

DC-Sputtering Power Supply

GSC 120

Operating instructions and technical data

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1 Technical data

Nominal power: 12kW

Output voltage: - 800V

Output current: 25A (34A puls)

Control: Voltage, current or power controlled.

Operation modes: External control via A/D interface AS 4 or profibus.

Setpoint: 0...100% of nominal voltage, current or power.

Noise emission: $L_{pA} < 70\text{db(A)}$

Mains connection: 3 x 400V, +5/-10%, 50/60Hz, PE

13.2kVA

Fuse protection: 25A

Cooling: Forced air, maximum ambient temperature 40°C.

Dimensions: 19'' slide-in, 3 HE (132,5mm) 570 mm deep.

Weight: 31kg

<p>Caution! Safe operation of this power supply is only possible within the range of above given specifications. Any alteration endangers safety.</p>
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2 Connecting the unit

Installation and start up may be carried out only by persons, who on the basis of their professional training, practical experience and profound knowledge of the valid regulations, are able to carry out the required work. They must be able to recognize possible hazards while conducting the work.

2.1 Scope of delivery

After unpacking a thorough check on possible visible damages must be made, in order to ensure the designated and safe operation of the power supply.

The delivery includes:

- 1 DC-Sputtering Power Supply
- 1 Operating instructions
- 1 High voltage plug
- 1 Data transfer plug Sub.-D 25 pins (Interface AS 4)
- 1 Interconnection 3 x 25A

If the delivery is incomplete or damaged, please immediately contact your dealer or distributor.

2.2 Installation of the unit

The power supply shall be installed in a 19'' cabinet, mounted to sub rack supports capable of bearing the weight of 75kg. After installation the power supply has to be secured with four screws at the front panel. To ensure enough cooling do not cover the ventilating louvres at both sides and the fan at the back and leave sufficient space between the unit and the rear wall. For cooling ensure enough fresh air in the cabinet.

(Optional: Front panel stack adapter for vertical installation)

2.3 Output voltage connection X1

The connecting cable between power supply and cathode must be a two-phase shielded cable with a minimum cross-section of $2 \times 4 \text{mm}^2$. Make sure that the output voltage contact to earth does not exceed $1000V_{\text{DC}}$ to ground. The two wires of the cable must each be connected with the plus and minus pole, the shielding must be connected with one of the ground terminals of the plug enclosure. In case one pole is grounded, then shielding and one pole must be connected to ground directly at the cathode.

Contact 1: plus pole Contact 2: minus pole

Before installation the plug insert must be separated from the plug enclosure (four screws).

The connecting cable has to be passed through the plug enclosure, the insulation has to be stripped off. The

two stranded wires have to be stripped off 8mm in the end and be placed central into the contact studs. The conus for sticking the stranded wire has to be fixed using a hex-socket-head screw 2mm, turning to the right. (see drawing of the high voltage plug). The contacts studs with axial hex-socket are turned from the front side of the plug.

The cable shielding has to be connected to the plug enclosure via ground clamps.

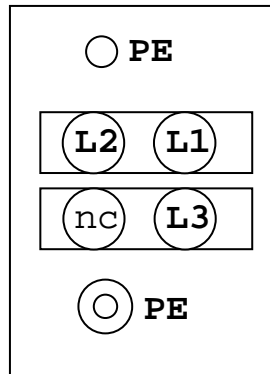
Then the contact plate has to be pushed back into the plug enclosure and secured by four screws.

Caution! This DC-sputtering power supply generates DC-voltages up to 1500V to ground. Before connecting to X1 make sure that the connection to the recipient is correctly installed according to the instructions of the manufacturer of the vacuum high voltage interconnection. **Danger to life!**

2.4 Mains connection X2

The unit requires a 3-phase mains supply, protected by a 25 amps fuse. The mains cord must consist of a 4-wire cable with a minimum cross section of 4 x 2,5mm² - for example type NYSLYÖ - in accordance with VDE 0100. It is mounted to the plug supplied with the unit. The cable can then be connected to socket X2 on the back of the unit and secured by the locking device (see chapter 2.3.).

The pin assignement ist shown on the rear panel of the unit:



2.5 Control socket X3

Depending on the type the power supply is equipped with the interface AS 4 or profibus.

2.5.1 Interface AS 4

This 25-pole Sub.-D-socket is the interface for all signals required to remotely switch on and off the unit, select the operating modes, enter the set values and monitor the actual values for current, voltage and power.

