

# **plasma**brush®

## **Operating instructions** **Communication package digital I/O**



Thank you for buying a high-quality **relyon plasma** GmbH product.  
To get the best from your product, please read these instructions carefully.



## **Important!**

**Read these instructions carefully before assembling, installing and starting up the machine!**

**Always follow the safety instructions!** Failure to follow the safety instructions may result in accidents, serious injury and serious damage to the machine.

**The product may only be started up and operated by trained and qualified persons!**

**Train your staff!** The operator / user is responsible for ensuring that personnel have fully understood the operation of the machine and the safety requirements.

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Original Operating  
Instructions

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# 1 Safety

The system was designed in accordance with the relevant international standards. However, as with any technical product, hazards may arise if the system is not used properly or is used for purposes other than its intended use.

Working with the system can be dangerous and may result in serious or fatal injury. It is therefore essential to protect yourself and others.

In addition to the safety instructions in this document, you must also comply with general safety standards.



## Caution - Danger!

When working with the system, please note and observe the safety instructions and requirements in these operating instructions because non-compliance may result in serious or fatal injury.

## 1.1 Residual risks

This system has been manufactured in accordance with the current state of the art. However, it is impossible to eliminate residual risks.

Always adhere to the following safety instructions:



## Caution – Electrical voltage!

- Danger: 230 V. If damage is visible on the electrical connection, mains cable or system:
  - Do not start up the system.
  - Have the damaged parts repaired by a qualified person or replace them.



## Trip hazard!

Lay the connection cables in suitable cable trays. Lay cables such that they do not present a trip hazard.

## 1.2 Information and obligations for the operator

- The system may emit interference.
  - The system has been tested in accordance with EMC legislation.
  - The operator must verify and assure electromagnetic compatibility with other electrical and electronic equipment in the immediate vicinity of the system.
- Ensure that
  - operating personnel have read and understood these operating instructions.
  - anyone working near the machine is made aware of the dangers and is provided with the necessary protective equipment.
  - Repairs are only carried out by qualified persons.
- In particular, make operating personnel aware of the safety instructions in this document.
- Always keep the system in fully functional condition.
- Any modifications made to the machine will invalidate the operating licence and the warranty unless such modifications are expressly authorised by the manufacturer.

## 1.3 Intended use

The system is intended solely for operation with the PS2000 high-voltage source and a plasma generator from **relyon plasma** GmbH.

Coupled with a suitable plasma generator, the machine is intended solely for the plasma treatment of surfaces (metals, textiles, glass, plastics) to activate, clean, coat or remove residue at atmospheric pressure.

Under no circumstances may the system be used by non-trained persons.

#### **1.4 Impermissible operating conditions**

The system must not be operated under the following conditions:

- In explosive (ex) zones
- In areas with severe build-up of dust
- Where there is excessive air humidity (>80 % rel.)
- At temperatures beyond 0 – 40 °C / 32 – 104 °F
- Where there are strong vibrations



#### **Note!**

Please also observe the information in the operating instructions of all additional components connected to the system.

