

# Electronic Ballast

## EVG 2000-T



## Operating Manual

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## 1 Description

### 1.1 Advantages of this ballast

- Lamp power can be adjusted steplessly
- Lamp power can be automatically controlled to a constant value set
- Different lamps can be connected to the same ballast
- It is possible to operate nearly all types of mercury vapour medium-pressure lamps and metal halide lamps (doped mercury vapour lamps) the electrical characteristics of which are in the wide operating range of unit
- Lamp power can be pulsed quickly
- All functions are controlled via galvanically separate analogue inputs DC 0...10 V or 4...20 mA
- Any mains voltage variations are compensated
- Easy to install by little wiring work
- Smaller and lighter than a comparable conventional ballast
- Air cooling
- Advanced technology with digital control

**The ballast meets the requirements of DIN EN 50178 / VDE 0160 and other European and global standards (IEC).**

### 1.2 Functional principle

The EVG 2000-T unit is an electronic, controllable AC ballast for lamps of a nominal power from 500 W to 2000 W which is intended to be used for industrial applications. The unit is designed for the operation with lamps. The lamps are operated by a square-wave current, and thus the dark phase in the current's zero passage as usual in conventional ballasts.

The EVG 2000-T unit's function is based on a controllable power source up to 14 A. During the operation the lamp power is controlled and kept constant at an external set value via an internal control unit. The lamp's nominal voltage may be between approx. 100 V and 300 V. However, in order to get the full power of 2000 W, the maximum current of 14 A should be considered so that a minimum lamp voltage of 145 V is necessary. In most lamps the power can be adjusted from approx. 10 to 100 %, depending on the cooling and ambient conditions.

Using the integral power control unit, the lamp power is set from the outside via an analogue input (DC 0...10 V or 4...20 mA). Doing so, the minimum and maximum values as necessary and allowable for each lamp must be taken into account.

This control unit is used to control the set point to a constant value, i.e. to keep the lamp power constant, irrespective e.g. of the mains voltage or different lamp voltages.

The EVG 2000-T unit has a galvanic separation between the main and control circuit and can be controlled directly, e.g. by a stored-program control (SPS), via DC 0...10 V/4...20 mA input.

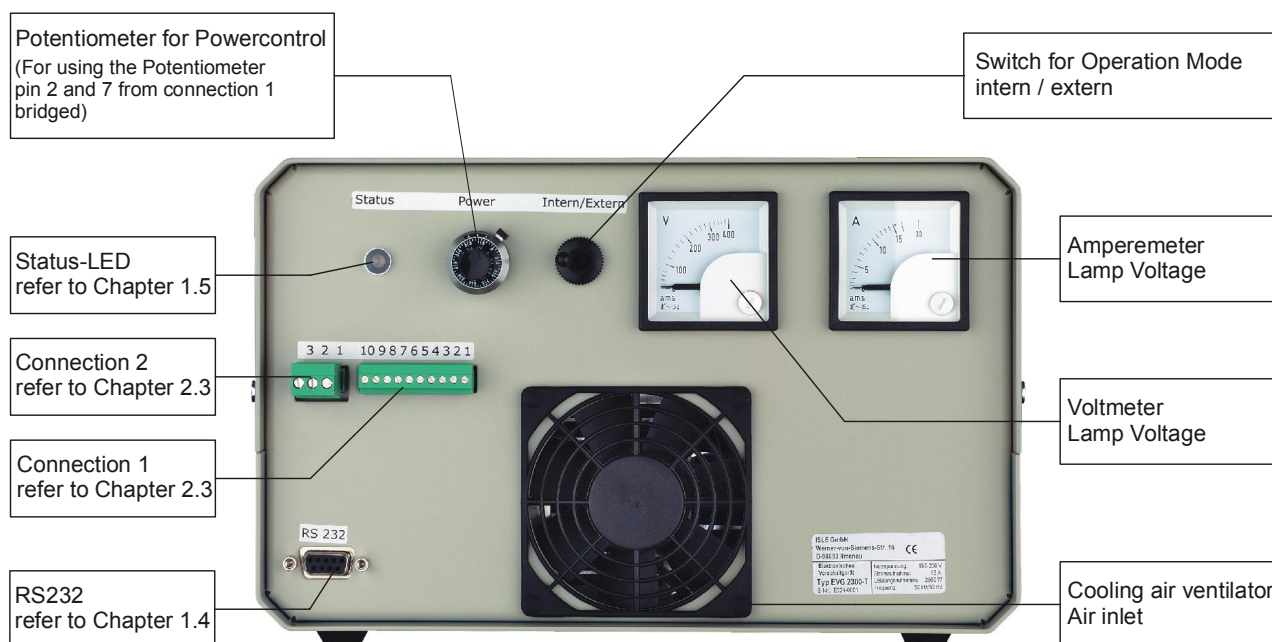
If DC < 1V at the input, the lamp is switched off (no safe disconnection as required by VDE because here semiconductors are used to switch! For this reason, a main switch or a relevant contactor is necessary in case of servicing work, e.g. for replacing the lamp).

