

COMPACT ELECTRONIC BALLAST FOR CIRCULAR LAMPS

Field of the Invention

The present invention relates generally to electronic ballasts and, in particular, to electronic ballasts for use with circular lamps.

Background Art

Electronic ballasts are used to regulate the flow of current through a fluorescent lamp.

Typical electronic ballasts for use with a circular fluorescent lamp include an electronic circuit which includes a printed circuit board and various other components mounted on the board. A 4-way connector for connecting the ballast to a lamp is connected to an output of the electronic circuit by four long wires. A 2-way connector for connecting the ballast to an electrical power supply outlet is connected to an input of the electronic circuit by a pair of long wires. The electronic circuit is housed in a plastic casing such that the various wires extend from the casing and are exposed.

The electronic ballast is typically installed in a lamp fitting and connected to a lamp which is also installed in the fitting by securing the casing of the ballast to the fitting and then connecting the 4-way connector to the lamp, and connecting the 2-way connector to the electrical power supply outlet.

In use, the electronic circuit outputs a high-voltage across the four wires which connect the 4-way connector to the electronic circuit. To reduce the risk of a person such as a user or installer who touches the wires from being electrocuted, the wires are usually insulated by safety insulation sleeves. However, despite this precaution, the exposed wires can still present a safety risk. Also, the safety insulation sleeves are costly and their inclusion can add significantly to the overall cost of the ballast.

As a consequence of the four high-voltage wires of the electronic ballast being exposed, the ballast is classified as a controlled item when being imported

into certain markets such as Singapore. Such items need to be subjected to regular batch testing when they are imported into such markets.

The inclusion of the four high-voltage wires which connect the 4-way connector to the output of the electronic circuit also adds to the overall cost of the ballast.

The need to secure the casing of the electronic ballast to the lamp fitting, and to connect the ballast to the electrical power supply with a 2-way connector can add to the work involved in installing the ballast and a circular fluorescent lamp in a new lamp fitting, and can also add to the work involved in replacing a faulty ballast.

Also, the electronic ballast cannot be used as a common ballast for 22 to 40 watt lamps, or for tri-phosphor coated and normal fluorescent lamps.

It is against this background that the present invention has been developed.

Summary of the Invention

It is an object of the present invention to overcome, or at least ameliorate, one or more of the deficiencies of the prior art mentioned above, or to provide the consumer with a useful or commercial choice.

Other objects and advantages of the present invention will become apparent from the following description, taken in connection with the accompanying drawings, wherein, by way of illustration and example, a preferred embodiment of the present invention is disclosed.

According to a first broad aspect of the present invention, there is provided an electronic ballast for use with a lamp, the ballast comprising an electronic circuit, a casing in which the circuit is housed, a power connector for connecting the circuit to an electrical power supply, and a lamp connector for connecting the circuit to a lamp, the ballast being characterized in that the lamp connector is mounted on the casing.

Preferably, the ballast is adapted for use with a circular lamp. It is also preferred that the ballast is adapted for use with a fluorescent lamp.

It is preferred that the electronic circuit includes a printed circuit board. Preferably, the power connector and the lamp connector are secured to the printed circuit board. It is particularly preferred that the power connector and the lamp connector are soldered to the printed circuit board.

Preferably, the casing includes a first part, and a second part secured relative to the first part. In a preferred embodiment, the first part is a top part of the casing, and the second part is a bottom part of the casing. It is preferred that the casing also includes a plurality of screws which secure the first and second parts relative to each other. Alternatively, the casing may include a plurality of tapered studs and a plurality of hollow supports for receiving the studs such that the first and second parts are thereby secured to each other. In a preferred form, the first part and the second part define a first opening which receives the power connector, and a second opening which receives the lamp connector. Preferably, the lamp connector is clamped between the first and second parts of the casing. Preferably, the power connector is also clamped between the first and second parts of the casing. Preferably, the electronic circuit is mounted on the second part and the first part includes a plurality of projections which press against the circuit so that the circuit is thereby clamped between the first and second parts.

