

**BlueLine**

*Instruments for Electrophoresis*

## INSTRUCTION MANUAL

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**BluePower™ 200x4**  
**BluePower™ 500x4**  
**BluePower™ 1500x4**  
**BluePower™ 3000x4**

**SERVA**  
Electrophoresis

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## **WARNING**

**These units are capable of delivering potentially lethal voltage and are to be operated only by qualified technically trained personnel.**

**The BluePower power supplies are designed to give long service and reproducible results in your laboratory. They comply with European safety regulations EN 55014, EN 55104, EN 60555-2, EN 60555-3 and VDE 0805. A few moments spent reading these instructions will ensure that your expectations are reflected in the successful use of the apparatus.**

**Please read the entire operator's manual thoroughly before operating this unit.**

First check with the aid of the packing list that the apparatus has been received complete and undamaged following shipment and check that all components and accessories are present. Any damages or missing parts must be notified to **SERVA Electrophoresis GmbH** Heidelberg resp. to the responsible distributor immediately, **SERVA Electrophoresis GmbH** cannot accept responsibility for goods returned without prior notification.

**Warranty is 12 months from the date of delivery.**

**Please retain all packaging materials until the warranty period has expired.**

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# 1 Pack list

After receipt of the power supply, the packaging should be checked carefully for transport damages. A heavily damaged packaging may mean a damaged and therefore not functioning device. Eventual damages to the device should be put forward to the mail order firm. Carefully unpack the power supply. Check the extent of delivery. Missing or damaged parts should be reported immediately to **SERVA Electrophoresis GmbH** resp. the according distribution partner.

The delivery of the **BluePower** power supplies contain:

- 1 power supply
- 1 power cable
- 1 user manual

Packed additionally to BP1500x4 and BP3000x4:

- 4 high voltage adapter for a 4mm-plug (red)
- 4 high voltage adapter for a 4mm-plug (black)

## 2 Introduction

### 2.1 Operational overview

With the help of the **BluePower** power supply, electrophoresis chambers may be operated at constant voltage, constant current or constant power. The device works with an automatic change of constants. They are regulated by voltage, current or output in accordance to whichever factor is reached first.

The **BluePower** power supply may be operated in the mode “**Manual**” or “**Program**”.

In the “**Manual**” mode the power supply works time limited and continuously. In “**Program**” mode, runs may be carried out in up to 9 steps. The duration of the program step can be set by time and/or volt hours product. After termination of a program the device optionally shuts itself off or changes into quiescent run.

In the version **BP3000x4**, the setting **LOW CURRENT (LCu)** allows fine adjustment for current values • • • • • • • • • • • • • • • • • **HIGH CURRENT (HCu)** appears in the display.

**BluePower** power supplies are able to save 9 different programs with 9 steps each, which can be generated and changed with the function “**Edit**”.

No-load operation (no electrophoresis unit connected): Rapid changes of the gel resistance and earthing is recognized automatically. A run interrupted through a power failure may be resumed.

## 2.2 Parameters

A run is characterized through the course of the actual operating values of the electrical parameters voltage, current and output, and is restricted through the break off parameter time and/or volt hours product. The course of the actual values of voltage, current and output is determined through the changing in electrical resistance of the gel and through the changes of the settings of voltage, current and output.

$$R = \frac{U}{I}$$

The settings of the electrical parameters in the mode “**Manual**” and “**Program**” may also be changed during a run. The mode “**Program**” contains the additional possibility to change the settings from program step to program step.

A run, resp. a program step may be time limited through break off parameter. On the one hand a timer function allows monitoring of the actual run time and on the other hand the elapsed number of actual volt hours can be measured.

$$\text{Volt hours (Vh)} = U \times t$$

Both the electrical parameters and the break off parameters may be changed in wide ranges:

Product	BluePower 200x4	BluePower 500x4	BluePower 1500x4	BluePower 3000x4
Regulation	const. Voltage / const. current/ const. power / programming			
Load End				
Voltage	5 V – 200 V	10 V – 500 V	30 V – 1500 V	30 V – 3000 V
Current	10 mA – 2000 mA	10 mA – 1000 mA	3 mA – 400 mA	0,3 mA – 20 mA (LCu) 3 mA – 200 mA (HCu)
Power	1 W – 200 W	1 W – 200 W	1 W – 300 W	1 W – 300 W
Resolution				
Voltage	1 V	1 V	1 V	1 V
Current	1 mA	1 mA	1 mA	0,1 mA (LCu) 1 mA (HCu)
Power	1 W	1 W	1 W	1 W
Time	1 min / 1Vh <sup>1</sup>	1 min / 1Vh <sup>1</sup>	1 min / 1Vh <sup>1</sup>	1 min / 1Vh <sup>1</sup>

<sup>1</sup> The timer may be changed from **00:00 h:min up to 23:59 h:min**, the volt hours product from **0 up to 999999 Vh**.

In the mode “**Program**”, at least one of the two values must be chosen differently from zero. If acting against this, the power supply reports an error after the program start, resp. after change into this program step.

If the other break off parameter is zero, it has no effect on the automatic program step change and the program end, resp. end of run. The device ends the run

(program) or the program step when the preset limit of the break off parameter has been reached.

