



Installation and Operating Instructions for Electronic Ballasts by ZED GmbH type "standard"

Please read this before installing the ballasts!

Important safety notice:

Risk of electric shock! High voltage may occur inside the ballast and at the ballast terminals. Please refer to the appropriate safety rules.

1. The ballast may only be used to operate uv lamps.
2. The ballast does not provide galvanic isolation from mains.
3. Without written permission of the manufacturer the ballasts may not be used for equipment that is used for medical treatment or for life saving measures.
4. The ballast may only be installed by qualified personnel. All appropriate safety rules must be fulfilled.
5. The ballast is only intended for use in dry and chemical and biological inactive environment.
6. The ballast has to be mounted upright with the mains terminals at the bottom side. It is recommended to mount the ballast at a thermal conductive heat dissipating base plate.
7. The ballast may only be operated with the uv lamp, specified in the data sheet.
8. The ballast may only be wired according to the wiring diagram that is shown at the case. Lethal voltages at the complete system can result from contact between lamp and water. A separate protective grounding of the complete system is mandatory.
9. Make sure that the line voltage is within the tolerances given in the data sheet (either 100V AC \pm 10%, 115V AC \pm 10%, 200V AC \pm 10% or 230V AC \pm 10% according to the data sheet). Otherwise the ballast may be damaged.
10. Solid wire and braid wire may be used for wiring. Use only wire gauges, specified in the data sheet. The terminals are intended to clamp braid wire without wire ends. If wire ends are used make sure they match to the terminal specifications. Do not use soldered wire ends. Check wiring for safe connection. This is very important after mechanical stress such as transport.
11. Make sure all applicable safety rules are fulfilled. Safety rules may vary in the country where the ballast is operated.
12. Make sure that under no circumstances imbalances in 3 phase line supply will lead to line voltage outside the specified line voltage range of the ballast.
13. Overvoltage at line terminals will damage the ballast, even if the overvoltage occurs just for short time.
14. Short circuits, wrong wiring and loose contacts may damage the ballast.
15. Never interrupt wiring to the lamp while the ballast is operating.
16. During switching on inrush current may reach high values up to 100A in the first 2ms and up to 15A in the first 15ms. Then it fades to normal mains current. The inrush current depends on the instantaneous value of the sinusoid line voltage at the moment of start-up. It is recommended to turn on groups of ballasts separately. We recommend slow-blow lead fuses for protection.
17. Do not mount the ballasts in an environment with high mechanical stress such as vibrating assemblies or mechanical shock.
18. Make sure all wires, connectors and terminals provide sufficient isolation to each other and with respect to earth ground. Under all circumstances keep water away from the whole electrical assembly. Watch out for water leaks.
19. The cable length between the ballast and the lamp must not exceed 2,9 m.
20. The temperature at the t_c point, marked at the ballast must never exceed the value specified in the datasheet.
21. If ballasts are operated in parallel, EMI emissions and harmonic distortions may add up and exceed the limits, given in standards. In that case appropriate filters may be used. CE compliance is guaranteed only for operation of a single ballast.
22. Damaged or worn lamps may overload the ballast, resulting in a possible damage. Replacing lamps within the service interval, given by the lamp manufacturer is mandatory.
23. The load for the fault detecting contacts has to be kept within the limits specified in the datasheet. It is recommended to use parallel operation of contacts instead of serial operation in case of summarizing fault detection. The isolated contacts of the error relay do not provide protection against electric shock. All wires of the error control loop have to be installed with appropriate protection against contact according to applicable regulations. The wires of the error control

loop should never be accessed from outside the grounded cabinet without protection against contact. You may use isolation relays to access the control loop from outside the cabinet.

24. Danger! While start up of ballast, in case of lamp defects or due to wrong lamp wiring, high voltages up to 1200V_{eff} may occur at the output terminals of the ballast. The duration of these high voltages is limited by internal protection circuits and may last for a couple of milliseconds. After turning off and on of line voltage the high voltages may occur again for a short time.