Control inputs:

The control inputs are provided with opto-couplers or relays (Interlock and Ext. ON) and thus electrically isolated. In order to set a function a voltage of +24V is applied to the respective control input. This control voltage is always referred to pin 21 (Digital Gnd.) In case an external control voltage of +24 V is not available, it is possible to connect pin 21 (Digital Gnd) to pin 25 (Gnd) and the respective inputs to pin 14 (+24V).

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<p>Extern ON Pin 3</p>	<p>Output voltage is switched ON.</p>
<p>Enable Pin 16</p>	<p>Enabling the controllers when activated. The main contactor is not affected; if energized it stays energized!</p>
<p>Set value Ext. Pin 17</p>	<p>The unit is switched over to remote control.</p>
<p>Interlock Pin 15</p>	<p>This input can be used as a process alarm loop or in a personal protection system for door contacts etc.. Normally this pin is connected to +24V. If the input is interrupted, the controllers switch off output voltage and the main contactor is deenergized.</p>
<p>Option 1 U1/U2 Pin 4</p>	<p>Depending on the type of the unit, a second voltage range may be selected.</p>
<p>Option 2 Program Pin 5</p>	<p>Starting the run-in program for new targets.</p>
<p>Control Mode U Pin 18 Control Mode I Pin 6</p>	<p>Selection of the control characteristic. "Mode U" controls the output voltage, "Mode I" controls the output current. In case no voltage is applied to either of the two inputs, the output power is controlled.</p>

Control outputs:

All function signals are output via relay contacts referred to a common point (pin 2). The contacts are class B contacts (make contacts).

Ready Pin 8	The unit is switched ON and ready for operation. The signal output is independent of the controllers being switched off via control input "Enable" or not.
Plasma Pin 20	The contact closes as soon as the plasma has fired and power is being drawn from the unit.
Overload Pin 7	The signal is output as soon as the unit has switched off in case of a short-circuit. After removal of the fault and having waited a short period of time (~ 1 minute) the unit can be restarted by shortly switching off and on again control input "Extern On".
Short-circuit (Arc) Pin 19	This contact closes as soon as spark-over occurs in the recipient, even if no permanent short-circuit is established.
R-Lock Pin 9	This contact closes as soon as a controller is switched off by the internal protection circuitry by an external command (Enable, Ext.-On, Interlock).

Set value input:

Inputting of external set values can be accomplished after switching over of the unit (Set value Ext.) and selecting an operating mode (Control Mode U, I, P) by means of connecting a voltage of 0...10V, according to a range of 0...100%. The set value of output voltage, current or power corresponds with the input voltage in a calibrated relationship.

In order to allow suppression of noise signals the set value input is a differential input. The set value voltage is input via pin 22 (set value high) and pin 10 (set value low). The potential of the input voltage may be offset against Gnd by a maximum of 1V. If the differential input is not required, pin 10 may be connected to Gnd.

Reference voltage source:

In case of no external 10V reference voltage source is available, the reference voltage output (X3, pin 23) may be used for supplying of the set value input.

Actual value output:

The actual values of output voltage, output current and output power are present on pin 24 (voltage), pin 12 (current) and pin 11 (power) as voltages from 0...10V, representing 0...100% of the respective nominal value. The signals are referred to Gnd.

2.5.2 Interface AS 5 (Joulemode module)

With the interface AS 5 the power supply can remotely controlled only be operated in P-Mode. The control inputs „Interlock``, „Extern On``, „Enable`` and „Set value ext`` are the same inputs as on interface AS 4. Four control inputs of the interface AS 4 (U1/U2, Ramp, control mode U and control mode I) have different functions on the interface AS 5. All control outputs, analogue outputs and the set value input are the same on the interfaces AS 4 and AS 5.

The joulecounter controls the energy output of ``Maris`` power supplies during the process. The ``Maris`` generates a trigger signal of which frequency is proportional to the actual output power and which is counted by the joulemode.

When the energy value presettet by the SPS is reached, the Maris is stopped by the joulecounter.