If the time as well as the volt hours product is different from zero, the device stops the run (program) or the program step, as soon as the time or the volt hours product is reached.

## 2.3 Power output

After the power supply has been started, there is no voltage on the voltage sockets ( $U=0$  volt). No current flows through the connected electrophoresis chamber ( $I=0$  ampere). This means, the power supply does not emit any output.

$$P (W) = U \times I$$

When a run is started, the output emittance begins. Now the voltage sockets are under voltage. Current flows through the connecting electrophoresis chamber. Power output will be terminated at break or termination of run.

## 3 Technical description

### 3.1 Front

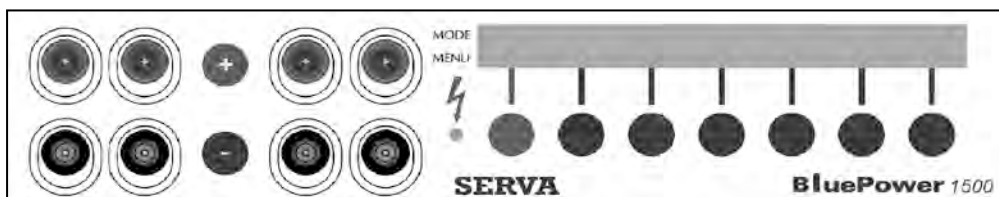


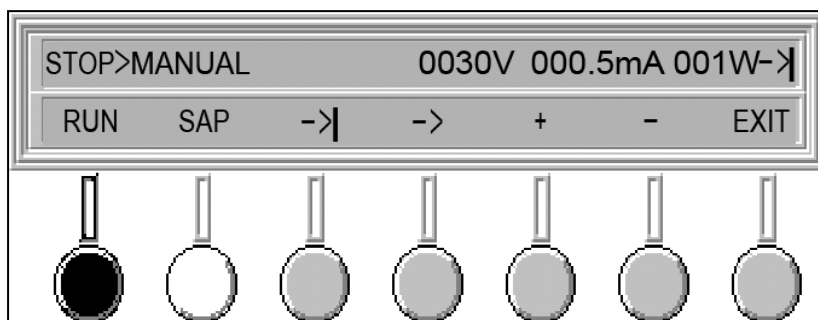
Abb. 1: Front (Example BP1500x4)

On the front are arranged an alphanumeric display, the keyboard, an LED and eight voltage sockets (see paragraph 3.1.4. for models BP1500x4 and BP3000x4). Four electrophoresis units may be connected parallel to the voltage sockets providing the electrical parameters are considered.

#### 3.1.1 Display

The two-line display shows in the upper line (MODE) the actual status of the program. In the modes “Manual” and “Program”, for example is shown, if a run has been started [RUN>], has not been started, resp. has been stopped [STOP>] or if a interruption of the run took place [WAIT>]. In addition, the actual value resp. the preset limit for voltage, current and output, time and volt hours is displayed. If programs are edited, **EDIT** points to this program mode. **OPTION** in the first line shows, that the user may change the device settings.

The lower line (MENU) displays the keyboard reservation. Above each key the actual function is shown on the display. The key **SAP** activates the settings of the „**STEP AFTER PROGRAM**“. Keys with no name do not have an actual function.



**Fig. 2: Display**

### **3.1.2 Keyboard**

The keyboard consists of 7 keys, which are arranged in the line under the display and whose functions show up in the lower line of the display (**see paragraph 3.1.1.**). With the red key the output in the mode “**Manual**” and “**Program**” may be started or interrupted.

### **3.1.3 LED**

The LED in the mode “**Manual**” and “**Program**” shows the status of the device and gives information about the output. The LED lights up when a run has been started [RUN>]. If a run has not yet been started or interrupted [STOP>], the LED does not light up. When a run has been interrupted [WAIT>] the LED blinks.

If the LED shines continuously, the device emits output and the voltage outlets are under voltage [RUN>].

### **3.1.4 High voltage sockets**

With the help of high voltage cables, which have 2-mm plugs, electrophoresis chambers may be connected directly to the high voltage sockets of the models **BP1500x4** and **BP3000x4**. When using high voltage cables with 4 mm plugs, the high voltage adapters, which are included in the delivery contents, should be used.



## 3.2 Rear

On the rear of the device the following elements are aligned:

- 1 Device plug for the power supply
- 1 Power supply switch
- 1 Ventilator airing slits
- 1 Serial port RS-232

## 4 Functions

After switching the device on, it offers the functions **MANUAL**, **PRGM**, **EDIT** and **OPTION**.

### 4.1 Mode “Manual”

When choosing the mode “**Manual**” (function **MANUAL**), continuous runs and runs with a time limitation may be carried out. The preset (programmed) time and/or the volt hours product determines the end of a run. At the end of a time limited run a signal tone optionally sounds and the power supply shuts itself off or optionally switches over to a minimal output (**SAP**, quiescent run). Changes of the electrical and break off parameters before the start of a run, during a run and by interrupted run are possible.

When leaving the function **MANUAL** the settings of the parameters will be saved. When calling up this function again, the parameters take on the last settings. If a run is interrupted through a power failure, it may be continued after return of the power.