By default, the unit is equipped in the factory with an internal, temperature-controlled ventilator (keep in mind that the maximum cooling air temperature is 40 °C!). The cooling air may not be contaminated or exert any other negative influence on the electronics (e.g. by aggressive gases or high humidity). The EVG 2000-T ballast can be used as a tabletop unit or installed in a switch cabinet etc.

#### **General note for electric measurements!**

For measurements around the ballast, e.g. to measure the mains and lamp currents or voltages, a true RMS measuring instrument with a frequency range of up to at least 10 kHz is necessary. In most cases, other instruments do not indicate the correct values, in particular, the lamp current and voltage. When measuring the lamp voltage, be aware of the fact that ignition pulses may destruct the measuring instrument.

### 1.3 Energization



**Note:** The inputs and outputs have a delay of 3 s from switching ON the mains, in order to avoid an uncontrolled behaviour during the internal run-up.

Analogue power control input:  
(use a shielded cable!)

Potentiometer ( $R > 2k\Omega$ ) or DC 0...10V ( $R_i < 10k\Omega$ ) and DC 4...20 mA (has priority to DC 0...10V input)  
 DC < 0.9V = OFF  
 DC > 1V = ON and igniting  
 DC 1...10V = ON; lamp power 10...100%  
 or  
 4...20 mA ( $R_i = 250 \Omega$ )  
 4... 5.5 mA = OFF  
 5.6...20 mA = ON; lamp power 10...100%  
 within the current limits ~1.4...14.4 A

Signals of EVG 2000-T :

Multicolour LED (green, orange, red) to signal the status  
 Potential-free change-over contact to signal a trouble

2 outputs for external LEDs :

1 output indicates OK by a green LED to be provided by the customer  
 1 output indicates FAULT by a red LED to be provided by the customer  
 A 220 Ohm resistor is integrated in EVG 2000-T for each output.  
 The typical LED current is 10mA each.  
 Integrated (refer to 1.4)

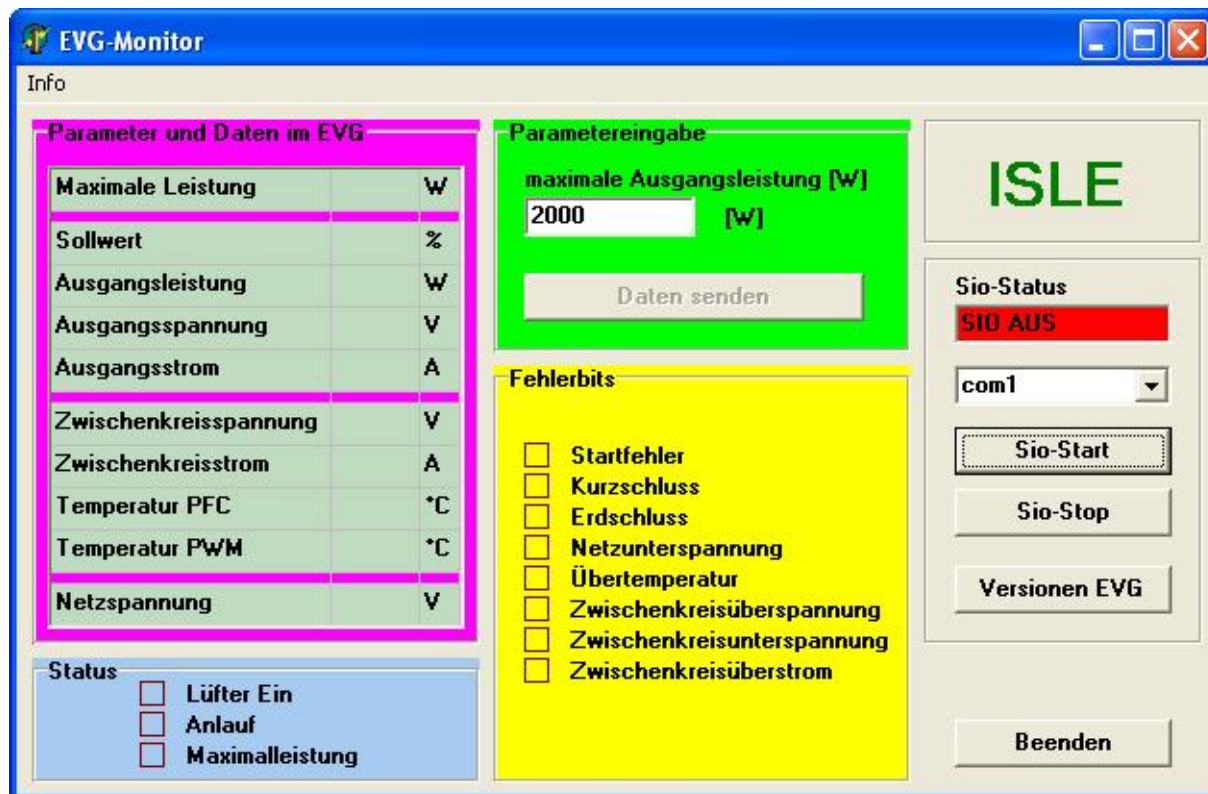
RS232 interface:

**Note:** In case of fault, do not immediately disconnect the EVG 2000-T from the mains because, otherwise, the reason of fault is not issued.

**Reset:** is possible by disconnecting from mains for at least 10 s (e.g. after a fault message)

## 1.4 Visualization

Optionally, the ballast is delivered with a serial interface and visualization software. The visualization system shows all faults found in the EVG 2000 ballast as well as the internal measuring values. The maximum output power is parameterized via the software, too.



Parameters and data in the ballast  
 Maximum power  
 Setpoint  
 Output power  
 Output voltage  
 Output current  
 Intermediate circuit voltage  
 Intermediate circuit current  
 Temperature / PFC  
 Temperature / PWM  
 Mains voltage  
 Status     Lüfter Ein  
            Anlauf  
            Maximalleistung

Parameter input  
 Maximum output power  
  
 Send data  
  
 Fault bit  
            Startfehler  
            Kurzschluss  
            Erdschluss  
            Netzunterspannung  
            Übertemperatur  
            Zwischenkreisüberspannung  
            Zwischenkreisunterspannung  
            Zwischenkreisüberstrom

### Operating:

Sio-Start	Communication is started; RS232 interface is configured by the visualization software.
Sio-Stop	Communication is stopped; RS232 interface is released for other programs
Sio-Status	Red: Communication not started or stopped Yellow: Communication erroneous Green: Communication OK
Versions EVG	Firmware version is read out
Send Data	The value adjusted in the field „Maximum output power“ is transmitted to the ballast.
Exit	Program is ended

## 1.5 Indications and signalling

On the casing of the EVG 2000-T ballast there is a three-colour light-emitting diode to signalize different states. In addition, a potential-free change-over contact is available to identify any troubles. Some interconnections are shown in the table below:

Operating mode	LED	Diagnosis	Status	Signalling contact	Remark
<b>Normal</b>	<b>LED green, lights permanently</b>	Energization voltage $\geq 1.0V$	Desired power is reached (depending on the energization voltage)	Relay has released, no fault	
	<b>LED green, flashing at long intervals</b>	Energization voltage $< 0.9V$	Ballast is ready for switching ON	Relay has released, no fault	
<b>Warning</b>	<b>LED orange, lights permanently</b>	Energization voltage $\geq 1.0V$	Lamp voltage is too low, desired power is not reached, no load (10 s)	Relay has released, no fault	
	<b>LED orange, flashing at short intervals</b>	Risk of overtemperature (heat sink temperature $>70^{\circ}C$ , reset at $<65^{\circ}C$ )	Unit remains in switched ON state	Relay has released, no fault	
<b>Fault</b>	<b>LED red/orange, flashing at short intervals</b>	Mains voltage $<190 V$ (but not 0 V)	Unit is switched OFF, fault	Relay has pulled up, fault	Storing, reset is possible by disconnection from mains
	<b>LED red/orange, flashing at long intervals</b>	Overtemperature (heat sink temperature $>80^{\circ}C$ , reset at $<75^{\circ}C$ )	Unit is switched OFF, fault	Relay has pulled up, fault	Storing, reset is possible by disconnection from mains
	<b>LED red, flashing at long intervals</b>	Output circuit is open or the lamp does not ignite	Unit is switched OFF, no lamp is connected or the lamp does not ignite	Relay has pulled up, fault	Wait for three ignition attempts. Storing. Reset is possible by disconnection from mains
	<b>LED red, flashing at short intervals</b>	Short circuit in the output circuit	Unit is switched OFF	Relay has pulled up, fault	Storing, reset is possible by disconnection from mains („Short circuit“ may also be induced if the lamp's start voltage is too low, $<10V$ for $\geq 10s$ )
	<b>LED red, lights permanently</b>	Line-to-earth fault in the output circuit	Unit is switched OFF	Relay has pulled up, fault	Storing, reset is possible by disconnection from mains