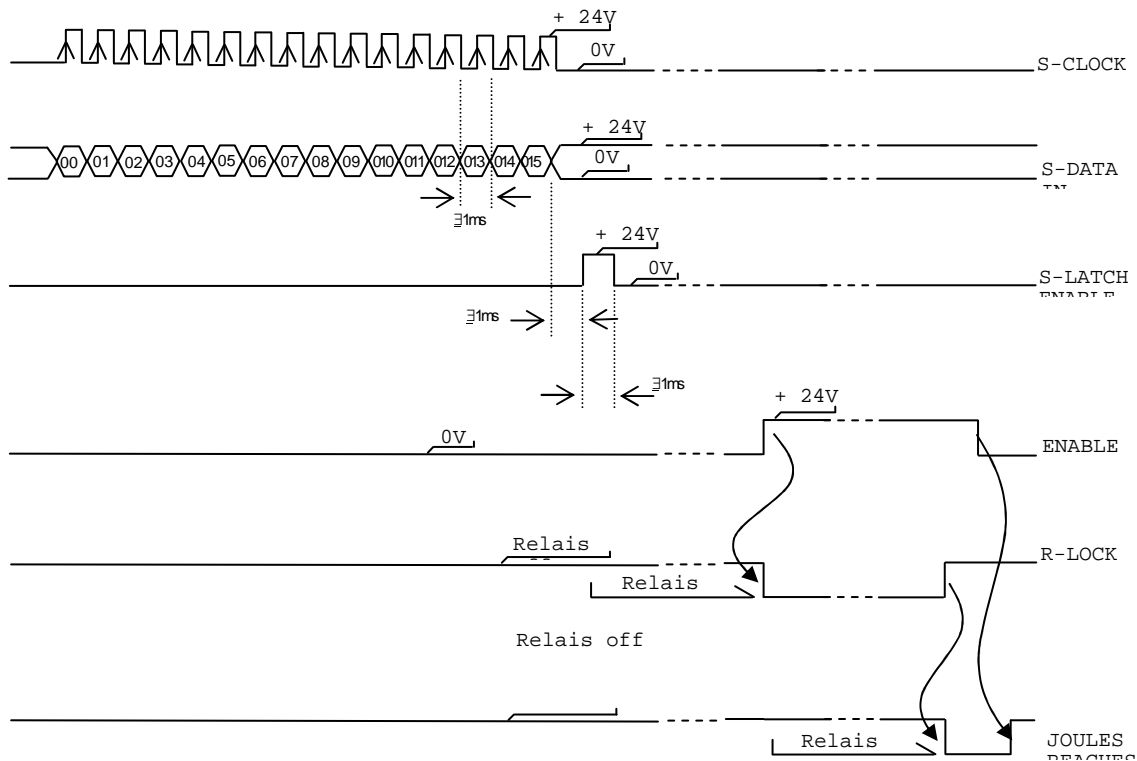
The data transfer from the SPS to the joulemode module on the AS5 inferface works synchronically - serially into a 16 Bit data shift register. Three control inputs are available, named as follows:

S-CLOCK (Pin 5) signal for synchronisation during data transfer

S-DATA (Pin 18) data, which have to be transfered serially {LSB-first}

S-LATCH ENABLE (Pin 4) signal to hold data in the latch

The data transfer and parts of the interface AS5, as far as it is relevant for the joulecounter, is described in picture 1. The maximum impulse frequency for all signals is 1 kHz!

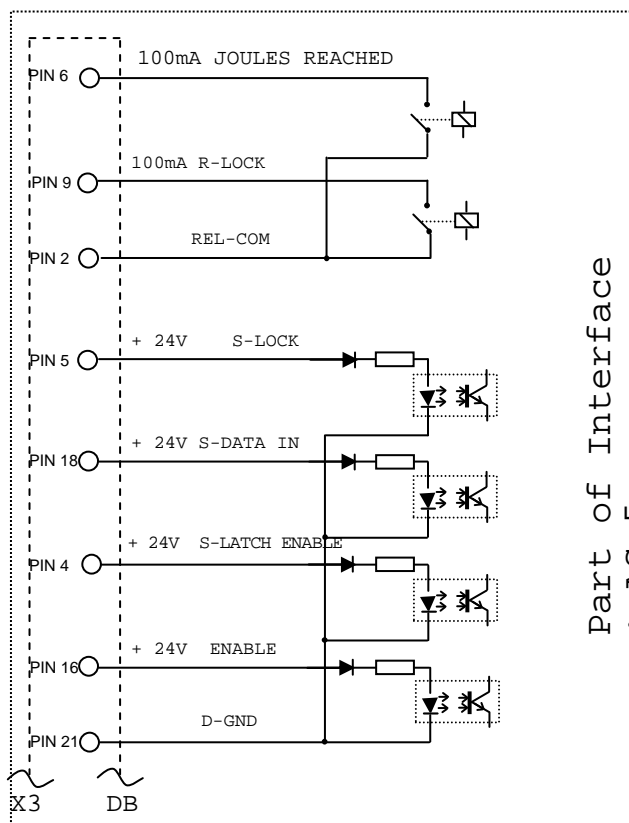


Pict. 1: Diagram of data transfer and control of the joulecounter. The input signals S-CLOCK, S-DATA IN and S-LATCH ENABLE are necessary for the serial data transfer. The input signal "ENABLE" will switch on (logical high) the power output. "R-LOCK" indicates with logical high that the power stage has shut down. "JOULES REACHED" indicates the successful end of process cycle.