### 4.2 Mode “Program”

The power supplies are able to carry out up to 9 steps (function **PRGM**). Each program may be started with a random program step and finishes with the last program step. The duration of each step is limited through the programmed time and/or the programmed volt hours product. The preset limits of the parameters change automatically from one program step to the next. Changes of the parameters through the user are possible before as well as during the program. Each program may be stopped and restarted. At the end of each program a signal tone optionally sounds and the power supply shuts itself off or changes optionally into a minimal output (**SAP**, quiescent run).

When leaving the function **PRGM** the program may be saved with the eventually changed settings of the parameters. After calling up **PRGM** again, the changed program may immediately be used again.

If the program is interrupted through a power failure, it may be continued after return of the current.

### 4.3 Mode “Edit”

It is possible to save 9 programs with a maximum of 9 steps. The default setting is 9 programs with one step each. The electrical parameters voltage, current and output and the break off parameters time and volt hours product are preset in the lower border values. All parameters may be programmed for each step within the border values of the device. The function **EDIT** allows to add, insert or delete program steps. Each program can be named with up to four characters. Changed programs may be saved under the old or under a new program number. In this manner it is possible to set up very quickly variations of the basic version. The programs may be operated in the function **PRGM**.

### 4.4 Options

The power supply has the following options:

- No load detection
- Quiescent run
- Signal tone
- Resume of run
- Data protocol

### 4.5 Choice of functions (modes)

**ATTENTION: Voltage sockets may carry voltage after switching on the device (see paragraph 8.5.)!**

After switching on the power supply the opening menu normally appears in the display [MAIN>]. Should the device shut down during a run [RUN>] or a run interruption [WAIT>] due to a power failure or operating the switch, then the run resp. the program will be continued after reestablishment of the current or reconnection, when the option "run resume" is active (see paragraph 8.5.).



**Fig. 3: Display after switching on**

In the opening menu the user is asked to choose a mode. It is possible to work in the mode “Manual” (key **MANUAL**) or “Program” (key **PRGM**), to edit a program (key **EDIT**) or to change the device settings (key **OPTION**).

## 5 Operational mode „MANUAL“

**ATTENTION: Voltage sockets may carry voltage after switching on the device (see paragraph 8.5.)!**

Is the function **MANUAL** chosen, the last electrical parameter settings are displayed automatically (**Fig. 4**), if the function **MANUAL** was properly left with **EXIT** after the last call.

```

STOP>MANUAL          2000V  014.0mA  014W->|
RUN      SAP      ->|  ->      +      -      EXIT
    
```

**Fig. 4: Display of the preset limits of the electrical parameters [STOP>MANUAL]**

To start a run, following steps have to be carried out:

1. Connect electrophoresis chamber(s) to the power supply
2. Set parameters
3. Start run

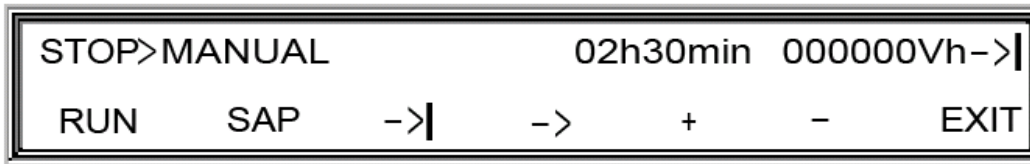
### 5.1 Display and change of parameter

Before each run all the parameters may be displayed and changed (**table 1**). The changed settings will be saved automatically, when leaving the mode with **EXIT**.

Step	Action	Description
1.	Cursor on parameter	Press the key →  <sup>1)</sup>
2.	Cursor on digit	Press the key →
3.	Change digit	Press the key +/-
4.	Change next parameter	Repeat from 1
<sup>1)</sup> The cursor changes in the order: Voltage → current → output → hours → minutes → volt hours		

**Tab. 1: Display and change of parameter**

If the cursor points to the output and the key →| is pressed, the break off parameters of the run will be displayed (**fig. 5**).



**Fig. 5: Display of the preset limits of the break off parameters [STOP>MANUAL]**

By setting of the break off parameters it is possible to choose between continuous running and time limited running.

### 5.1.1 Continual operation

Should one wish to work in the mode “**Manual**” without time limitation, which means, continuously, the time and the volt hours product each have to be zero.

### 5.1.2 Time limited operation

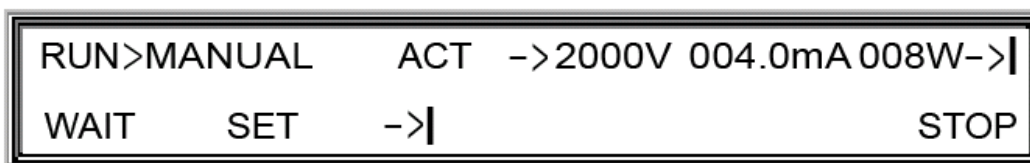
The break off parameters, time and volt hours product, may time limit the run. At least one of the values must be chosen different from zero. If a break off parameter equals zero, it has no effect on the end of the run. The device ends the run, when the preset limit of the break off parameter is reached. If both the time as well as the volt hours product is different from zero, the device stops the run as soon as one of the set points is reached.