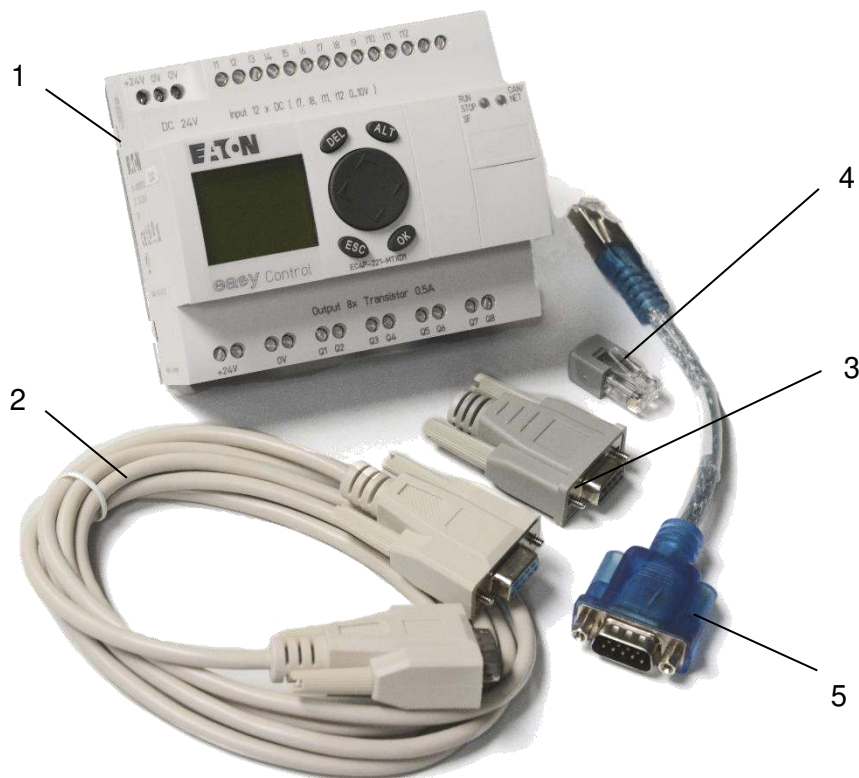
## 2 System description

### 2.1 Function

The components of this system are the basic elements for communicating with a PS2000 current source via digital input and output signals.

### 2.2 System overview

#### 2.2.1 Description of the components



No.	Component
1	EASY control with specific software from relyon plasma
2	CAN cable (length 2m)
3	CAN terminal resistor (sub-D)
4	CAN terminal resistor (RJ45)
5	CAN cable for adapting from RJ45 to sub-D

### 2.2.2 Scope of delivery

The scope of delivery includes the following components:

- EASY control with specific software from relyon plasma
- CAN cable (length 2m)
- CAN terminal resistor (sub-D)
- CAN terminal resistor (RJ45)
- CAN cable for adapting from RJ45 to sub-D
- Operating instructions

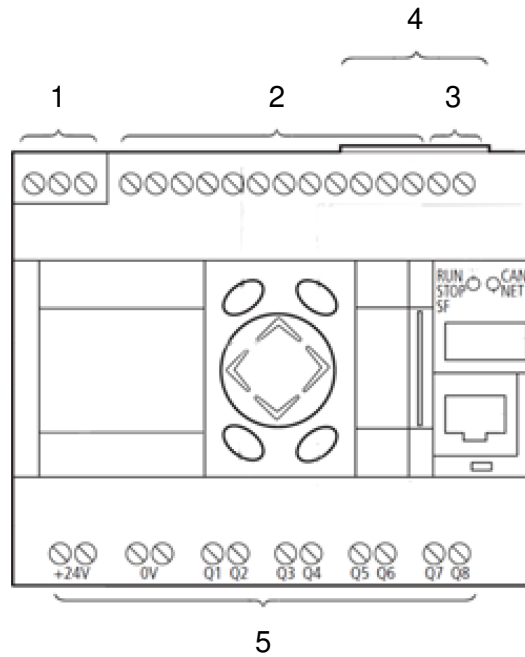
### 2.2.3 Other hardware components needed

Depending on the stage of expansion, several additional hardware components are needed for a functioning overall system. Either recommendations for these or the characteristics needed are listed below.

Component	Description
Voltage supply	U = 24 V DC; I ≥ 1 A; to supply the EASY control
Wiring material	Various cables, top hat rail terminals and bridges depending on stage of expansion
SFAB (MFM) flow sensor	Festo SFAB-200U-HQ8-2SV-M12 (optional)
SFAB connecting cable	Festo NEBU-M12W5-K5-LE5 (optional)

## 2.3 Connection assignments

### 2.3.1 EASY control connection assignments



Pos.	Description	Description	Type
1	+24 V / 0 V	Supply voltage	Terminal
2	I1 to I12	Inputs	Terminal
3	not assigned	-	Terminal
4	NET1, NET2	CAN connections	RJ45
5	+24V, 0V, Q1 to Q8	Transistor outputs	Terminal



The table below shows the connection assignment of the control in maximum design. For the signal level  $U_{HIGH} = 24V$ ,  $U_{LOW} = 0V$ .