25. Do not add any components like switches, capacitors or ignition devices at the wires in between the ballast and the lamp because it may destroy the ballast.

26. In case of preheat ballasts (-PH) the lamp filaments are heated up before ignition of the ballast. During that time the green LED is on, indicating the correct operation of the preheat process, even if the lamp is not turned on yet. Lamp ignition will happen after the specified preheat time is over. The preheat time is specified on the ballast label.

27. In case of step dimming ballasts (-SD) the lamp current can be reduced by applying an external DC control voltage. During turn on of the ballast this DC control voltage has to be 0V DC, otherwise the ballast may be destroyed. For a long lamp life it is recommended to operate the ballast for at least 10 minutes at 100% current before the lamp current is reduced by external DC control voltage. Even by keeping this rule, the lamp life may be shortened by operating in dimming mode. Avoid long lamp operation at a lamp surface temperature that is too low.

28. For more details please refer to the operation manual or to our web page www.z-e-d.com.

Important information

Power consumption:

The low pressure lamp ballasts will keep any fluctuations in power in the lamps within narrow limits. This is only true for the specified supply voltage range.

Specified Power:

The specified power of ballasts and lamps is based on a comparable uv radiation of an equivalent conventional ballast using choke inductor. Due to better efficiency the electrical lamp power is lower at high frequency operation. So an electronic ballast has a lower energy consumption compared to a conventional ballast (e.g. a 200W uv radiator system using conventional ballast consumes 200W electrical power, but an electronic ballast uses only 160W electrical power).

Efficiency:

The efficiency of the ballast is determined by the ratio of the electrical power that is delivered to the lamp and the electrical power that is drawn from the power line. The efficiency of the ballasts, manufactured by ZED GmbH exceeds the value of 90%. The remaining power is transferred to heat and has to be leaded away from the ballast.

Ignition:

The mechanism that ignites the lamps is slower at lower temperatures. Starts will also become unreliable if input voltage is reduced.

Parasitic wiring capacitances will affect ignition of lamp. Therefore the wires from ballast to lamp should be kept as short as possible.

In case of defective lamp the ballast will go into shut down mode and the red LED will flash. If this happens the reason must be found. Repeated rapid switching on and off can lead to failure of the ballast.

Do not turn off and on the ballast within less than 10 seconds.

Do not connect any additional components such as capacitors, switches or ignition devices to the output of the ballast.

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Power Factor:

Electronic ballasts do not have significant reactive power consumption. Expensive components for compensating of reactive power don't have to be added. The electronic ballasts do also have active power factor correction that keeps harmonic distortion of line current within limits, given by national and international standards.

Lifetime:

The lifetime of a ballast is determined by the temperature and by the failure rate of the electronic components. Electronic components can be destroyed by overheating, resulting in failure of the ballast. To avoid this, the maximum permitted temperature t_C , measured at the marked point at the ballast should not exceed the specified limit. The t_C -temperature has to be checked individually for each ballast in a cabinet to ensure sufficient heat dissipation.

Overheating will drastically shorten the lifetime of the ballast (see data sheet for details).

In general, lower t_C -temperature will additionally increase lifetime of the ballast.

Mains Supply:

Make sure, that the ballast is properly connected to earth ground. Keep the line voltage within the specified limits of sinusoidal line voltage.

Over- or undervoltage may damage the ballast. Low resistance wiring is required for mains supply. Due to high inrush current values difficulties with circuit breaker rating may occur. Depending on the type of ballast the inrush current may reach high values up to 100A in the first 2ms and up to 15A in the first 15ms. Then it fades to normal mains current. The inrush current depends on the instantaneous value of the sinusoid line voltage at the moment of start-up. We recommend slow-blow lead fuses for protection. It is recommended to charge all three phases in case of large number of ballasts. Inrush current may also be reduced by delayed turning on groups of ballasts. In case of using relays to turn on the ballasts make sure that it can handle the high inrush current of the ballasts.

Large numbers of parallel operated ballasts may also cause problems with earth leakage currents. The added up leakage currents of line filter capacitors of parallel operated ballasts may trip the earth leakage circuit breaker.