## 5.2 Start and stop of run

A run is started with the key **RUN**. A single sound can be heard and the LED lights up continuously. Through pressing the key **WAIT**, a run may be interrupted. By pressing the key **RUN** once again, the run will be continued (see paragraph 5.5.). Through pressing the key **STOP** a run may be stopped. An immediate termination is possible during a run [RUN>] as well as during a run interruption [WAIT>] (see paragraph 5.6.).

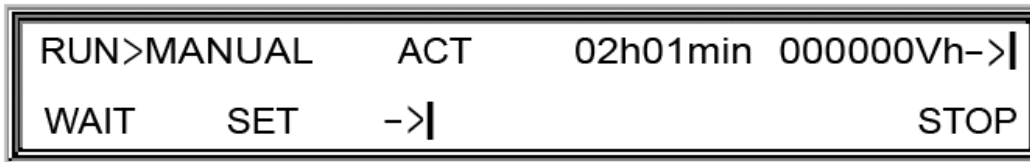
## 5.3 Display of the actual and preset parameters

If a run was started, the actual values for voltage, current and output (fig. 6) or for time and volt hours product are displayed (fig. 7). In the upper display line the actual values [ACT] can be retrieved. An **arrow** indicates the **constant parameter** (voltage, current or output).



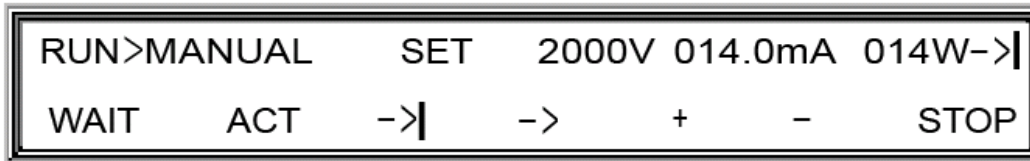
**Fig. 6: Display of the actual values of the electrical parameters [RUN>MANUAL]**

It is possible to change between the display of voltage, current and output and the display of time and volt hours through pressing the key →| (fig. 7).



**Fig. 7: Display of the actual values of the break off parameters [RUN>MANUAL]**

By pressing the key **SET**, the preset limits (settings) for the electrical, resp. break off parameters are displayed, which the inscription [SET] in the upper line of the display indicates (**fig. 8**).



**Fig. 8: Display of the preset limits of the electrical parameters [RUN>MANUAL]**

Now it is possible to change the preset limits of the parameters (**see paragraph 5.4.**).

By pressing the key **ACT**, the actual values are displayed again.

## 5.4 Change of preset parameters

The preset limits of the parameters may be changed before the start (**see paragraph 5.1.**). In addition, it is possible to change the preset limits during a run [RUN>] und during a run interruption [WAIT>]. Follow the steps in **table 2**.

Step	Action	Description
1.	Display preset limits	Possibly pressing the key <b>SET</b>
2.	Cursor on parameter	Pressing the key <b>→ </b>
3.	Cursor on digit	Pressing the key <b>→</b>
4.	Change of digit	Pressing the key <b>+/-</b>
5.	Change of next parameter	Repeat from 2

**Table 2: Change of preset limits**

During a run [RUN>] the adjustment of the power supply follows the changed electrical parameters immediately. Changing the preset limits of the break off parameters leads to an extension, resp. reduction of the run. A reduction of the preset limits of time and/or the volt hours product may lead to the ending of a run (**see paragraph 5.6.**).

If the preset limits of the break off parameters are changed during a run [RUN>] in such a way, that at least one preset limit is smaller or equal to its actual value, the end of the run is reached.

## 5.5 Run interruption

After pressing the key **WAIT** the run will be interrupted [WAIT>]. A simple signal sounds. The blinking line **WAIT** and the blinking LED indicate this status. The chosen display (preset limit or actual value/electrical or break off parameter) remains.

As actual values the last measured values before the interruption will be displayed. The actual values of the electrical (**fig. 9**)

WAIT>MANUAL	ACT	->2000V	004.0mA	008W->
RUN	SET	->		STOP

**Fig. 9: Display of the actual values of the electrical parameters [WAIT>MANUAL]**

as well as the break off parameters (**fig. 10**) may be displayed. Time and volt hours are counted upwards (i.e. start is at 00:00 h:min and 000000Vh).

WAIT>MANUAL	ACT	02h05min	000000Vh->
RUN	SET	->	STOP

**Fig. 10: Display of the actual values of the break off parameters [WAIT>MANUAL]**

It is possible to change between the display of voltage, current and output and the display of time and volt hours through pressing the key →|.

When pressing the key **STOP** and following restart of the run (key **RUN**) the measuring of time and volt hours product begins again (actual values of the break off parameters equal zero). On the other hand the measuring of time and volt hours product is continued (i.e. the actual values of the break off parameters remain), if the run interruption took place with the key **WAIT**.