Name of terminal	Name of signal	Description	Signal level
24V	Supply voltage	–	24V
0V	Earth	–	0V
I1	ON_1-in	With HIGH level present, activates the channel of current source 1 so this can be activated.	0V/24V
I2	HV_1-in	With HIGH level present, switches on high voltage of current source 1 and thereby starts the connected plasma generator.	0V/24V
I3	QUIT_1-in	With a HIGH level, acknowledges any ERROR message of current source 1 which may be present.	0V/24V
I4	ON_2-in	With HIGH level present, activates the channel of current source 2 so this can be activated.	0V/24V
I5	HV_2-in	With HIGH level present, switches on high voltage of current source 2 and thereby starts the connected plasma generator.	0V/24V
I6	QUIT_2-in	With a HIGH level, acknowledges any ERROR message of current source 2 which may be present.	0V/24V
I7	Not connected	–	–
I8	Not connected	–	–
I9	Flow sensor selection	With LOW level, the control is operated in a mode without integrated flow sensors. Monitoring of the gas flow is NOT active, channels I11, I12, Q7 and Q8 are not active. With HIGH level, the control is operated in a mode with integrated flow sensors. The gas flow is monitored and channels I11, I12, Q7 and Q8 are active.	0V/24V
I10	Source number selection	With LOW level, the control will communicate with one current source. With HIGH level, the control will communicate with two current sources.	0V/24V
I11	AI SFAB 1	Analogue input for the ACTUAL value of flow sensor 1. (10-bit resolution) $0 - 10 V \cong 0 - 200 \text{ NLM}$ (standard litres per minute)	0..10V
I12	AI SFAB 2	Analogue input for the ACTUAL value of flow sensor 2. (10-bit resolution) $0 - 10 V \cong 0 - 200 \text{ NLM}$ (standard litres per minute)	0..10V
NET1	CAN terminal resistor (RJ45)		–

NET2	CAN cable for adapting from RJ45 to sub-D		–
Q1	READY_1-out	Ready for operation feedback from current source 1.	0V/24V
Q2	HV_ON_1-out	Active high voltage feedback to current source 1.	0V/24V
Q3	ERROR_1-out	Current source 1 feedback indicating error message present.	0V/24V
Q4	READY_2-out	Ready for operation feedback from current source 2.	0V/24V
Q5	HV_ON_2-out	Active high voltage feedback to current source 2.	0V/24V
Q6	ERROR_2-out	Current source 2 feedback indicating error message present.	0V/24V
Q7	GAS_1-out	Feedback indicating sufficient gas flow at flow sensor 1 (value between 35 and 70 NLM).	0V/24V
Q8	GAS_2-out	Feedback indicating sufficient gas flow at flow sensor 2 (value between 35 and 70 NLM).	0V/24V

Please note that it is essential that a gas flow is present in order to start the plasma generator. If an SFAB flow sensor is connected to the control, this checks the presence of the gas flow. If the control is operated without SFAB flow sensors, no check takes place. This check then has to be provided in the overall system. Before activating the high voltage for plasma generation, there must be a gas flow through the plasma generator for at least 2 seconds.



**Attention – Damage to machine!**

The plasma generator may be damaged if it is operated with no gas or too little gas.

- Never switch on the high voltage before sufficient gas is flowing through the plasma generator!

### 2.3.2 Connection assignment of an optional SFAB flow sensor

The SFAB-200U-HQ8-2SV-M12 type flow sensor from Festo is suitable for use with this system. A suitable connecting cable, e.g. NEBU-M12W5-K5-LE5 from Festo, is needed for the connection. The connection assignment for this is shown by way of example.

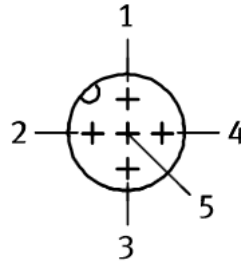


Fig.: Plug assignment of connecting cable to SFAB

Connection	SFAB assignment	Control assignment	Level	Surround colour
1	24 V	–	24 V	brown (BN)
2	not needed	–	–	white (WH)
3	0 V	–	0 V	blue (BU)
4	not needed	–	–	black (BK)
5	Analogue output	I11 or I12	0..10 V	grey (GY)

### 2.4 Stages of expansion

The digital I/O communication package serves as a basis for communicating with a PS2000 current source via digital input and output signals. Depending on the desired scope of function, extra components may be needed.

Up to two PS2000 current sources and up to two SFAB (MFM) flow sensors can be integrated in the overall system.