The isolated contacts of the error relay do not provide protection against electric shock. All wires of the error control loop have to be installed with appropriate protection against contact according to applicable regulations. The wires of the error control loop should never be accessed from outside the grounded cabinet without protection against contact. You may use isolation relays to access the control loop from outside the cabinet.

Type of protection:

IP 00

CE symbol:

The CE symbol on the ballast is an indication of compliance with the low voltage guideline and the electromagnetic compatibility guideline.

To summarise:

- ⇒ The CE symbol is geared to administrative authorities rather than to the final consumer.
- ⇒ The CE symbol is obligatory for the sale of separately to use products in the European Community (EC).
- ⇒ It is only an administrative symbol, not a symbol of safety or quality.
- ⇒ The CE symbol is based on the manufacturers statement rather than an inspection by an independent testing centre.
- ⇒ There is no obligation of CE certification on ballasts installed as components.
- ⇒ The ballast is a device that is designed to keep the limits for

EMI emissions for industrial environment. There may be interference with some sensitive equipment in household situations.

⇒ Because the manufacturer of the equipment using the ballast carries the responsibility for connecting the device to the lamp, he is obliged to concern himself with the CE conformity of the equipment when complete.

⇒ The measured EMI interference is valid only for one ballast without any external equipment. If multiple ballasts are operated in parallel higher values for emission may occur and additional components for EMI suppression may be necessary.

However, the level of interference depends not only on the ballast but also on the arrangement of the lamp and the ballast, on the construction of the equipment and particularly on the wiring.

Electromagnetic interference includes the radiated and conducted emissions of the equipment under test that can affect other equipment that is connected to the same line supply or that is placed in the near surrounding. To ensure that very different consumers of electric power can all use their equipment at the same time, it is necessary for every device to keep certain limits of electromagnetic interference. There are two signal path of interference known as radiated interference via electromagnetic field and conducted interference, mainly distributed via line conductors.

Conducted Interference:

Conducted interference is caused by non linear load characteristic, creating non sinusoidal currents which affect power quality and large transients caused by high frequency switch mode operation. By using high quality line filters interferences can be kept within a level that is given by standards. By using a ballast in a system the condition for distributing interference is changed considerably. It is recommended to follow the installation guide to avoid unnecessary high levels of interference.

In case of high content of harmonic distortions at line voltage the active Power Factor Correction may fail and damage the ballast. This is not covered by warranty. If that happens additional filters and overvoltage protectors have to be installed to protect the ballast. If the line voltage conditions are unknown, it is recommended to provide this components precautionary.

The carrier of the facility is in charge to keep the line voltage quality within the limits, given by regulations and standards.

Causes for radiated interference:

Due to nonlinear component characteristic and due to fast transients inside the ballast high frequency distortions are generated that may be radiated by the wiring of the ballast. The EMI line filter will attenuate this distortions so it can not be radiated by line cables. But the wiring between the ballast and the lamp may act as an antenna that radiates unwanted RF energy. The preferred frequencies, the signal level and the way the radiation leaves the unit depend among other things on the length and the arrangement of the wiring. Ferrite beads may be used to attenuate this distortions. To provide optimal attenuation all wires that lead to one lamp have to be wound around one ferrite bead. Check the Notes on Operation to provide optimum suppression of radiated emissions.

The operating agency (customer) is responsible to make sure that the quality of the mains supply voltage meets the limits, given by legal regulation.



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Notes on Installation

The ballast may only be installed by qualified personnel. All appropriate safety rules must be fulfilled. Do not place the ballasts too close to each other in a cabinet. This will affect the heat transfer, resulting in a possible overheating. The case temperature t_C may not exceed the maximum specified level even under worst case condition (max. possible ambient temperature, supply voltage next to the limits, max. load). Installation on a heat-dissipating base is recommended.

Usually the temperature t_C should be kept at least 5 to 10K lower than the specified maximum value (see data sheet) to have some safety margin.