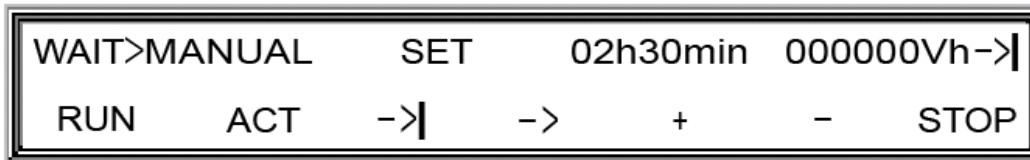
By pressing the keys **SET/ACT**, it can be switched between the display of the actual and the preset limits.

If the preset limits for voltage, current and output (**fig. 11**)

WAIT>MANUAL	SET	2000V	014.0mA	014W->		
RUN	ACT	->	->	+	-	STOP

**Fig. 11: Display [WAIT>MANUAL]**

or the preset limits for time and volt hours product (**fig. 12**) are displayed, the preset limits may be changed.



**Fig. 12: Display of the preset limits of the break off parameters [WAIT>MANUAL]**

Upon interruption of a run [WAIT>] the control of the power supply follows the changed electrical parameters only when the run is continued (operate **RUN**).

Changing the preset limits of the break off parameters leads to a prolongation, resp. reduction of the total run time.

If both preset limits of the break off parameters during a run interruption [WAIT>] in a time limited operation are set to zero, the device changes automatically to continuous operation by run continuation (operate **RUN**).

If exactly one preset limit of the break off parameters during a run interruption [WAIT>] in a time limited operation is set to zero, the end of the run after run continuation (operate **RUN**) goes only by the other break off parameter (unequal zero).

If the preset limits of the break off parameters during a run interruption [WAIT>] in a time limited operation are changed in such a way, that at least one is unequal zero and is smaller than its actual value, the end of the run is reached, as soon as the run is continued (operate **RUN**).


If at least one of the preset limits of the break off parameters during a run interruption [WAIT>] in a continuous operation is set to a value unequal zero, the device changes automatically into a time limited operation, when the run is continued (operate **RUN**). If the set preset limit is smaller than or equals its actual value, the run ends.

By operating the key **RUN** the run is started again. A single tone sounds and the LED lights up continuously.

Should the run be discontinued, the key **STOP** should be pressed.

## 5.6 End of run

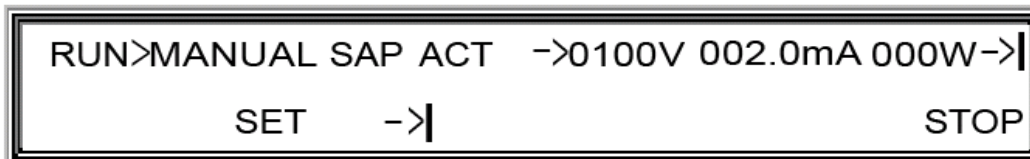
If conditions for break off of a run are accomplished, a double signal sounds. The power supply ends either the output (LED OFF) and shows in the display the last actual values of the parameters (fig. 13).



STOP>MANUAL END ->2000V 004.0mA 008W->|  
->| OK

Fig. 13: Display at the end of the program without quiescent run

or changes into quiescent run (paragraph 7.4.) and shows in the display the line **SAP** (**S**TEP **A**FTER **P**ROGRAM) (fig. 14). The LED blinks still continuously.



RUN>MANUAL SAP ACT ->0100V 002.0mA 000W->|  
SET ->| STOP

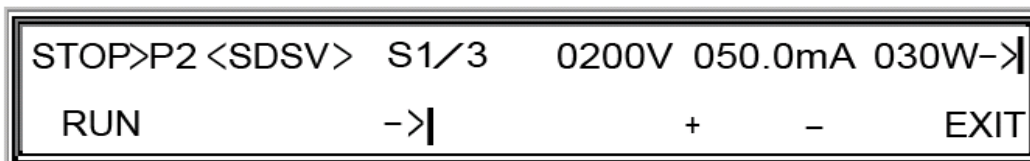
Fig. 14: Display at the end of the program with quiescent run

If the run is discontinued with the key **STOP**, the power supply changes back to the status [STOP>]. A single tone sounds. The LED goes out.

## 6 Operational mode „Program“

**ATTENTION: Voltage sockets may carry voltage after switching on the device (see paragraph 8.5.)!**

Was the mode **PRGM** selected, the last chosen step of the last selected program is displayed, if the mode **PRGM** was quit correctly after the last call with **EXIT**.



STOP>P2 <SDSV> S1/3 0200V 050.0mA 030W->|  
RUN ->| + - EXIT

Fig. 15: Display of the preset limits of the parameters [STOP>P2]

Next to the number of the program (fig. 15: [P2]), the name of the program (fig. 15: [<SDSV>]), the number of the program step (fig. 15: [S1]), the total number of program steps (fig. 15: [/3]) and the electrical parameters are displayed.



To start a program, the following steps have to be carried out:

1. Connect electrophoresis chamber(s) to the power supply
2. Eventually choose new program (s. 6.1.)
3. Eventually change the parameters of the single program steps (s. 6.2.)
4. Eventually choose the program step (start at a later program step)
5. Start program (s. 6.3.)