Flashing frequencies: **Long intervals** = 1s ON, 1s OFF (0.5 Hz); **short intervals** = 2x per second ON (2 Hz)

## 1.6 Switch-on behaviour in case of fault

The lamp does not ignite or is not connected:

The EVG 2000-T ballast attempts for 10 s to ignite the lamp (LED orange, lights permanently; potential-free change-over contact has pulled up). If the lamp does not ignite within this time, a break of 30 seconds will follow. During this break the LED is flashing red with a low frequency and the potential-free change-over contact has pulled up. After the first ignition attempt was not successful, a second ignition attempt and, if necessary, a third ignition attempt is made in the above-described manner. After the third ignition attempt the unit will remain in the fault status and the red LED is flashing at long intervals.

In order to be able to start a fourth and further ignition attempts, it is necessary to disconnect the unit from the power supply and then to switch ON again.

## 1.7 Cooling

**In order to guarantee the maximum power output and life of the EVG 2000-T ballast, it is important to efficiently cool the unit.**

The cooling effect depends on the air volume flowing through the heat sink and the air temperature. To reach the full power output of up to 2000 W, the air temperature may not be higher than 40°C. Pay attention to this fact, in particular, when the unit is installed in a switch cabinet or a similar casing. Arrangements should be made to ensure that the lost heat of the unit can be sufficiently dissipated!

The EVG 2000-T ballast is equipped with a temperature-controlled ventilator and is independently switched ON or OFF if a defined heat sink temperature is reached.

### **Note for controlling the ventilator!**

If the ballast is disconnected from the mains, the ventilator continues to run for approx. 10 s and, doing so, it discharges the intermediate circuit capacitors.

## 1.8 Safety requirements when using the unit together with ultraviolet lamps

Before starting any work at the connections of the ballast or UV lamp, e.g. when replacing the lamp, it is necessary to completely disconnect the unit from the mains by actuating the main contactor or main switch, to preclude the risk of an electrical shock.

After having switched OFF the unit, wait still for 10 minutes to ensure that the capacitors can be discharged to a non-hazardous value.

Reason: According to the operation principle, the ultraviolet lamp is switched OFF by semiconductors. However, this does not involve a safe disconnection from the mains as required by VDE! There is the risk of residual voltages!

**! Danger to life !**

## 1.9 Repairs

The EVG 2000-T ballast is a reliable electronic unit which, according to experience gained hitherto, may be hardly damaged. If, contrary to expectations, this should be happen the unit may be repaired by replacing the defective parts and subsequent detailed performance test at the factory.

## 2 Technical data

Electrical data of the trouble signalling contact:	Nominal voltages AC 250 V / DC 30 V Maximum continuous current 16 A Maximum switching capacity (AC) 500W / 750VA Maximum switching current (AC with 230V) 30 A Maximum switching current (DC with 30 V) 16 A Minimum switching load 300 mW, 5 V, 5 mA
Protection against short circuit and overload in the lamp circuit:	yes
Protection against line-to-earth fault in the lamp circuit:	yes
Efficiency:	> 91%
Ambient temperature:	5°C to 50°C
Mounting position:	Longitudinal axis in horizontal position
Dimensions:	263 x 173 x 340 mm (w x h x d)
Weight:	8.5 kg

### 2.1 Mains connection

Mains voltage and frequency:	196 to 255V at 50 and 60Hz
Connection:	L1, N and PE
Power factor:	> 0.996 (with full load)
THDi :	< 3.0%
Fuse /mains:	- Protective motor switch (tripping current $I_a$ is calculated as follows) $I_a = P_s * 1.15 / U_{Netz}$ wherein $P_s$ = maximum lamp power desired, in W $U_{netz}$ = actual minimum mains voltage - B 16 automatic circuit breaker
Peak value of starting current when mains is switched ON:	Typically approx. 35A (10ms)
Peak value of starting current when the lamp is switched ON:	No
EMC:	DIN EN 55011/VDE 0875 Part 11, class A, group 1 When used in residential areas (class B, group 1), an additional external line filter is necessary.
Fault-current circuit breaker:	When fault-current circuit breakers are used, the units shall have a DC tripping system.

