converter is needed to output a dc bus voltage of 220V/ 50Hz or more. The part of paper to propose of used two-device unidirectional boost converter or bridgeless boost topology shown in Fig.7(b).It is an attractive solution for application, where power density and efficiency are important. The bridgeless boost converter solves the problem of heat management in the rectifier diode bridge, and another disadvantage of this topology is the floating input line with respect to the PFC stage ground, which makes it is impossible to sense the input voltage without a low frequency transformer or an optical coupler. Also in order to sense the input current, complex circuitry is needed to sense the current in the MOSFET and diode paths separately, since the current path does not share the same ground during each half-line cycle, as in reference (e.g.[35]-[43]. The bridgeless boost converter has the filter inductors on the input side, which provides a smooth continuous input current waveform. The continuous conduction mode (CCM), the following are design equation for the CCM operated bridgeless boost converter. The component are identified, the efficiency of only PFC stage is generally in the range of 90-95%,Vac is the (rms) ac line input voltage, the filter inductor value and its peak current and ac current input are determined based on the specified maximum inductor current ripple as in equations Eq(14) - Eq(15).

$$I_{ac(in)} = \frac{P_{out}}{(\eta).V_{ac(in)}}, \quad I_{L(peak)} = \frac{2\sqrt{2}.(P_{out})}{(\eta).V_{ac(in)}} \tag{14}$$

$$L_{\max} = \frac{V_{ac(in)}\left(\frac{Vdc_{out}}{\sqrt{2}} - V_{ac(in)}\right).\eta}{\sqrt{2}.Vdc_{out}.P_{out}.f_{sw(kHz)}} \tag{15}$$

$$f_{sw(kHz)} = \frac{\eta.V_{ac(in)}{}^{2}}{2.L_{\max}.P_{out}}\left(1 - \frac{\sqrt{2}.V_{ac(in)}}{Vdc_{out}}\right) \tag{16}$$

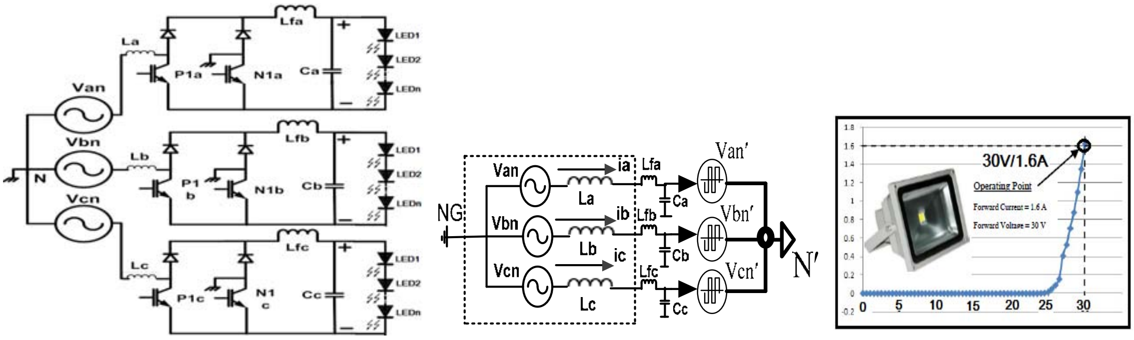
$$t_{on} = \frac{2.L_{\max}.P_{out}}{\eta.(V_{ac(in)})^{2}}, \quad t_{off} = \frac{\frac{2.L_{\max}.P_{out}}{\eta.(V_{ac(in)})^{2}}}{\left(\frac{V_{out}}{\sqrt{2}.V_{ac(in)}}\right) - 1} \tag{17}$$

$$C_{dc(out)} = \frac{P_{out}}{2.\pi.V_{ripple}.f_{in(Hz)}.V_{out}} \tag{18}$$

Switching frequency is the minimum desired switching frequency as in Eq(16) and the maximum on time *t(on)* occurs at the minimum line input voltage and maximum output power, and the off time *t(off)* is a maximum at the peak of the ac line voltage and approaches zero at the ac line zero crossings as in Eq(17).The output capacitor value, where line the ac input frequency and voltage ripple (peak-peak) output voltage ripple as in Eq(18).