## 6.1 Choosing a program

Should a program proceed, it has to be chosen out of the 9 programs in the memory of the device. Follow **table 3**.

Step	Action	Description
1.	Cursor on program number	Pressing the key →
2.	Choice of program number	Pressing the key +/-

**Table 3: Choice of a program number**

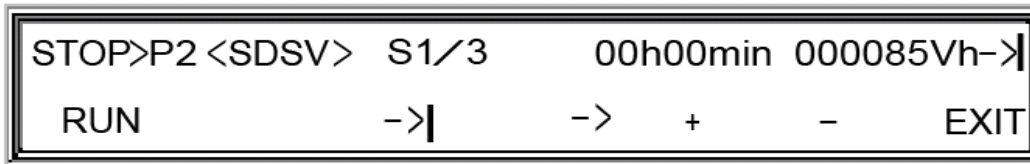
## 6.2 Display and change of program

At the beginning of each program start, all steps with their parameters may be displayed and changed (**table 4**). In the mode “**Program**” it is not possible to insert, add or delete program steps (**see paragraph 7.**). The changed program may be saved when leaving the mode.

Step	Action	Description
1.	Cursor to program step number	Pressing the key →  <sup>1)</sup>
2.	Choice of the program step	Pressing the key +/-
3.	Cursor to the parameter	Pressing the key →  <sup>1)</sup>
4.	Cursor to the digit	Pressing the key →
5.	Change the digit	Pressing the key +/-
6.	Change next parameter	Repeat from 3.
7.	Change next program step	Repeat from 1.
<sup>1)</sup> Cursor changes in the order: Program number → step number → voltage → current → output → hours → minutes → volt hours		

**Table 4: Display and change program**

If the cursor points to the output and the key →| is pressed, the break off parameters of the program step are displayed (**fig. 16**).



**Fig. 16: Display of the preset limits of the break off parameters [STOP>P2]**

It is necessary to choose at least one of the break off parameters of each program step differently from zero.

If violating this, the power supply indicates an error after the program start, resp. the change into the corresponding program step (see paragraph 9.).

### 6.3 Start of program

A run is started with the key **RUN**. A single tone sounds, and the LED lights up continuously. It is possible, to interrupt a run by operating the key **WAIT** and to continue this run by renewed operation of the key **RUN** (see paragraph 6.7.). Immediate run termination by pressing the key **STOP** is possible in the mode [RUN>] as well as in the mode [WAIT>] (see paragraph 6.8.).

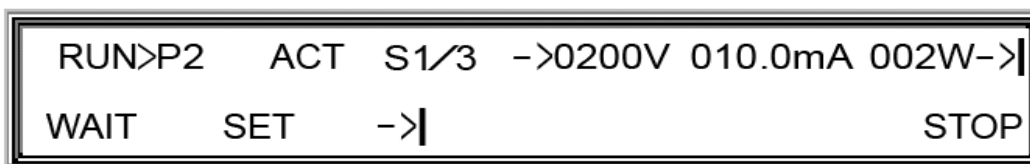
The program step, with which the program starts the run, may be chosen freely. This means, the first program steps may be skipped, if necessary. Basically a program may be started with any step (e.g. different from the first). To choose this step and to start the program, follow table 5.

Step	Action	Description
1.	Cursor to program number	Pressing the key →
2.	Choice of the start program step	Pressing the key +/-
3.	Start of the program	Pressing the key <b>RUN</b>

**Table 5: Start of program**

### 6.4 Display of actual and preset parameters

If a run has been started, the actual values for voltage, current and output (fig. 17) or for time and volt hours product are displayed (fig. 18). The line [ACT] in the upper line of the display indicates the display of the actual values. An arrow shows the constant parameter.



**Fig. 17: Display of the actual values of the electrical parameters [RUN>P2]**

It is possible to change between the display for voltage, current and output and the display for time and volt hours through pressing the key →| (fig. 18).

RUN>P2	ACT	S1/3	00h00min	000002Vh->
WAIT	SET	->		STOP

**Fig. 18: Display of the actual values of the break off parameters [RUN>P2]**

By pressing the key **SET**, the preset limits (settings) for the electrical, resp. the break off parameters are displayed, which the line [SET] in the upper line of the display indicates (**fig. 19**).

RUN>P2	SET	S1/3	0200V	050.0mA	030W->	
WAIT	ACT	->	->	+	-	STOP

**Fig. 19: Display of the preset limits of the electrical parameters [RUN>P2]**

Now it is possible to change into a different program step (**see paragraph 6.6.**) or change the preset limits of the parameters (**see paragraph 6.5.**). By operating the key **ACT** the actual values are displayed again.

## 6.5 Change of preset parameters

The preset limits of the parameters of a program step may be changed before the start of a program (**see paragraph 6.2.**). Additionally, the preset limits of the actual program step may also be changed during the program run [RUN>] and during a program interruption [WAIT>]. Follow **table 6**.

Step	Action	Description
1.	Display preset limits	Pressing the key <b>SET</b>
2.	Cursor to the parameter	Pressing the key <b>→ </b>
3.	Cursor to the number	Pressing the key <b>→</b>
4.	Change the number	Pressing the key <b>+/-</b>
5.	Change next parameter	Repeat from 1

**Table 6: Change of preset parameters**

During a program run [RUN>] the power supply adjusts to the changing electrical parameters immediately.

