MediPlas

Driver

Series/Type: **V 7.0**
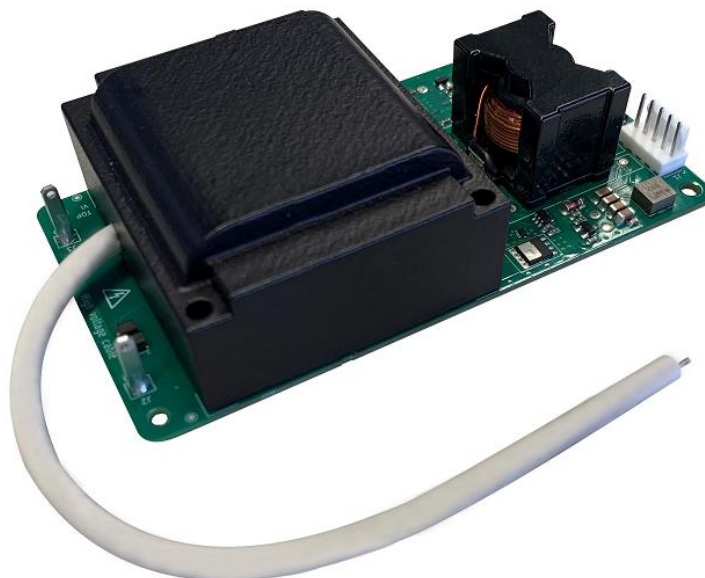**Ordering code:** **Prototype**

Date: 2025-02-19
Version: 3

Preliminary data

Intended use

HV-Driver for DBD-Loads

Features

- Compact
- Passive cooling
- Broad capacitance range of applicable loads
- Adjustable output voltage
- PWM power control Input
- Process monitoring signal
- Overheating protection with auto recovery


Specification

- Electrical Data

Output Voltage Range U_{HV} (Proportional to Input Voltage)	1.2 … 2.7 kV AC RMS 4.5 kV AC PEAK$_{MAX}$
Output frequency range	20 … 30 kHz (auto resonant)
Input Voltage Range U_{DC}	12.0 … 24.0 V DC
Maximal Continuous Input Power	30 W
HV-Output connection	HV-cable
Input/Output connection	Connector (see pin configuration)
Device protection functions	Reverse polarity Input overvoltage Input undervoltage Overtemperature
Control Input: Enable	HV output control via PWM up to 100 Hz or DC ON/OFF
Diagnostic Output	PLASMA_OK (Attenuated analogue feedback signal)
Steady state settling time	< 2 ms (load dependent)
Inrush current (typical, cold start)	35 A peak @ 24 V DC
Load Capacitance Range	5 … 80 pF, see Figure 2
Load Resistance Range	0.3 … 1 MΩ, see Figure 2

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Minimum load	5 pF, 1 MΩ
Stored Energy	< 1.5 mJ
Overvoltage category According to IEC 61010-1	Class II

■ Dimensions and Weight

Length	112 mm (Board only; see Figure 1)
Width	60 mm
Height	33 mm
Mounting hole diameter	3.2 mm
Mounting hole spacing, length	104 mm
Mounting hole spacing, width	52 mm
HV Connector (J4)	Silicone cable Ø 4.57 mm; 22 AWG; length 160 mm, Striped end l= 10.5 mm
Weight	260 g
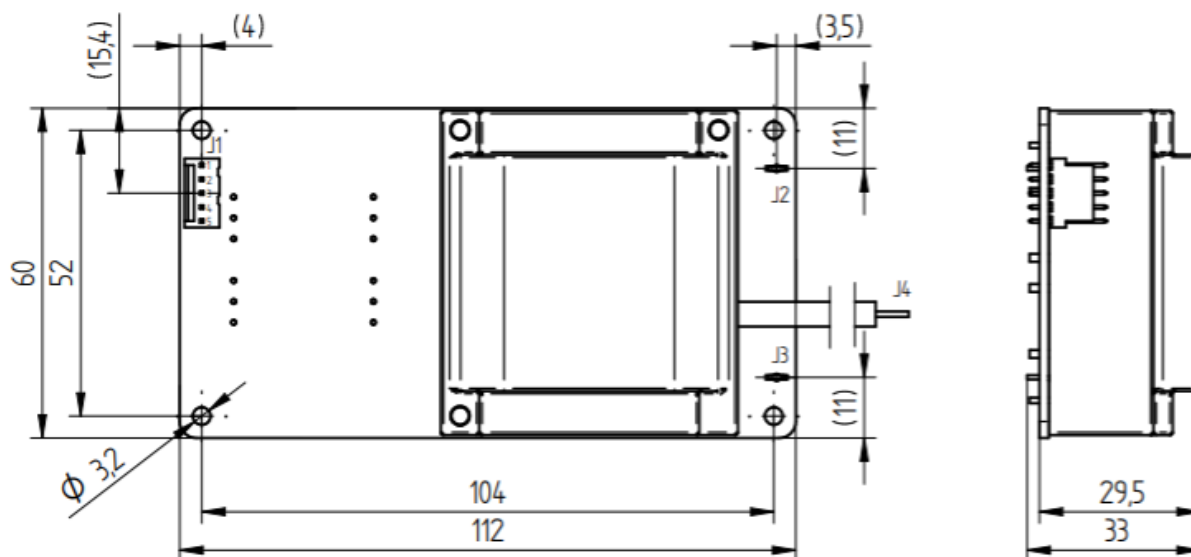
Figure 1: Dimensions drawing