It is recommended to provide thermal separation between lamp and ballast, e.g. by placing the ballast outside the lamp housing. The application of additional heat-dissipating measures may be useful. To provide maximum heat transfer the ballast should be mounted vertically with the mains terminals at the lower side. In addition, ensure that the surface on which the ballast is mounted, and any parts that touches the ballast housing are not in contact with external heat sources.

Notes on operation

The over voltage protection, provided in the line filter of the ballast is only intended to protect the ballast under regular line voltage conditions. In case of using a special mains supply, (e.g. IT-Net) the provider needs to provide sufficient overvoltage protection.

Attention should be paid to the following notes:

- ⇒ In case of high content of low frequency harmonic distortions in the AC line voltage the Power-Factor-Corrector of ballast may fail in operation. If this happens an appropriate line filter may solve the problem.
- ⇒ Take particular care when wiring up the cables between ballast and lamp. The ballast can fail early if there are poor contacts or sparks in between the wires. Take care for the maximum temperatures given for the individual components (cables, terminals).
- ⇒ Avoid long parallel wires, shielded wires and tracing the wires in a shielding cover (metal tubes). This will increase parasitic capacitances, resulting in poor ignition of lamp.
- ⇒ Do not connect or disconnect any wires while the ballast is under voltage.
- ⇒ The ballast has an active power factor correction. Changes of supply voltage in the specified range has no influence to the lamp current or voltage.
- ⇒ The lamp can not be dimmed by any changes in the line voltage. Neither by varying the line voltage itself nor by phase controlled modulation of line voltage. If the line voltage is not within the specified limits, the ballast may be damaged.
- ⇒ The electronic ballast will shut down under the following fault condition:
 - ⇒ lamp not sealed tight
 - ⇒ raised lamp voltage due to worn, old lamps
 - ⇒ no lamp connected to ballast
- ⇒ Warranty is void if the equipment was opened or taken apart.
- ⇒ Using the electronic ballast without its housing will damage the unit due to overheating of power components.
- ⇒ Any alteration to the equipment as delivered voids warranty. CE conformity will also be lost.
- ⇒ Technical data of lamp and ballast must match to each other. Attempts to use ballasts with other lamps than specified for this particular ballast will possibly lead to failure. Furthermore, the warranty is void. Only lamp and ballast combinations, approved by manufacturer may be used. Also replacing a lamp by a similar type from a different manufacturer needs to be approved by manufacturer due to possibly different electric parameters.
- ⇒ Keep away from the unit any wires or equipment other than required to operate the ballast and the lamp.

Ballast Temperature:

Lifetime and reliability considerably depend on the operation temperature of the ballast. The thermal management of the ballast has to be designed very careful. The ballast dissipates about 10% of electrical power as heat. Make sure the maximum Test Point Temperature t_C will never be exceeded.

t_C (where c stands for case or housing) is the maximum temperature permitted at the marked point on the ballast unit (see also EN 60598). This point is the t_C - test point under normal operating conditions at nominal input voltage or at the specified limits of the input voltage range respectively. In practice, t_C is determined by the heat generated by losses inside of the ballast and the heat transfer to the ambient temperature. While this heat transfer happens t_C is always higher than the ambient temperature. Note that ambient temperature inside of closed cabinets may be higher than ambient temperature outside of cabinet.

If the maximum permitted t_C is exceeded even by a few degrees, the life expectancy of the equipment will be drastically reduced. If t_C is exceeded by more than 10K the life time will be halved. If the t_C rises up more than 20K higher than the specified value (see data sheet) the equipment can be expected to fail. This is caused by the temperature limits of specific components such as electrolytic capacitors.

On the path from the ballast housing to environment heat transfer depends on thermal resistors. Stainless steel, Plastics and non moving air are bad thermal conductors. If this materials block the heat transfer it might take hours until thermal equilibrium conditions may allow to measure maximum Test Point Temperature t_C . It is recommended to mount the ballast on a thermal conductive plate with maximum size. Avoid multiple thermal junctions with convection heat transfer. If possible allow forced air to remove dissipated heat in the cabinet.