Changes of preset limits of break off parameters lead to an extension, resp. reduction of a program step, resp. the program. Reducing the preset limits of time and/or volt hours product may cause a switch into the next program step (**see paragraph 6.6.**) or lead to the end of the program (**see paragraph 6.8.**).

If the break off parameters are changed during a run [RUN>] in such a way, that the actual values are higher or equal than the preset limits for time or volt hours product, an automatic program step change takes place (**see paragraph 6.6.2.**) or end of the program is reached.

## 6.6 Change of program steps

### 6.6.1 Manual change of program step

During running or interrupted program it is possible to change into any different program step of this program. Follow **table 7.**

Step	Action	Description
1.	Cursor to program number	Pressing the key <b>→ </b>
2.	Choice of the start program step	Pressing the key <b>+/-</b>

**Table 7: Manual change of program step**

### 6.6.2 Automatic change of program step

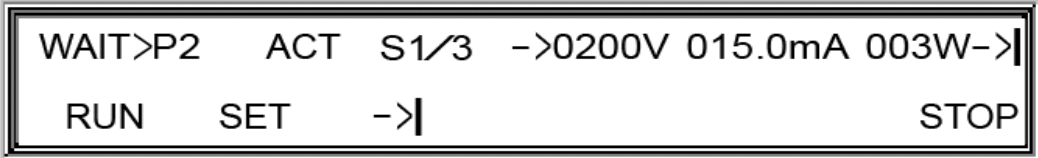
If the actual values for time and/or volt hours product have reached the preset limits, the break off condition is fulfilled. If the actual program step is not the last step of the program, the program step number is raised by one and the next program step starts.

After the change of program step the new preset limits of the parameters are automatically adjusted.

### 6.7 Interruption of program steps

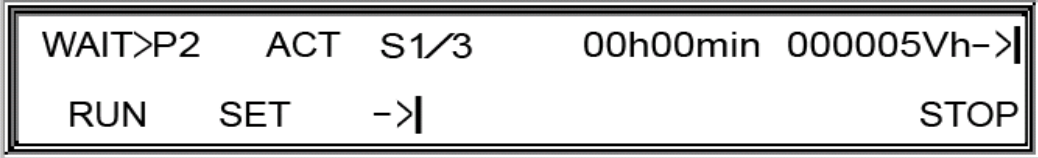
After operating the key **WAIT** the running program is interrupted [WAIT>]. A single tone sounds. The blinking line **WAIT** and the blinking LED display the status. The chosen display (preset limits or actual values of the electrical or break off parameters) remains.

As actual values the last reading before the program interruption will be displayed. The actual values of the electrical (**fig. 20**).



**Fig. 20: Display of the actual values of the electrical parameters [WAIT>P2]**

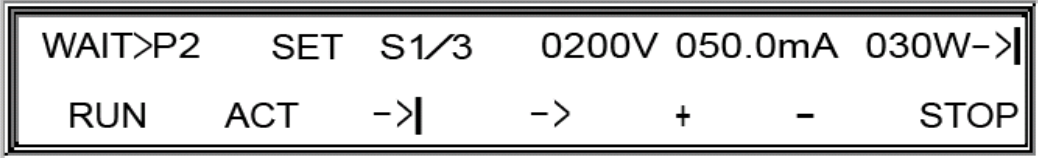
and the break off parameters may be displayed (**fig. 21**). Time and volt hours are counted upwards (i.e. **START** is at 00:00 h:min and 000000Vh).



**Fig. 21: Display of the actual values of the break off parameters [WAIT>P2]**

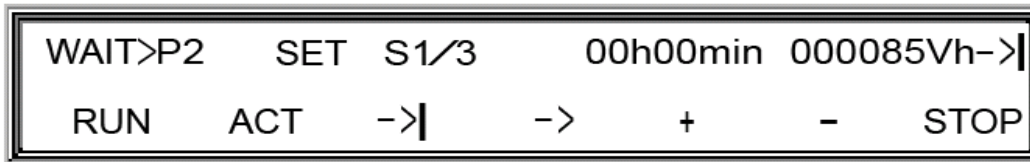
It is possible, to change between the display for voltage, current and output and the display for time and volt hours through pressing the key →|. When operating the key **STOP** and following, renewed start of the run (key **RUN**) the measuring of time and volt hours product starts again (actual values of the break off parameters equal zero). On the other hand the measuring of time and volt hours product continues (i.e. the actual values of the break off parameter remain), if the run interruption took place with the key [WAIT>].

Changing from the display of the actual and the preset limits may be accomplished by pressing the key **SET/ACT**. If the preset limits for voltage, current and output (**fig. 22**).



**Fig. 22: Display of the preset limits of the electrical parameters [WAIT>P2]**

or the preset limits for time and volt hours product are displayed (**fig. 23**) the preset limits may be changed.



**Fig. 23: Display of the preset limits of the break off parameters [WAIT>P2]**

To change the preset limits, follow **table 6** (see **paragraph 6.5.**).