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■ Environmental Conditions

Operating Temperature Range	5 … 50 °C
Operating Altitude	≤ 3000 m
Humidity	< 80%, non-condensing
Pollution rating according to IEC 61010-1	Degree 2
Usage	Indoor only

■ Safety specification(s)

Standard	Designed to meet IEC 61010-1

■ Other specification(s)

Standard	Mechanical shock: Meets IEC 60601-1-11 Chapter 10.1.2 a)

Description

The MediPlas driver is a DC-AC high-voltage driver for operation with igniting DBD (Dielectric Barrier Discharge) or non-igniting high-voltage loads. The DC voltage on the input side is converted into a high-frequency high voltage by means of an auto-resonant circuit.

The operating frequency of this output voltage depends on the load and the level of the high voltage depends on the input DC current level. To switch on the driver, the ENABLE input must be activated. In addition, a PWM signal can be used at the ENABLE input to achieve power regulation at the output. When operating an igniting DBD load, the PLASMA_OK feedback signal can be used to infer the intensity of the plasma discharges. The level of this signal depends on the process and environmental conditions of the DBD load.

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Pin configuration and functions
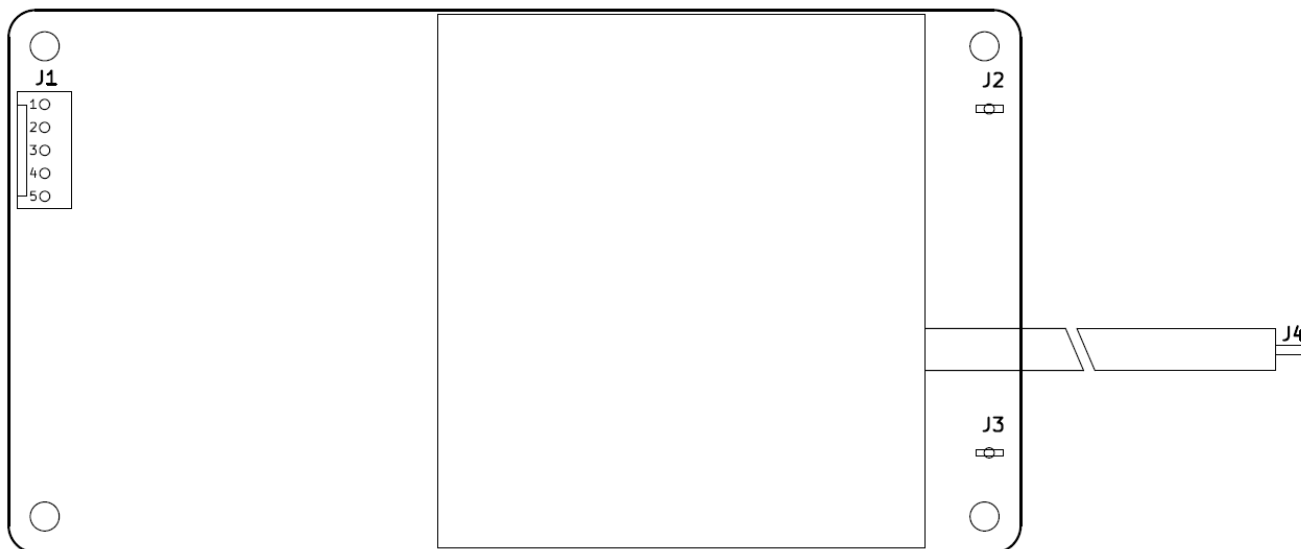
Table 1: Pin-out signal names