#### Main switch or protective motor switch

A contactor is necessary to safely disconnect the unit from mains as specified by IEC and VDE regulations, in order to avoid any residual voltages at the lamp connection. Instead of the contactor, the disconnecting function can also be implemented by a main switch or a suitable protective switch.

### 2.2 Lamp connection

Output frequency:	55 Hz, square wave
Maximum lamp current:	14.4 A
Lamp voltage:	100 V to 300 V
No-load voltage:	420 V



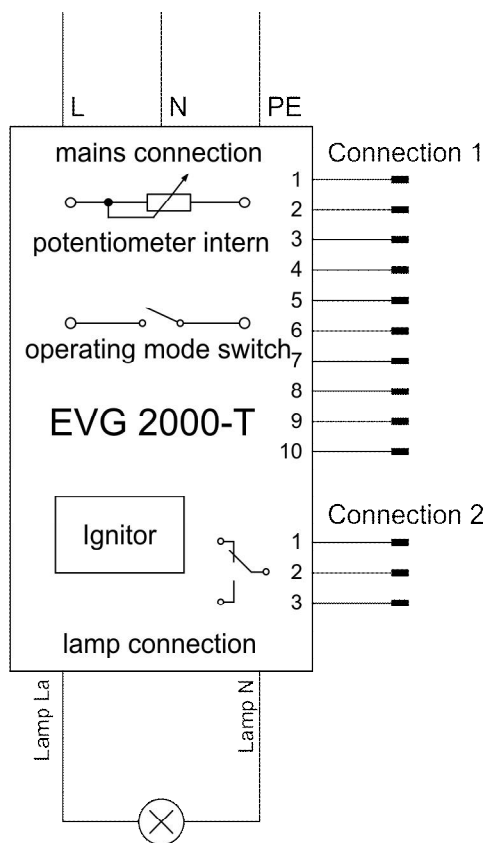
Maximum lamp power:	2000 W (with lamp voltages > 145 V)
Pulse operation:	Rise time / lamp current ≤ 50 ms Fall time / lamp current ≤ 50 ms
Maximum cable length between EVG 2000-T and ignitor:	30 m
Maximum cable lengths between the ignitor and lamp: (these values depend on the cable and lamp types used)	for Hg lamps 5 m for doped lamps 3 m

For reasons of electromagnetic compatibility, the cables/lines to the lamp shall be of shielded type. The shield may be earthed on one (!) side only, preferably on the side of the ballast, and led from both lines and the EVG 2000-T unit to a common point!

**IMPORTANT!!** The ignitor is integrated and is switched OFF after 10s !!

**IMPORTANT!!** The cable capacitance between the EVG and lamp may not exceed 1nF (measured from pole to shield). Otherwise, the EVG 2000-T unit will switch OFF itself by sending a line-to-earth fault message!!

### 2.3 Connection plug arrangements



#### Connection plug, 10-pole

- 1 GND
- 2 Analogue input for power adjustment DC 0V..10V
- 3 10V output for potentiometer f. power adjustment (10kΩ, max. 8mA)
- 4 Analogue input for power adjustment DC 4mA..20mA (priority to pin 2)
- 5 Analogue output DC10V, proportional to the lamp power (10V = 2000W)
- 6 Reserve
- 7 GND
- 8 Anode for external LED green, 10mA, ballast in the EVG unit
- 9 Anode for external LED red, 10mA, ballast in the EVG unit
- 10 Maximum power specification, L-aktiv (priority to analogue inputs for desired values)

#### Connection plug, 3-pole

- 1 Relay contact / NC contact
- 2 Relay contact / Root
- 3 Relay contact / NO contact (Relay is pulled up in the „fault“ status)

#### Use shielded cables!

The shield shall be earthed on one side only, together with the ballast, to **one** common point near the EVG unit!

#### Lamp connection

Maximum cable length between the lamp and ignitor: 5m



#### WARNING:

When doing any work on the lamp connections, always disconnect the ballast from the mains!  
Residual voltages possible!