IV. PHASE-MODULAR Y-RECTIFIER.

Owning to prevalence of power electronics system, many problems with regard to diode rectifiers, one of problems is a low input power factor, and another is current harmonics. These are reasons reduce the harmonic component of the input current, as in reference (e.g.[44]-[46]. The requirement placed on active PFC rectifier system can thus be summarized as follows: the Standard EN 6100-3-2 if < 16A and EN 6100-3-4 if > 16A,The harmonics <5% at rated power is often required, ohmic fundamental mains behaviour (cos(ϕ)>0.99), compliance with specifications regarding electromagnetic, especially conducted interference emissions by means of suitable EMI filtering. The output dc voltage relative to the main voltage, a system with boost type, buck type, buck-boost-type characteristic has to be provided. As the one method to consider begins with plotting the I–V data on a semi-log graph, indicative of the exponential nature of the current voltage relationship as shows in Fig.11(c).



(a) (b) (c)

Fig.11. The main proposed power circuit diagram (a) Phase-Modular Y-Rectifier system, boost–type (bridgeless) PFC Rectifier or Symmetrical two-device unidirectional boost converter (b) equivalent circuit of the ac system part with couple the EMI input filter form AC power system (c) typical Characteristics of operation voltage and current for a typical power LED (30V / 1.6A), current–voltage curve for an LED. Note that once the LED turns on, the current increases very quickly with increasing voltage. Be especially careful in this region not to exceed the maximum current.

As shows in Fig. 11(b), the equivalent circuit of the ac system part with the EMI input filter (Lf ,C) form connection PMSG, the ac currents is via the differences of the mains phase voltages to formed at the input of the rectifier stages shows in Eq (19).An offset of the reference phase voltage values (Va,Vb,Vc) is formed which, however, cannot be set by the phase current controllers because of the free star-point N′, ia + ib + ic = 0 is unalterable. The phase currents thus keep their sinusoidal shape and the symmetry to the time axis.

$$\frac{d}{dt}(Ia + Ib + Ic) = 0 \qquad (19)$$

The star-point voltage u(N′GN) with consideration of and the star-point N′ is not connected to an artificial star-point, which could be formed e.g. by filter capacitors, a switching frequency voltage U(N′GN) occurs between N′ and the mains star-point GN consideration of results shows in Eq(20) and Eq(21), Remark, voltage drop in the EMI filter (Lf ,C) is three phase not shows equation due to not take in to consideration.

$$\mathrm{U(N'GN)} = -\frac{1}{3}(Ua\mathrm{N'} + Ub\mathrm{N'} + Uc\mathrm{N'}) \qquad (20)$$

$$\begin{aligned} La\frac{d}{dt}Ia &= UaGN - (Ua\mathrm{N'} + UN'GN) \\ Lb\frac{d}{dt}Ib &= UbGN - (Ub\mathrm{N'} + UN'GN) \\ Lc\frac{d}{dt}Ic &= UcGN - (Uc\mathrm{N'} + UN'GN) \end{aligned} \qquad (21)$$

The input voltage required for the impression of the input current, the same conditions are present for the phase modules as for single-phase PFC rectifiers supplied from a mains phase. In connection with the balancing of the output voltages it should be pointed out that a symmetrical mains current system can be surprisingly also maintained for unequal distribution of the input power to the three outputs, i.e. is also possible for asymmetrically loaded outputs.