After a serial data transfer, the process can be started with signal ENABLE. As long the "Maris" provides power, the contact "R-LOCK" is closed. When

the process is finished and the provided energy has reached the preset value, the output signal JOULES REACHED is set until the SPS resets the ENABLE-signal. Setting ENABLE again, a new process can be started, working with the same preset value for energy. In case a different preset value is necessary, the latch of the joulecounter can be overwritten. Nevertheless, this is only possible, when the ENABLE-signal is 0V in order to protect the running process from unintentional changes.

In case of the process being interrupted before the end, no JOULES REACHED-signal is output.



Pict. 2: The control inputs are provided with optocouplers and thus electrically isolated. In order to set an input logical high a voltage of +24 V is applied to the respective control input.

The signals ``R-LOCK`` and ``JOULES REACHED`` are output via relay contacts referred to a common point (Pin 2).

The set value of the energy input is coded binary. Number Z transmitted to the counter correlated to the energy output in Joule during the normal process procedure. The maximum programming value is:

$$Z = 0 \dots 2^{16} - 1 = 0 \dots 65535$$

and therefore the controllable energy input is:

$$E = 0 \dots 65535 \text{ J}$$

2.5.3 Profibus

Power supplies of the series GS can be equipped with a profibus-interface. Choosing this option, the following profibus-components will be delivered together with power supply:

- operating instructions
- 1 disk with GSD-files.
- 1 adapter cable for the serial interface (extension and adapter)
- Interlock-plug
- PCB ADLB x-408

3 Remotely controlled operation / Interface AS 4

3.1 Switching ON/OFF

In order to switch on the unit, the control input „Interlock“ (X3, Pin 15) has to be connected to +24V. In case of an interruption of the running process, the main contactor opens and stays deenergized. After having reconnected the control input „Interlock“ to +24V, the unit can started again during remote control operation, switching the control input „Ext.ON“ shortly to 0V and then back to +24V.

Note:

„Interlock“ is an electromechanical controller. It serves as an emergency switch-off for purposes of personal protection or as a locking device for the prevention of inadvertent switching-on.

The control socket X3 (Interface AS 4) offers two possibilities for switching on and off output voltage:

1) Extern On (X3, pin 3):

The controller locking circuit and the main contactor are operated. This input should be used for longer-term interruptions, or if short starting times are not of importance.

2) Enable (X3, pin 16):

Only the controller locking circuit is operated, the main contactor remains energized. In case of short

operation/pause-cycles this control input should be used.

3.2 External set value setting

1) Selecting the operating mode:

Select the desired control characteristic via "Mode I" (X3, pin 6) and "Mode U" (X3, pin 18) - (see chap. 2.5).

2) Selecting external set value:

For external set value input, connect "Set value, external control" (X3, pin 17) to +24V.

3) Inputting a set value:

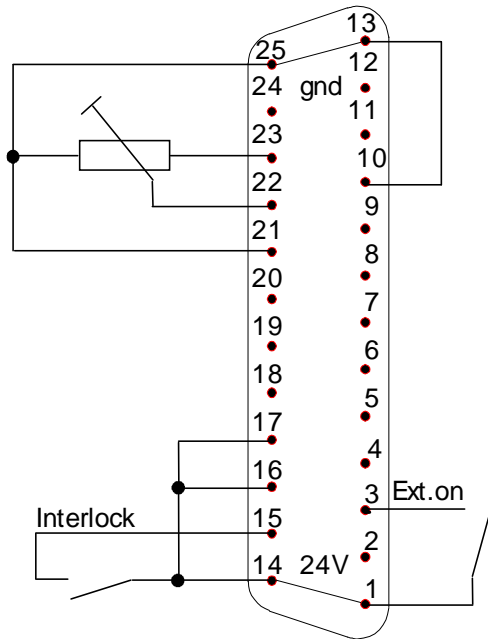
Connect a voltage of 0...10V to "Set value high" (X3, pin 22) and "Set value low" (X3, pin 10) - (see chap. 2.5).