In one preferred embodiment, the power connector includes a pair of wires. In an alternative preferred embodiment, the power connector is a socket.

Preferably, the lamp connector is a 4-way connector.

According to a second broad aspect of the present invention, there is provided a lamp assembly comprising a lamp, and an electronic ballast according to the first broad aspect of the present invention secured to the lamp.

Preferably, the electronic ballast is permanently secured to the lamp. In a particular preferred form, the electronic ballast is permanently secured/assembled next to a 4-way connector of the lamp and is part of the lamp.

Brief Description of the Drawings

In order that the invention may be more fully understood and put into practice, a preferred embodiment thereof will now be described with reference to the accompanying drawings, in which:

Figure 1 depicts an electronic ballast according to a first preferred embodiment of the present invention; and

Figure 2 depicts an electronic ballast according to a second preferred embodiment of the present invention.

Best Mode(s) for Carrying out the Invention

Figure 1 depicts an electronic ballast 20 according to a first preferred embodiment of the present invention. Ballast 20 is designed to be used with a circular fluorescent lamp (not depicted), and includes an electronic circuit 21 which includes a printed circuit board 22 on which the various other components of the circuit 21 are mounted and connected to each other. For ease of illustration, the various other components of the circuit 21 have not been depicted in figure 2.

Circuit 21 is designed to operate with a 20 to 260 Volt AC power supply which has a frequency of 50 or 60 Hertz, and to be used with circular fluorescent lamps having a current wattage of 20 to 40 W. During usage, one preferred embodiment of the circuit 21 is able to supply a lamp with an electrical current of between 0.11 to 0.17 Amps with a power factor of 0.66 to 0.68. In another preferred embodiment, the circuit 21 operates with a current between 0.084 to 0.125 Amps with a power factor of 0.96 to 0.97. Circuit 21 is designed to be able to reduce the energy consumption of the lamp by 23% to 30%, without the need for a starter. Ballast 20 is able to provide a soft instant start. Moreover, ballast 20 is able to provide a non-flickering light and better/higher luminance.

The design and construction of electronic ballast circuits for use with circular fluorescent lamps as well as other types of lamps are well-known in the art. Therefore, the design and construction of the circuit 21 will not be described any further here.

A 4-way lamp connector 23 is soldered to the printed circuit board 22 so that the connector 23 is thereby secured relative to the board 22. Also, the connector 23 is connected to an output of the circuit 21. The connector 23 can be for any one of a T2 through to a T12 circular fluorescent lamp.

Although not depicted in figure 1, the ballast 20 also includes a power connector for connecting the electronic circuit 21 to an electrical power supply which is also not depicted in figure 1. The power connector includes a pair of wires much like the pair of wires of the previously described prior art ballast which are for connecting the electronic circuit of that ballast to an electrical power supply. The wires of the power connector are soldered to the printed circuit board 22 such that the power connector is thereby secured to the printed circuit board 22 and is also connected to an input of the circuit 21.

The lamp connector 23 and the power connector of the ballast 20 are secured to the circuit board 22 such that they are located at opposite ends of the board 22.

Ballast 20 also includes a casing 24 in which the electronic circuit 21 is housed. The casing 24 includes a plastic top part 25, and a plastic bottom part 26. The top part 25 includes a substantially rectangular top wall panel 27, a pair of opposing and substantially rectangular side wall panels 28 extending downwardly from the top wall panel 27, and a pair of opposing and substantially rectangular end wall panels 29 extending downwardly from the top wall panel 27.

Each side wall panel 28 includes a series of vents 30 which extend into the top wall panel 27.

Each end wall panel 29 includes an edge 32. One of the end wall panels 29 also includes a first rectangular recessed portion 33 which extends into the end wall panel 29 from the edge 32 of that panel 29, a second rectangular recessed portion 34 which extends further into the end wall panel 29 from the first recessed portion 33, and a semicircular-shaped thickened portion 35 which extends around the second recessed portion 34. The other end wall panel 29 includes a substantially rectangular recessed portion 36 which extends into the end wall panel 29 from the edge 32 of that panel 29.