V. CONTROL SPWM TECHNIQUES

The past of control technique of the PWM converter, which enables the converter to achieve the unity power factor with voltage source sensor and DC- current load sensor. The technique Y-Rectifier in a three phase star connection with floating star point *N´*, the combines single-phase modules output stages with unity power factor rectifier and therefore represents an interesting concept for the realization of high power supply systems, with separate dc sources by DC links based LED driver topology. In Fig 11(a), as shows the few circuit diagrams of Phase-Modular Y-Rectifier DC-link and the control strategy Phase-Modular Y- Rectifier SPWM rectifiers. This new breed of AC/DC converters gives excellent power quality indices like nearly unity input power factor, negligible THD in source current, reduced ripple factor of load voltage and fast-regulated load voltage. It is employed to reduce the dc-link voltage ripple supply currents, even in the case of unbalanced as reference in (e.g. [44] - [46]). The control technique proposed used in the rectifier is the One Cycle Control, consideration in Fig 12. In the negative half cycle of the line voltage where P1a is turned on, the current will flow in the reverse direction through the switch itself, and when P1a is turned off, the current will flow in the reverse direction through the antiparallel diode. In the positive half line, when N1a is turned on, the current will flow in the reverse direction through itself and, when N1a is turned off the current will flow in the reverse direction through the antiparallel diode. In Fig.11(a) and Fig.12, The proposed the control of a two-level *Y-Rectifier* in a three phase star connection with separated DC-source for power driver power LED . The control system technique, this is the only control technique that allows getting high power factor in continuous conduction mode without the necessity of a reference signal for the current. This technique consists of two control loops, a voltage loop and a current loop. The duty cycle (D) of switching command pulse depends on the input voltage value, allowing that the current loop keeps the sine wave shape of input current analogous to input voltage in phase and form. The Command VDC* and feedback DC output voltage loop (VDC), due to compared different signal value regulations, the feed forward loops of ac input voltage (Van,Vbn,Vcn) of AC line power, and voltage going through pass abs absolute voltage (ABS),and output the average current (Idc) by mean of switching the duty cycle of PWM. The difference of signal from both paths is detected for error with output signal from the process then passes PI-controller.

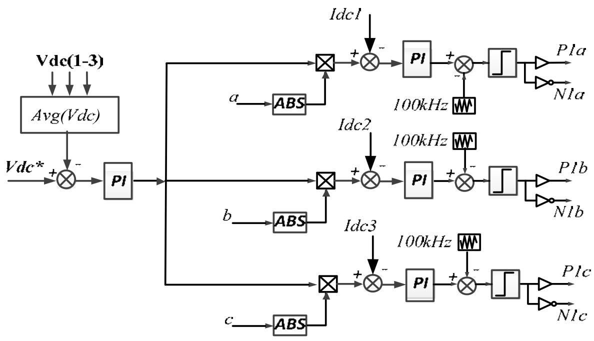
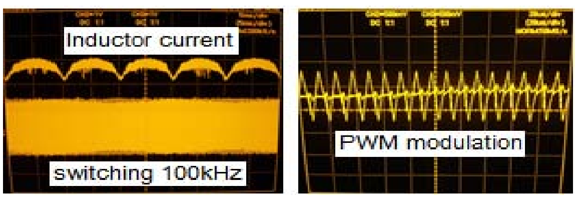


Fig.12. The control proposed of a two-level *Y-Rectifier* for proposed in a three phase star connection with separated DC-source LED driver topology.

VI. STUDY RESULTS

As show in Fig.13, the controller of symmetrical two-device unidirectional boost converter, the boost converter can operated in two modes of PFC operation: discontinuous (DCM) and continuous mode (CCM). Discontinuous mode (DCM) is when the boost converter’s MOSFET is turned on when the inductor current reaches zero, and turned off when the inductor current meets the desired input reference voltage. Continuous mode (CCM) typically suits SMPS power levels greater than 100W. This is where the boost converter’s MOSFET does not switch on when the boost inductor is at zero current, instead the current in the energy transfer inductor never reaches zero during the switching cycle. Fig.13 shows modelled waveforms to illustrate the inductor current and switching frequency.



(a) (b)

Fig. 13. For high performance and tested prototype in the laboratory, (a) with continuous mode with inductor (line) current and (b) switching frequency (on-off) about 100kHz

For high performance and tested prototype in the laboratory as shows in Fig.(14). The comparisons data with the experimental tester of results the single phase rectifies (4 - pulses) being delivered to a power factor corrected supply for a non-PFC unit and after improvement with PFC control with Phase-Modular Y-Rectifier converter system can be improved sinusoidal current flow created by the input power converter stage and can be reduce input current power factor and harmonic current. The power circuit of diagram of the Phase-Modular Y-Rectifier converter system. The hard ware prototype consisted of not only the main and controller circuits but also have digital and analog elements. The parameter tester consist of the AC power about rated power per phase 500VA, frequency 50 Hz, and Phase-Modular Y-Rectifier system with the parameter consist of switching 100kHz, EMI, L-Filter (300uH), EMI, C-Filter (1uF), the output voltage (Vdc) for power LED about (30VDC), Output(Inductor) about 0.6mH and Output (capacitor) about (470uF) and PI-controller (kp=4,ki=0.084ms).The program simulation using by MATLAB and PSIM for Power Electronics, for realize that can solve the current power factor and reduce harmonic current.