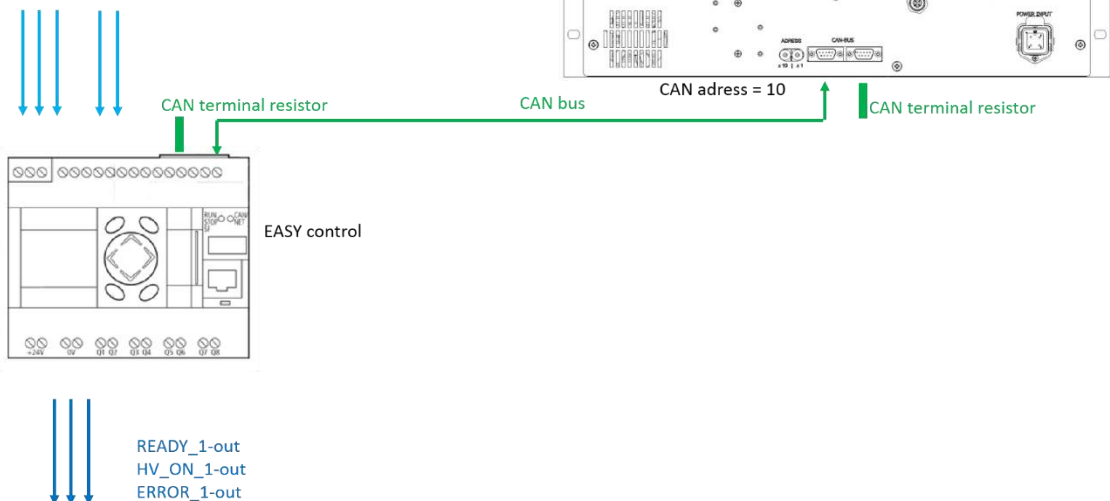
Two possible stages of expansion are explained below. Please note that the schematic illustrations only show the signal paths because different characterisations of the external components and resulting wirings are possible depending on the system setup.

## 2.4.1 Minimum setup

Operation of a PS2000 current source without SFAB flow sensor.

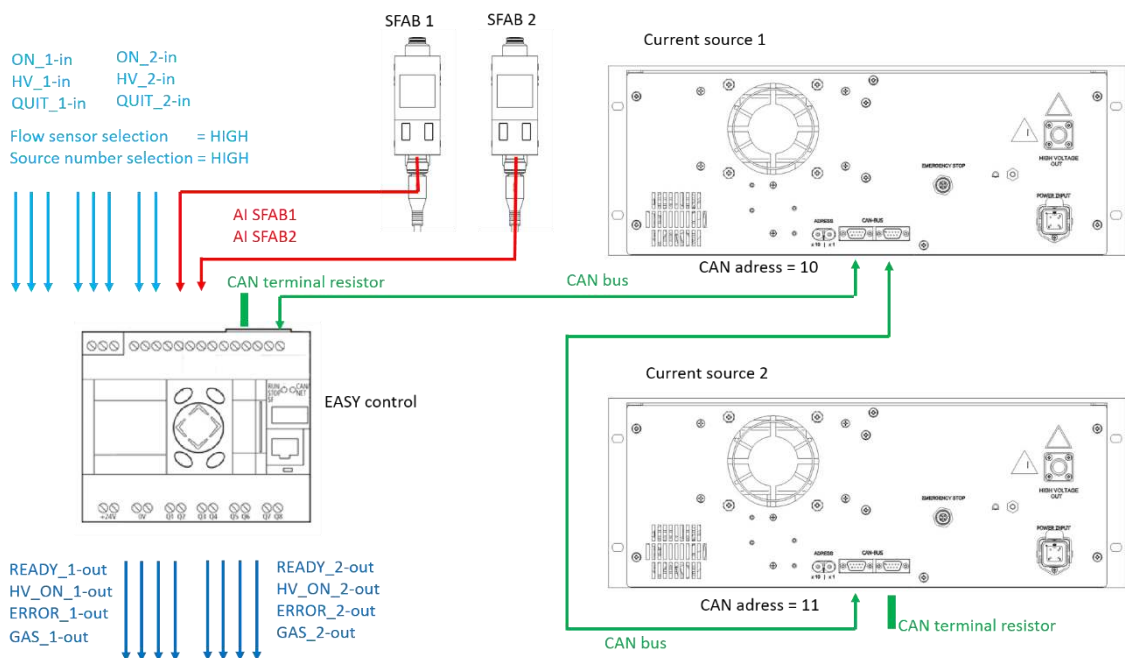
ON\_1-in  
HV\_1-in  
QUIT\_1-in

Flow sensor selection = LOW  
Source number selection = LOW



## 2.4.2 Maximum setup

Operation of two PS2000 current sources with two SFAB flow sensors.



### **3 Transport / storage**

- Protect the system from dirt and foreign bodies.

## **4 Unpacking and installation**

### **4.1 Unpacking**

- Carefully open the packaging.
- Take the components out of the packaging.