3.3 Execution time table

Step	<u>Order</u>	<u>Note</u>
1	Select control mode (X3.6, X3.18)	X3.6 applied: current controlled X3.18 applied: voltage controlled No pin applied: power controlled
2	Cancel Interlock (X3.15)	LED "Interlock" exceeds
3	Delay loop app. 500ms	
4	Set External On (X3.3)	Main contactor is energized, contact ``Ready`` (X3.8) closes, LED "AC-On" lights up.
5	Set Enable (X3.16)	Enables controller, R-Lock contact opens, LED "DC-On" lights up.
6	Enter set value (0...10V)	Unit operates, contact ``Plasma`` (X3.20) closes when plasma has fired.

3.4 Wiring examples - control socket X3 (AS 4)

3.4.1 Use of internal voltage sources



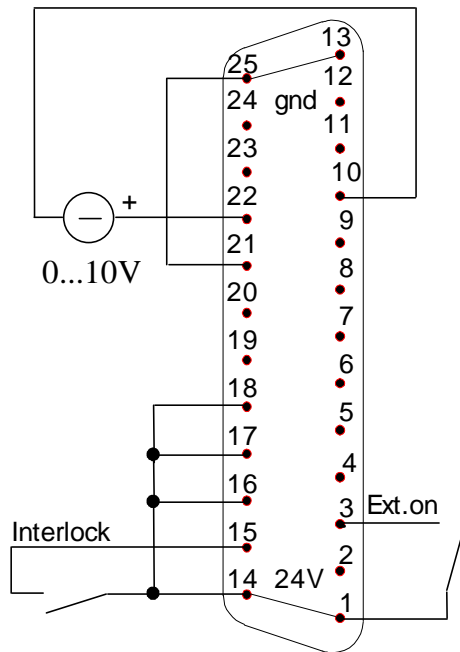
For remote control operation of the unit connect a potentiometer (5kOhm to 10kOhm) across the reference voltage source and ground. Connect its wiper to input "set value high".

Input "set value low" must be connected to Gnd. If the interlock loop is closed, the power supply can now be switched on with "Ext. On".

In this example the selected control mode is power control.

The set value can be adjusted between 0...100% by means of the potentiometer.

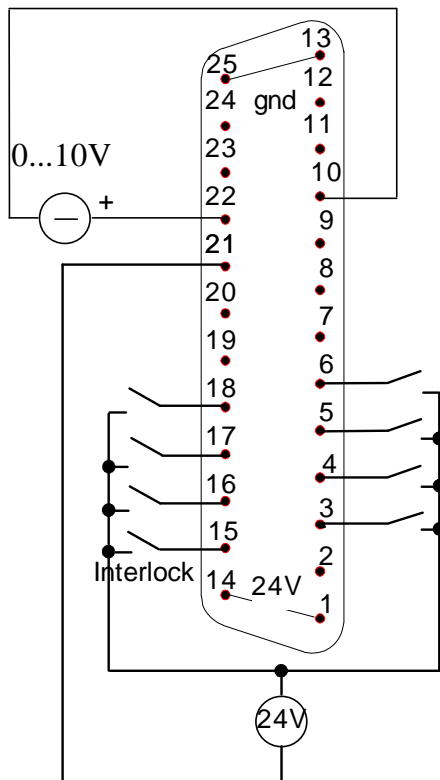
3.4.2 Internal control voltage, external set value setting



The analogue set value is applied to pin 22 (set value input high) and pin 10 (set value input low). Connect the shield of the control cable to Ground. In this example the connected pin 18 (Mode U) selects voltage control.

The symbolically shown interlock switch represents a serial connection of contacts and switches located in designated positions to ensure safe operation of the plant. The input can be used e.g. as a process alarm loop or in a personal protection system for door contacts etc..

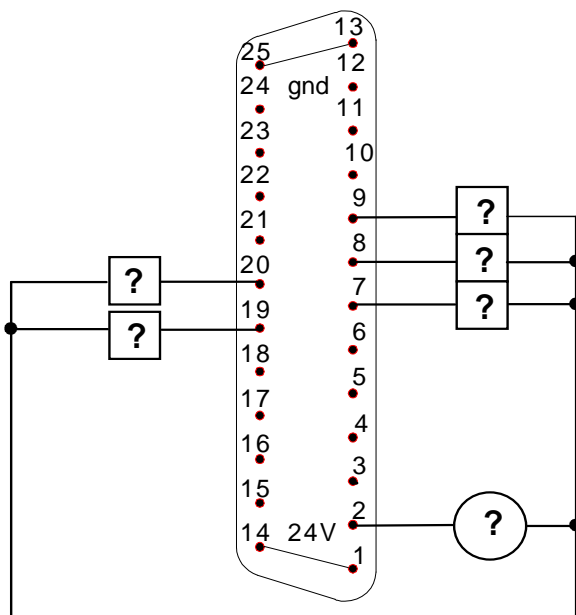
3.4.3 External control voltage



If an external floating DC-voltage source (24V) is used, its negative pole must be connected to pin 21. The potential of the external control voltage may be offset against the internal Gnd. by a maximum of 50V.