Ref.	Pin	Name	Comment
J1	1	U_DC	Supply voltage
	2	GND	Ground potential
	3	GND_SIG	Optional GND reference for PLASMA_OK and/or ENABLE signal
	4	PLASMA_OK	Signal voltage
	5	ENABLE	PWM or DC control
J2	-	GND	Ground potential
J3*	-	GND	Ground potential
J4	-	U_HV	High voltage (AC) output

* J3 GND_HV is functional identical to J2 connection. When used with MediPlas® reactor, this connection facilitates wiring.

■ U_DC

U_DC is the voltage supply pin of the driver. The logic supply and the power supply are provided via this input. The AC output voltage can be set via the level of the U_DC voltage. Figure 3: AC high voltage output RMS over DC input voltageshows the U_HV (RMS) over U_DC in the steady state for minimum and maximum load.

■ ENABLE

The ENABLE input is required to control U_HV output. For continuous ON mode, a voltage higher than the EN_{TH} threshold must be applied to the ENABLE input. The switch-on and switch-off phases of the U_HV can be controlled by using a pulse-width modulated signal. The U_HV output is enabled in the high phases of the PWM and disabled in the low phases of the PWM. The Enable Signal has an internal signal delay EN_{DEL} that limits the minimum duty cycle of the PWM signal. This is dependent on the PWM frequency. Table 2: Electrical characteristics of the ENABLE input shows the electrical characteristics and the formula for calculating the minimum required duty cycle.

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Table 2: Electrical characteristics of the ENABLE input

Parameter		Min.	Typ.	Max.	Unit
EN	Enable voltage	0	-	65	V
EN$_{TH}$	Enable threshold	2.0	-	-	V
EN$_{THH}$	Enable threshold hysteresis	-	0.2	-	V
EN$_{PWM}$	PWM frequency	-	-	100	Hz
EN$_D$	Duty cycle	$1.06 \times 10^{-3}\,s \times EN_{PWM}$	-	1	s/s
EN$_{DEL}$	Enable delay time	0.58	0.75	1.06	ms

■ PLASMA_OK

The PLASMA_OK output is a feedback signal for process monitoring of the intensity of the plasma discharge. The signal is only provided during active DBD plasma discharge cycles. The signal is load- and process-dependent. If U_DC and ENABLE are in HIGH state, the PLASMA_OK signal shows an analogue signal which is proportional to the U_HV output discharge power.

For stable signal acquisition a terminating resistor of >100 kΩ is recommended.

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Device protection functions

The MediPlas driver has 3 different protective functions. These device protective functions protecting the driver from damage if it is operated outside the specified operating and ambient conditions. If the maximum supply voltage or the temperature threshold is exceeded or if the supply voltage falls below the minimum supply voltage, the driver is switched off. When the normal operating or ambient conditions are reached again, the driver automatically goes back into operation. Table 3: Trigger thresholds and hysteresis of the protection functions shows the threshold values for the device protection functions and the associated hysteresis when exceeded.

Table 3: Trigger thresholds and hysteresis of the protection functions

Parameter		Min.	Typ.	Max.	Unit	Reset
U_DC_{OVPT}	Over Voltage protection threshold	28.3	30.0	32.0	V	Auto recovery
U_DC_{OVPH}	Over Voltage protection hysteresis	-	-	3.6	V	
U_DC_{UVLOT}	Under Voltage lockout threshold	8.4	10.7	11.8	V	Auto recovery
U_DC_{UVLOH}	Under Voltage protection hysteresis	-	-	1.2	V	
T_{OVT}	Over Temperature protection	88	90	93	°C	Auto recovery
T_{OVTH}	Over Temperature protection hysteresis	-	10	-	°C	