### **4.2 Installation requirements**

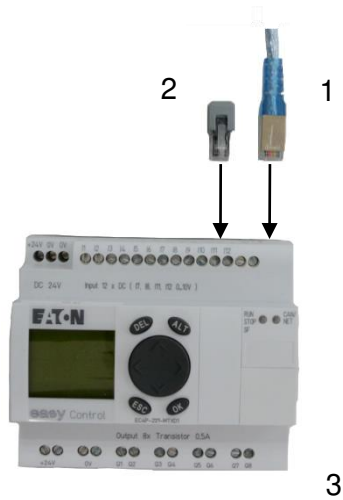
Before installing the machine, the following must be true:

- The components must be undamaged.
- If installing as a permanent installation or in a building, a suitable switch or circuit breaker that satisfies national safety requirements (in Germany: VDE 0100) must be fitted as an upstream all-pole cut-off device that will disconnect the system from the power supply. This cut-off device should be fitted near the machine and must be easily accessible to the user. The switch must also be labelled as the cut-off device for the machine.
- Only a trained electrician may wire the system.
- Observe all installation requirements and safety notices of the additional machines connected.

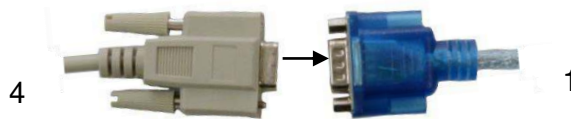
### 4.3 Installation

To install the system, perform the following steps in the order given:

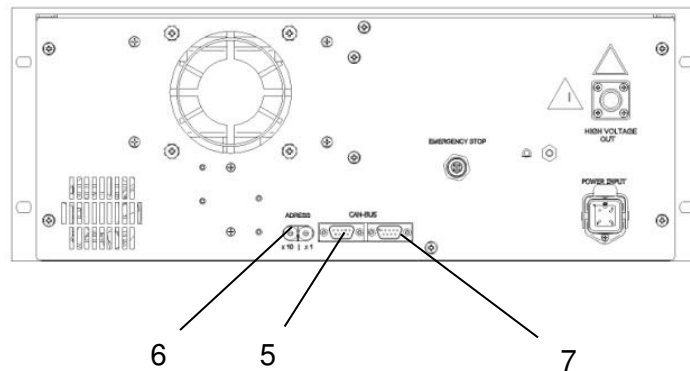
1. Mount the intended components on a top hat rail to ensure a stable attachment.
2. Wire the components in accordance with the wiring plans and the desired stage of expansion.
3. Remove the cover cap of connections NET1 and NET2 and plug CAN adapter cable (#1) and CAN terminal resistor RJ45 (#2) onto EASY control (#3).



4. Connect CAN cable (#4) with CAN adapter cable (#1).



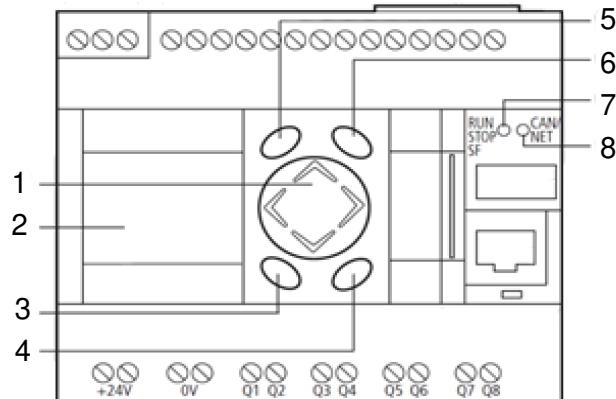
5. Connect CAN cable with rear connection of PS2000 current source (#5). If using two current sources, these are linked to one another with another CAN cable.
6. Terminate CAN bus on the last PS2000 with the intended terminal resistor (#7); if necessary, also refer to the operating instructions of the PS2000 current source.
7. Set the node number of PS2000 to "10" (or "11" if there is a second current source) (#6).
8. Assemble the emergency stop circuit for the PS2000 and all other connections of the additional machines as described in the corresponding operating instructions.
9. If using an SFAB flow sensor, connect this to the plasma generator's gas supply.



✓ The system is installed.