A plurality of projections 37, which are located in the interior of the top part 25, extend from the side wall panels 28 and end wall panels 29.

The bottom part 26 includes a substantially rectangular bottom wall panel 38 which has a plurality of tapered studs 39 extending from it. A pair of opposing end wall panels 40 extends upwardly from the bottom wall panel 38. One of the end wall panels 40 includes a rectangular recessed portion 41, and a semicircular-shaped thickened portion 42 which extends around the recessed portion 41.

A plurality of hollow supports 43 extend from the interior of wall panel 27 and are supported by ribs (not depicted) that are connected to the panels 28. Each support 43 is aligned with a respective tapered stud 39. Studs 39 are received by hollow ends of the supports 43 such that the bottom part 26 is thereby fastened to the top part 25.

The printed circuit board 22 of the electronic circuit 21 rests on the supports 37.

The wires of the power connector are arranged so that they extend through the recessed portion 41 of the end wall panel 40.

The top part 25 of the casing 24 is mounted on top of the bottom part 26 such that the edges 31 of the side wall panels 28 and the edges 32 of the end wall panels 29 rest on top of the bottom wall panel 38, and such that the one of the end wall panels 40 is received by the recessed portion 36, and the other end wall panel 40 is received by the first recessed portion 33. Also, the lamp connector 23 is mounted on the casing 24 such that the connector 23 is received by the recessed portion 36.

The recessed portions 34 and 41 cooperate to define a rectangular first opening 44 which receives the two wires of the power connector such that the two wires extend through the opening 44.

The recessed portion 36 and the end wall panel 40 which it receives cooperate to define a generally rectangular second opening 45 which receives the lamp connector 23.

The top part 25 is secured relative to the bottom part 26 by the studs 39

which are inserted into holes in the ends of the supports 43. Pressing the studs 39 into the holes in the ends of the supports 43 not only secures the top and bottom parts 25, 26 relative to each other, it also causes the lamp connector 23 to be securely clamped between the top part 25 and the bottom part 26, and also presses the projections 37 against the printed circuit board 22 so that the board 22 is thereby clamped between the top part 25 and the bottom part 26.

Figure 2 depicts an electronic ballast 50 according to a second preferred embodiment of the present invention. Ballast 50 is similar to the ballast 20, and many of the features of the ballast 50 correspond to features of the ballast 20. Therefore, for convenience, the reference numbers which have been used to reference such features of the ballast 50 are the same as the reference numbers which have been used to reference the corresponding features of the ballast 20.

Instead of the power connector of the ballast 50 including a pair of wires which are secured to the printed circuit board 22, the ballast 50 includes a power connector which is in the form of a power input socket 51. Socket 51 is soldered to the printed circuit board 22 such that the socket 51 is thereby secured to the printed circuit board 22 and is also connected to the input of the circuit 21.

Unlike the end wall panel 40 of the ballast 20, the end wall panel 40 of the ballast 50 does not include a recessed portion 41 or a thickened portion 42.

Also, pressing the studs 39 into the holes in the ends of the hollow supports 43 of the ballast 50 to secure its top and bottom parts 25, 26 relative to each other not only causes the lamp connector 23 of the ballast 50 to be securely clamped between the top part 25 and the bottom part 26, it also presses the end wall 40 against the socket 51 so that the socket 51 is thereby clamped between the top part 25 and the bottom part 26.

Mounting the lamp connector 23 directly on the casing 24 is advantageous in that it eliminates the need to have exposed high-voltage wires extending between the casing 24 and the connector 23, which reduces the safety hazard presented by the ballast 20, 50.

Eliminating the high voltage wires also removes the cost associated with including such wires as well as the cost to insulate the wires with safety

insulation sleeves.