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Input Power and High Voltage Output
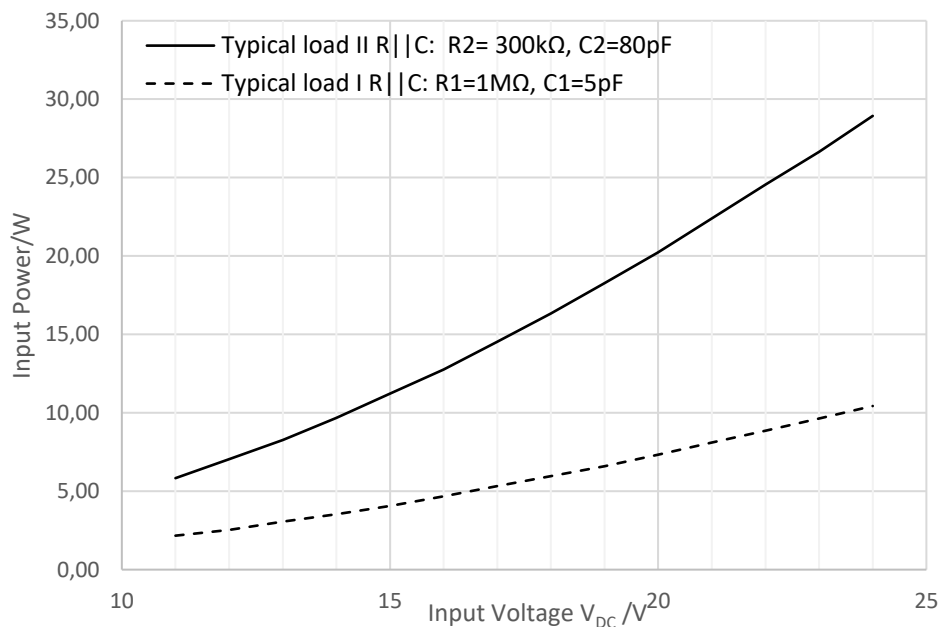
Input

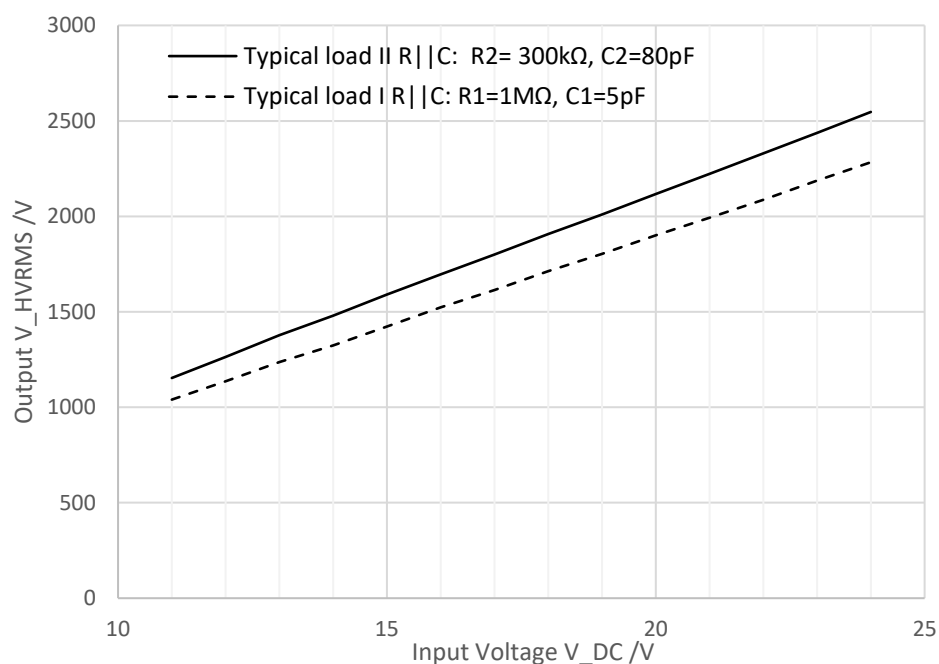**Figure 2: DC Input power over DC input voltage for typical loads**

Output

Figure 3: AC high voltage output RMS over DC input voltage

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Installation instructions

The MediPlas driver is intended for installation in a device or machine. To prevent personal injury, the driver must be installed in such a way that the end user cannot come into direct contact with the driver. The precautionary measures and warnings for dangers for the installer are described in the chapter Cautions and warnings.

Note: The safety of a system into which the MediPlas driver is integrated is the responsibility of the installer of the system.

Machine, device and housing integration

In a device, machine or enclosure in which the driver is to be integrated and the objective is to comply with IEC 61010-1, the mechanical, fire protection and requirements to the circuit breaker of IEC 61010-1 must be met.

A required additional energy-limiting circuit in the end device must limit the current consumption of the driver in the event of a fault. The supply current must be limited to a maximum of 6.25 amps by fuses, circuit breakers, thermal releases, current-limiting impedances or similar devices.