## 5 Operation

### 5.1 Operating elements of the EASY control



No.	Description
1	Cursor buttons P1...P4 (rocker)
2	LCD
3	ESC button
4	OK button
5	DEL button
6	ALT button
7	Operating LED "RUN/STOP/SF"
8	Operating LED "CAN/NET"

### 5.2 Operating LEDs of the EASY control

When operating the EASY control, the operating LEDs may assume the following states:

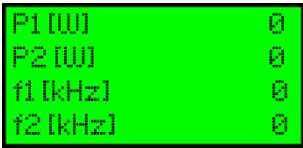
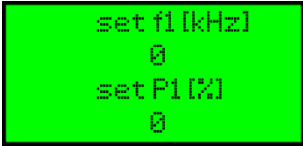
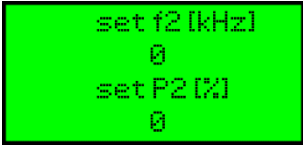
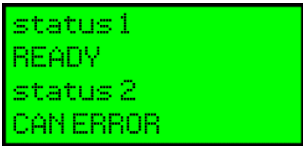

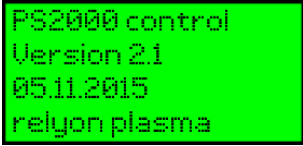
LED RUN/STOP/SF	LED CAN/NET	Meaning, CPU state
green	off	Communication not activated
green	red	STOP bus state
green	orange	PREOPERATIONAL bus state; participant may be initialised, no transfer of process data
green	green	OPERATIONAL bus state; process data is transferred



### 5.3 Displays of the EASY control

You can page through the following menu items by pressing the "<" and ">" cursor buttons. Pressing the "ALT" button takes you to editing mode for the current menu item. You can then select the value to be changed with the cursor buttons. Selecting "OK" activates editing mode for the numerical value, which you can then change with the cursor buttons. Pressing the "OK" button again saves the value. By pressing the "ESC" button you can decide NOT to accept a modified numerical value or having saved the change, you can switch out of editing mode and back into the menu item view.

Note: Values outside the input range can also be selected under menu items 2 and 3. This change is not however implemented by the control.

Menu item	Screen	Explanation
1		Start of EATON control; instantaneous values for power "P" (in W) and frequency "f" (in kHz) of both high voltage sources are displayed; if the control is only operated with one high voltage source, the instantaneous values for P2 and f2 are both zero.
2		Setting of power and frequency values for the first source at node 10  Input range for "f1" = 40 to 65 [kHz] Input range for "P1" = 70 to 100 [%]
3		Setting of power and frequency values for the second source at node 11; if the control is only operated with one high voltage source, the input values for "set f2" and "set P2" can be assigned but are inactive.  Input range for "f2" = 40 to 65 [kHz] Input range for "P2" = 70 to 100 [%]
4		Output of status message of high voltage source(s); the status messages can be found in the operating instructions for PS2000; specific error messages are output as of PS2000 firmware version 4.04; with firmware version 4.03, in the event of an error, the central switching circuit error is always shown, if the control is only operated with one high voltage source, CAN ERROR is always displayed for the second status
5		Display of gas flow currently being measured. If there are no SFAB flow sensors connected to the control, "0" is displayed.
6		Version number of control and date of last update.

## 5.4 Start-up

In order to operate the system, the following points must be satisfied:

- The main switches of the connected PS2000 current sources must be switched on.
- The emergency stop circuit must be correctly connected.
- The CAN bus cables must be connected, both ends terminated with terminal resistors and the correct CAN bus addresses set at the current sources.
- The baud rate of the current source(s) must be 500 kBd.
- The software version of the current source(s) must be 4.03 or higher.
- The EASY control must have a power supply.
- The plasma generator must have a gas supply.
- All additional machines/components must be correctly connected.

If these points are satisfied, you can communicate with the PS2000 current sources and operate them in accordance with the signals described under 2.3.1.

## 5.5 Settings during first start-up

During the first start-up the desired start parameters must be entered because they are initially set to "0".

Do this as described under 5.3 for the values f1 / f2 and P1 / P2. Depending on whether you are using one or two current sources, do this for one or both menu items.

The default parameters of the PS2000 current source are power (P) = 100 [%] and frequency (f) = 54 [kHz].

These values are just one possible setting. Depending on application, the desired start parameters may deviate from this.

Once set, these values are saved and are even retained if the system is restarted.

## 6 Environment

### 6.1 Disposal



#### **Consider the environment.**

Used electrical and electronic equipment must not be disposed of along with normal waste.

- The machine contains valuable materials that can be recycled. Take the machine to a suitable collection point.

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