Also, because it does not include exposed high-voltage wires extending from the casing 24 to the lamp connector 23, the ballast 20, 50 may be classified as a non-controlled item for the purposes of importing it into markets such as Singapore. Such items do not need to be subjected to regular batch testing when they are imported in to such markets.

Mounting the lamp connector 23 directly on the casing 24 allows the whole ballast 20, 50 to be secured to the lamp by the lamp connector 23 without having to secure the casing 24 to the ceiling, lamp fitting or other support structure with screws or other fixtures/fasteners. Securing the ballast 20, 50 to the lamp in this way simplifies the installation of the ballast 20, 50 and the lamp in a new lamp fitting. It also allows a person to more easily and quickly replace defective magnetic or electronic ballasts without them having to firstly undergo a lot of training.

The ballast 20, 50 is sufficiently lightweight that securing it to the lamp with just the lamp connector 23 will not cause rotation of the connector of the lamp which the connector 23 connects to, and the ballast 20, 50 is therefore safe to use.

The only other connection which needs to be made when the ballast 20, 50 is secured to the lamp by just the lamp connector 23 is to connect the power connector of the ballast 20, 50 to the electrical power supply. The power connector wires of the ballast 20 can be connected to an electrical power supply with a 2-way connector terminal. To allow for easier replacement of faulty ballasts, and to eliminate the current need to use 2-way connectors for connection of the ballast to the power supply and the lamp, the power input socket 51 of the ballast 50 can be connected to an electrical power source by a power plug which is connected to the power source by a power cord.

An earth cable can be separately fitted on to the metal (e.g. steel) of the lamp fitting which the ballast 20, 50 is installed on.

The ballast 20, 50 is slim and is also small in size. Consequently, the ballast 20, 50 is unlikely to create any issues of preventing a cover of the circular

lamp fitting from being installed after installation of the ballast 20, 50.

The ballast 20, 50 can also be connected in series to an existing magnetic ballast in an old lamp fitting, and can increase its existing power factor higher. The ballast 20, 50 is capable alone of achieving a power factor of above 0.95 (i.e. 95%). In particular, it is capable of achieving a power factor of 0.96 to 0.97 (i.e. 96% to 97%). Moreover, it is capable of handling abnormal lamp conditions, and is able to self-power down if the lamp it is installed in is in poor condition or is broken.

The ballast 20, 50 may be used as a common ballast for 22 to 40 watt lamps, or for tri-phosphor coated and normal fluorescent lamps.

In other preferred embodiments, the lamp connector 23 may be connected to the electronic ballast circuit 21 by a plurality of wires/conductors which are completely contained within the casing 24 so that they are not visible from outside the casing 24 and do not pose a safety hazard to users/installers, thus ensuring better safety for users/installers of the electronic ballast 20. For example, if the lamp connector 23 is a 4-way connector which is connected to the electronic ballast circuit 21 by four wires/conductors, those wires/conductors are preferably contained or housed within the casing 24.

In other preferred embodiments, the lamp connector 23 may be clipped within the casing 24.

The electronic ballast 20, 50 allows for easy replacement of installed ballasts. It typically takes less than 1 minute to replace an existing ballast with the ballast 20, 50. This compares to more than 15 minutes which is typically required to replace a ballast with a conventional magnetic ballast.

Electronic ballast 20, 50 is able to reduce the problem encountered with conventional magnetic ballasts whereby the connector of such ballasts and the starter holder are often degraded by heat produced by the magnetic ballast.

The design of the ballast 20, 50 allows it to be classified as an uncontrolled item in Singapore compared to existing magnetic ballasts and other electronic ballasts which are classified as controlled items. This is due to the elimination of the exposure of the high voltage wires/conductors/cables which

connect the lamp connector 23 to the electronic ballast circuit 21.