The required additional circuit breaker for integration must meet the following requirements in accordance with IEC 61010-1.

   a) A switch or circuit breaker must be present in the system.
   b) The switch or circuit breaker shall be suitably located and easily accessible.
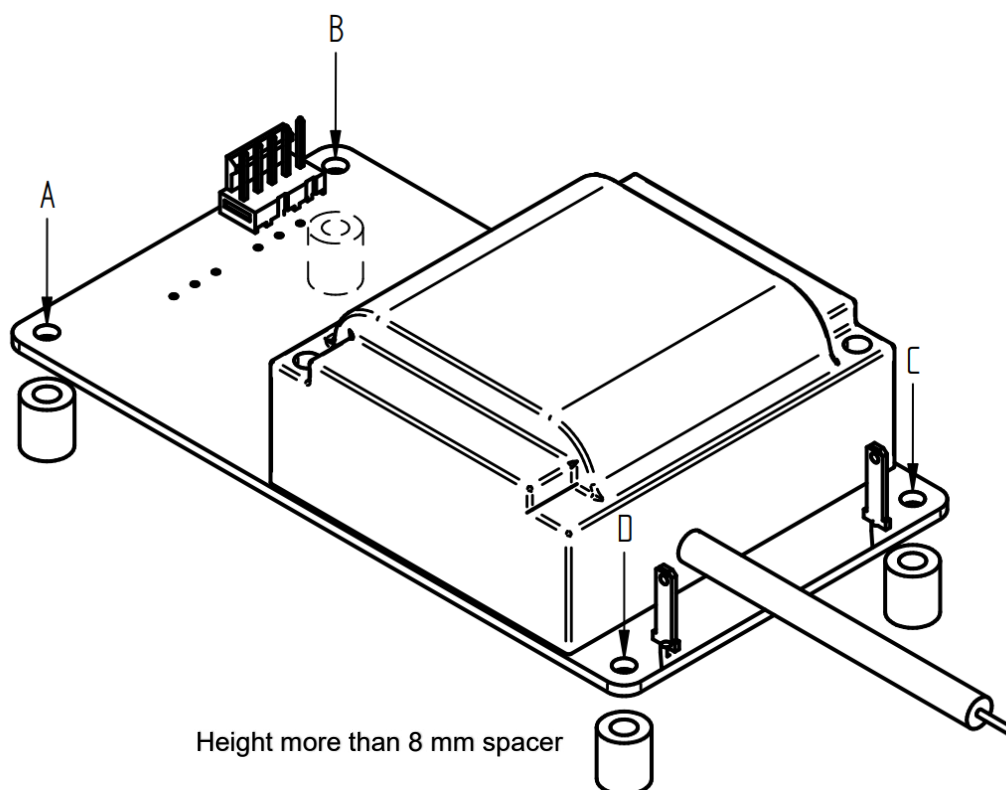   c) The switch or circuit breaker must be labeled as a disconnecting device for the appliance.
   or
   End product must meet the requirements for the disconnecting device of EN 61010-1.

Mounting Method

Insert the spacer (metal or insulator) of height more than 8 mm to all mounting holes to lift the unit. All four mounting holes should be utilized for best mechanical performance. The recommended screw size is M3. The head diameter of the screw used must not exceed 6.0 mm. The recommended torque for the screws is 0.5 Nm. The four mounting holes are electrically isolated and providing mechanical mounting only.

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Height more than 8 mm spacer

Mounting directions

Recommended standard mounting direction is (A). Mounting direction (B)-(E) are also possible.