The switches shown may be relay contacts or integrated driver circuits (e.g. ULN 2801, ULN 2823). The current consumption is approximately 20mA per input.

3.4.4 Control outputs



All function signals are relay contacts and referred to a common point (pin 2). The contacts are class B contacts (make contacts). If required by the external controller (PLC, PC) the common pin 2 can be connected to Gnd. or to any control voltage up to 42V (AC or DC).

4 Safety, service and warranty

4.1 Safety instructions

4.1.1 General information

The valid regulations for the prevention of accident must be observed when work is carried out on power supplies.

These specifically include:

- Regulation for prevention of accidents
"General regulations"
VBG1
- Regulation for prevention of accidents
"Electrical systems
and equipment"
VBG4

The safety instructions listed below specifically refer to power supplies and the hazards inherent in such equipment. The statutory provisions and regulations for the prevention of accidents are not rendered invalid or modified by these instructions. The above mentioned regulations apply in all cases.

4.1.2 Hazards

The power supply is an electrical device for the transformation of mains voltage into controlled DC voltage or AC voltage. The following voltages are used:

- Line voltages of 230 and 400 V_{AC}
- DC voltages up to 1500V

Disconnected units may carry residual DC voltage, which can, in cases of malfunction, be as high as the operating voltage of the unit.

4.1.3 Working on the system

**HIGH VOLTAGE!
DANGER TO LIFE!**

Any work on the unit may be carried out only by persons who, on the basis of their professional training, practical experience and through the knowledge of the valid regulations, are able to assess and to carry out the required work and who are able to recognize the possible hazards.

The following must be observed under all circumstances:

Work may be carried out only on disconnected unit!

To ensure that the system is completely dead, the following five safety rules must be observed:

1. Disconnect.
2. Ensure that the unit cannot be switched on unintentionally.
3. Ensure that the unit is free of voltage.
4. Ground and short-out the unit.
5. Cover or block of parts in the direct surroundings which carry voltage.

To ensure the unit to be completely free of voltage, the power supply must be disconnected from the mains, as several parts of the unit carry voltage even when the mains is switch of.

4.2 Warranty

Pre-tested material was used for production and final inspection of the unit. Should there still be reason for complaint, we provide warranty for the material and technical defects related to production for a period of :

24 months

starting the date of purchase. Damages caused by improper use or unauthorized work carried out on the unit is not covered by this warranty.

In case of any trouble, or if you just have a question, feel free to contact either company at any time. We shall be glad to help you.

5 Annex

Declaration of conformity

According to the EC-guideline Machines 89/392 / EWG, Amendment II B for Machines and the EC -guideline for Electromagnetic compatibility 89/336/EWG

We,

hereby declare the unit named below, due to its technical design as well as in its traded version, meets the known basic safety and health requirements of the EC guidelines.

Device name:	DC Sputtering Power Supply
Type:	GSC 120

Harmonized standards applied:

- ⇒ DIN EN 60204.1 Safety of machinery - Electric equipment for industrial machines
- ⇒ DIN EN 60146 Semiconductor converters: Basic requirements
- ⇒ DIN EN 50081.2 EMC; Generic emission standard; Industrial environment
- ⇒ DIN EN 50082.2 EMC; Generic immunity standard; Industrial environment

National standards, guidelines and specifications applied:

- ⇒ VDE 0558 part 1.3 General requirements and self-commutated converters
- ⇒ VDE 0838 part 2 Harmonic current emissions
- ⇒ VDE 0106 part 1 Protections against electric shock
- ⇒ VDE 0109 part 11 Insulation coordination
- ⇒ VBG4 Electric systems and production facilities

The technical documentation for this unit is complete. The operating manual for this unit has been submitted in German and English.

Installation and start-up of the device mentioned above is prohibited until it can be stated that the electrical system to which the device shall be attached to, meets the directives of the EC-guidelines, the Harmonized and European standards or the related National standards.