To ensure optimal lifetime and to have enough safety margin it is recommended to keep the Test Point Temperature t_C more than 10K below specified maximum value.

Notes on wiring:

(please see also data sheets for details):

Both rigid and flexible cable is acceptable for the ballast units.

a) rigid wiring

⇒ may be inserted direct into the terminals without moving the release lever if specified wire gauge is used

b) flexible wiring

⇒ may only be inserted direct into the terminals by pressing the release lever on the terminal

⇒ may not be soldered (tinned). This applies especially to screw terminals. The solder migrates into the contact, resulting in less reliable connection.

⇒ wire termination may be used, but this is actually not necessary.

To check the wiring at the terminal try to pull out the cable gently. The terminal should not allow the wire to move.

To avoid radio interference and to ensure maximum equipment's reliability in use, pay attention to the following notes when positioning the cables:

1. Keep the wiring between ballast and lamp (high frequency wires) as short as possible (to reduce electromagnetic interference and to minimise parasitic capacitances).
2. On no account trace mains wires and lamp wires in parallel or close to each other. Keep lamp wires and mains wires as far away from each other as possible (Minimum: 5-10 cm). This will avoid radio interference between mains and lamps leads.
3. To reduce radiated emissions at lamp wires it is recommended to trace a separate wire with size of 4mm² that is connected to earth ground in parallel to the lamp wires. Do not connect any wire of multi-conductor cables to earth ground.
4. Keep mains cable short to reduce radio interference.
5. Do not place mains wires too close to the ballast unit or to the lamp (this applies particularly to through-wires).
6. Do not cross mains and lamp wires. If this is unavoidable, keep right angle in between the wires and keep a distance as far as possible in order to reduce high frequency coupling.



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Wiring must be done according to applicable regulations (in Germany, for instance, VDE 0100, VDE 0107 etc.).

Additional insulation is required for through metal wiring. There should always be some insulation material or insulating sheath or a grommet or edge protection as appropriate.

The frame of the lamp is not intended to be used for wiring. Mains or lamp wires should not come in contact with the frame of the lamp by bare wires, excessive striped wires or screws/sharp metal edges pointing through the insulation. This could result in electric shock and/or destruction of the ballast.

Cable lengths acceptable:

A maximum length of cable of 2,9 m between the electronic ballast and the lamp is allowed.

Temperature of lamps:

UV low pressure lamps are usually optimised for a tube wall temperature of approx. 40°C and doped lamps are optimised for approx. 100°C (because of higher power density). In both cases the lamps are operated at an ambient temperature of 25°C while the lamp is not covered. These are the temperatures at which the lamps have their nominal electrical properties and the highest radiation efficiency. Even small variations in temperature will influence the electrical and radiation properties.

If the temperature deviates significantly from the nominal value, the electrical behaviour will drastically change and the radiation density will drop seriously. In extreme cases the ballast may be damaged. If the lamp temperature is too low, the lamp may not ignite or the radiation density may drop.

These facts lead to the following rules:

- ⇒ The ambient temperature should not drop below the lower temperature limit for ignition of the lamp.
- ⇒ During operation, the specified tube wall temperature of the lamp should not be exceeded significantly.
- ⇒ Too much humidity may disturb ignition.

General Safety Facts

The electronic ballast consists of many parts. Some parts are very high stressed. Though a high safety margin for highly stressed components is provided in the design it can happen that under certain circumstances the ballast fails in operation. In case higher ranking systems depend on the function of the ballasts a redundancy has to be provided.

The manufacturer provides no warranty for any damages or losses that are caused by malfunction of the ballast.

Electronic ballasts are highly sensitive complex electronic modules. It has to be handled with care by installation and servicing personnel.

General instructions:

- ⇒ All dimensions and technical data may vary within small tolerances as usual in practice.
- ⇒ We reserve the right to make changes to technical and delivery details.
- ⇒ The instructions above are based on our experience and are for information only.
- ⇒ No warranty for completeness and correctness of details.