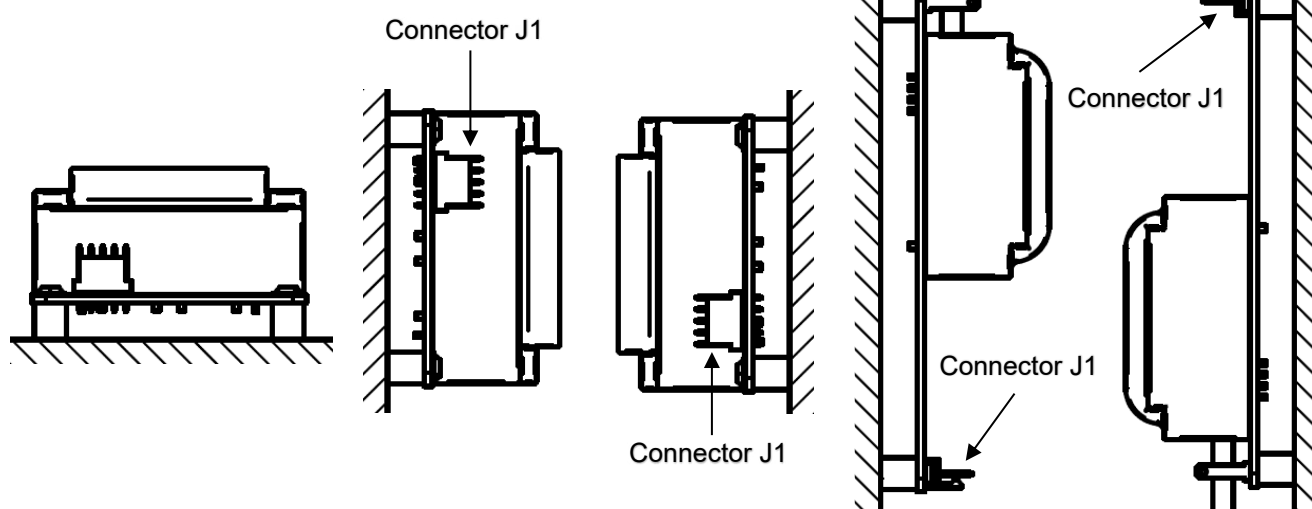(A) Standard mounting   (B)   (C)   (D)   (E)

Connector J1

Connector J1

Connector J1

Connector J1

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Input/Output connectors

Ref.	Connector	Maker	Mating connector(s)	Maker	Comment
J1	0022232051	molex	0022013057 or similar	molex	Recommended wire size is AWG 22
J2	63756-1	TE Connectivity	Quick disconnect receptacle 2.8 mm x 0.81 mm	-	Recommended wire size is ≥ AWG 22
J3					
J4	-	-	-	-	Silicone cable Ø 4.57 mm; 22 AWG; length 160mm, Striped end l= 10.5 mm

Power supply

The driver must be supplied by a DC power supply unit with an output of ≥ 30 watts which fulfills IEC 61010-1 or certified after IEC/EN 60601-1.

Cleaning

No cleaning is necessary when used as intended and under the conditions described under chapter Specification.

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Cautions and warnings

Warning symbol
This symbol indicates a hazard which, if ignored, could result in serious injury or death and/or damage to property. Observe the safety instructions in this manual! Failure to do so can have serious consequences for the health of persons as well as damage to property and the environment. This manual is an integral part of the appliance and must be accessible each time it is used. Read the instructions completely before using the appliance. Only use the appliance in accordance with the instructions contained herein!

Warning symbol of electrical voltage

Warning symbol of non-ionizing radiation

Only TECHNICALLY QUALIFIED SERVICE PERSONNEL familiar with the principles of electrical safety should operate this supply. The power supply SHOULD NOT BE EXPOSED TO WATER) OR MOISTURE OR DUSTY ENVIRONMENTS (Pollution degree 2). Electrical safety must be always maintained.

Danger from high voltage! Always proof proper connection of the high voltage parts. Don't open the device. If the device is damaged disconnect the voltage supply and contact the manufacturer.

Do not touch the device and connection cables during operation. All parts of the device can carry high voltages during operation. After switching off the supply voltage and disconnecting the supply plug, wait at least one minute and make sure by measurement that the input capacitors are discharged. before touching the device.

The device has integrated device protection functions which switch off the high voltage at the output when triggered. When the device returns to the specified ambient and operating conditions, the high voltage at the output is automatically released again.

Do not use the device in a flammable or explosive atmosphere.

Do not operate the device if it is damaged.

The device is designed for indoor use only. Splashing water, excessive humidity may cause the device to destruction or fail.

Never attempt to operate the power supply in any manner not described in this manual. Never remove DANGER and WARNING labels from the device. Replace lost or damaged labels immediately.

Do not use screws with a head diameter >6.0 mm to mount the driver.

If the product is used in a manner not specified in this data sheet the protection provided by the product safety may be impaired.

This product is not serviceable outside of relyon plasma GmbH. When manipulating the device, the protection provided by the product safety may be impaired.

Before adjusting or changing the device, ensure that the device is in a safe state by associated high-voltage generator is switched off or disconnected from the it's all dedicated power supplies or supply voltage lines.

When operating this device with plasma reactors (intended use), high EMI with other devices can/will occur. When used with a plasma reactor, it is recommended to keep the connecting cables short and shield both devices accordingly.

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2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified.** In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.

3. **The warnings, cautions and product-specific notes must be observed.**

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