Eliminating the exposed high voltage wires/conductors/cables which connect the lamp connector 23 to the electronic ballast circuit 21 enables the ballast 20, 50 to be attached directly on to a lamp (e.g. a circular fluorescent lamp), thereby making the lamp a self-integrated ballasted lamp.

The casing 24 of the ballast according to the present invention may be any suitable size and shape, and is not limited to having the particular size and rectangular shape of the ballasts 20, 50. For example, in another preferred embodiment, the casing 24 may have a cylindrical shape. Irrespective of the particular shape of the casing 24, the lamp connector 23 is mounted/held/secured to the casing 24. Also, if present, the wires/conductors/cables/leads which connect the connector 23 to the electronic ballast circuit 21, are fully enclosed in the casing 24.

After connecting the ballast 20, 50 to the lamp, the only other connection that needs to be made is to connect the ballast 20, 50 to a power source. The ballast 20 includes two wires for connecting the ballast 20 to a power source, and the ballast 50 includes a socket for connecting the ballast 50 to the power source. The two wires of the ballast 20 and the socket of the ballast 50 can be connected to the power source with a 2-way connector terminal or a power cord.

The wires of the power connector/cable of the ballast 20 are clamped between the top part 25 and the bottom part of the casing 24. This is advantageous because it dispenses with the need to use a cable or wire to fasten down the power cable as needs to be done with the power cable of most prior art electronic ballasts.

It will be appreciated by those skilled in the art that variations and modifications to the invention described herein will be apparent without departing from the spirit and scope thereof. The variations and modifications as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of the invention as herein set forth.

Throughout the specification and claims, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising",

will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

Throughout the specification and claims, unless the context requires otherwise, the term "substantially" or "about" will be understood to not be limited to the value for the range qualified by the terms.

Also, future patent applications for the invention which is the subject of the present application may be filed in Singapore or overseas on the basis of, or claiming priority from, the present application. It is to be understood that the following provisional claims are provided by way of example only, and are not intended to limit the scope of what may be claimed in any such future application. Features may be added to or omitted from the provisional claims at a later date so as to further define or re-define the invention or inventions.

It will be clearly understood that, if a prior art publication is referred to herein, that reference does not constitute an admission that the publication forms part of the common general knowledge in the art in Singapore or in any other country.

CLAIMS:

1. An electronic ballast for use with a lamp, the ballast comprising an electronic circuit, a casing in which the circuit is housed, a power connector for connecting the circuit to an electrical power supply, and a lamp connector for connecting the circuit to a lamp, the ballast being characterised in that the lamp connector is mounted on the casing.
2. The electronic ballast of claim 1, wherein the electronic circuit includes a printed circuit board, and the power connector and the lamp connector are secured to the printed circuit board.
3. The electronic ballast of any one of the preceding claims, wherein the casing includes a first part and a second part secured relative to the first part.
4. The electronic ballast of claim 3, wherein the first part is a top part of the casing, and the second part is a bottom part of the casing.
5. The electronic ballast of claim 3 or 4, wherein the first part and the second part define a first opening which receives the power connector and a second opening which receives the lamp connector.
6. The electronic ballast of claim 5, wherein the lamp connector is clamped between the first and second parts of the casing.
7. The electronic ballast of claim 6, wherein the power connector is clamped between the first and second parts of the casing.
8. The electronic ballast of any one of claims 3 to 7, wherein the electronic circuit is mounted on the second part and the first part includes a plurality of projections which press against the circuit so that the circuit is thereby clamped between the first and second parts.
9. The electronic ballast of any one of the preceding claims, wherein the power connector includes a pair of wires.
10. The electronic ballast of any one of claims 1 to 8, wherein the power connector is a socket.
11. The electronic ballast of any one of the preceding claims, wherein the lamp connector is a 4-way connector.

12. A lamp assembly comprising a lamp, and an electronic ballast according to any one of claims 1 to 11 secured to the lamp.
13. An electronic ballast for use with a lamp, the ballast being substantially as hereinbefore described with reference to figure 1 or 2 of the drawings.