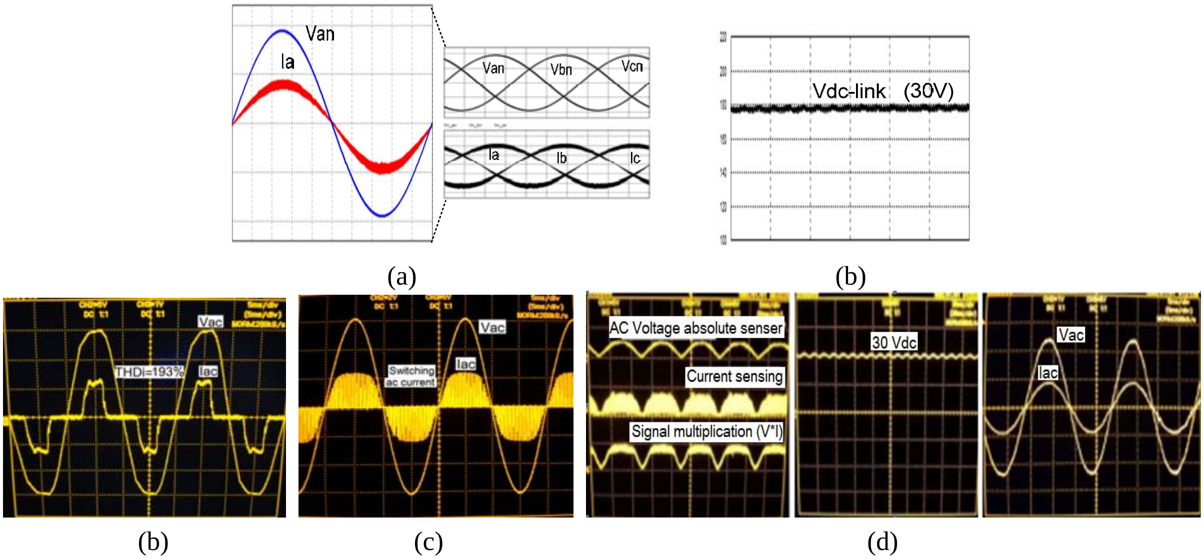


Fig. 14. Phase-Modular Y-Rectifier system, boost–type (bridgeless) PFC Rectifier Data collected by MATLAB and PSIM simulation are used in comparison with the experimental tester of results. (a) Results of Simulation, voltages and line current and output voltage (Vdc-link), (b) Before implements with experimental of results of depicts the effects of current quality this circuit with the single phase rectifies (4 - pulses) being delivered to a power factor corrected supply for a non-PFC unit (c) Experimental of results switching ac current with continuous mode with inductor (line) current and switching frequency (on-off) about 100kHz and (d) this sensor consist of feed forward voltage (ABS), and current feedback (Idc), the output voltage (Vdc-link) per set and AC input current power factor and harmonic current reduced vie voltages (Phase) and current (line).

VII. CONCLUSION

This work presents described proposed Phase-Modular Y-Rectifier connection three phase balance phase current AC/DC conversion system, boost–type (bridgeless) PFC Rectifier. The research papers, conclusions for study and evaluate the circuit can be operation and suitable for use with LED 50 W(LED lamp), the LED package Surface Mouth Type rated 30 Vdc /1.65A. For high performance method and tested of the result for realize that can solve power factor and reduce harmonic current and the control can make it the input ac line current of LED driver topology, the PFC control can make it the input line current waveform distortion results of the lower harmonics distortion. In particular, Phase-Modular Y-Rectifier converter is the topology could generated a significant three phase balance sing current. The data collected by MATLAB Simulation are used in comparison with the experimental tester of results. In addition, this study also provides guideline to further analyze and improve power quality in electrical system.

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