Upon program interruption [WAIT>] the regulation of the power supply follows the changed electrical parameters only when the program run is continued [RUN>].

The changing of the preset limits of the break off parameters leads to an extension resp. a reduction of the run.

It is necessary to choose at least one of the break off parameters of each program step differently from zero.

If exactly one preset limit of the break off parameters is set to zero during a program interruption [WAIT>], the end of the program step follows the other break off parameter (unequal zero) only upon continuation of the program (operate **RUN**).

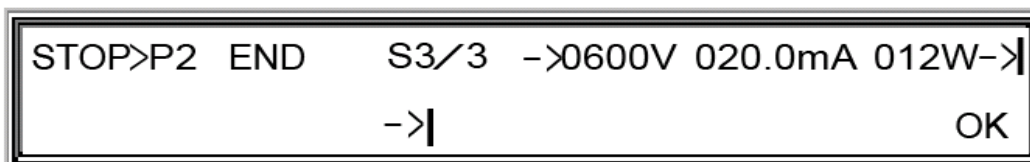
If the preset limits of the break off parameters are changed during a programme interruption [WAIT>] in such a way, that at least one is unequal zero and smaller or equal than its actual value, the end of the program step is reached as soon as the program is continued (operate **RUN**).

By operating the key **RUN** the run is resumed. A single tone sounds and the LED lights up continuously.

Should the program be discontinued, press the key **STOP**.

## 6.8 End of program

If the break off condition for the last step during the running program is reached, a tone sounds. The power supply ends either the output (LED OFF) and shows the last actual values of the parameters on the display (**fig. 24**).



**Fig. 24: Display of the program end without quiescent run**

or changes into a quiescent run (see **paragraph 8.4.**) and indicates this with the line **SAP** (**S**T**E**P **A**F**T**E**R** **P**R**O**G**R**A**M**) in the display (**fig. 25**). LED lights up continuously.

```

RUN>P2   ACT   SAP   ->0100V 002.0mA 000W->|
          SET   ->|                               STOP

```

**Fig. 25: Display of the program end with quiescent run**

Operating the key **STOP** stops the program run; the power supply changes to the status [STOP>]. A single tone sounds. The LED turns off.

## 7 Operational mode „Edit“

**ATTENTION: Voltage sockets may carry voltage after switching on the device (see paragraph 8.5.)!**

If the function **EDIT** was chosen, the 1. program step of program 1 is displayed.

```

EDIT>P1 <EMPT> S1/1   0030V 000.5mA 001W->|
SAVE          ->|           +     -     EXIT

```

**Fig. 26: Display of the electrical parameters [EDIT>P1]**

Beside the number, the name of the program, the number of the program step, the total number of program steps and the electrical parameters are displayed.

The possible 9 programs are already created in the memory of the processor. All 9 programs first consist each of one program step. The parameters are preset to the minimal operation values of the device.

To change the programs, the following functions may be used:

- Change parameter
- Add program step
- Insert program step
- Delete program step
- Save program

## 7.1 Choice of program

For editing a program, it has to be chosen out of the 9 programs in the memory of the processor. Follow **table 8**.

Step	Action	Description
1.	Cursor to program number	Pressing the key →
2.	Choice of the start program step	Pressing the key +/-

**Table 8: Choosing a program**

## 7.2 Display and change parameters

When a program step was chosen, the electrical and the break off parameters may be changed. Follow **table 9**.

Step	Action	Description
1.	Cursor to program step number	Pressing the key →  <sup>1)</sup>
2.	Choosing of the program step	Pressing the key +/-
3.	Cursor to the parameter	Pressing the key →  <sup>1)</sup>
4.	Cursor to the number	Pressing the key →
5.	Change of the number	Pressing the key +/-
6.	Change next parameter	Repeat from 3
7.	Change next program step	Repeat from 1

<sup>1)</sup> Cursor changes in the order: Program number → step number → voltage → current → output → hours → minutes → volt hours

**Table 9: Display and change parameters**

Points the cursor to the output and the key →| is pressed, the break off parameters of the program step are displayed (**fig. 27**).

EDIT>P1 <EMPT> S1/1	00h00min	000000Vh->
SAVE	->	-> + - EXIT

**Fig. 27: Display of the break off parameters [EDIT>P1]**

At least one of the break off parameters of each program step has to be chosen differently from zero. If violating this, the power supply shows a mistake after the program start, resp. the change into the corresponding program step (**see paragraph 9.**).



### 7.3 Adding a program step

If the maximal number of 9 program steps has not yet been reached, a program step may be added.

To add a program step, the number of the program step has to be increased as long until the display points out the possibility to add a program step (**fig. 28**).

```
EDIT> Append a new STEP or Select SAP ?
      APPEND      SAP      EXIT
```

Fig. 28: Display add program step

The added program step will be displayed as the actual step. As parameters the minimal operation values of the device are preset (**fig. 29**).

```
EDIT>P1 <EMPT> S2/2 0030V 000.5mA 001W->|
SAVE  INS/DEL  ->|      +      -      EXIT
```

Fig. 29: Display of the added program step

### 7.4 Insertion or deletion of a program step

In order to insert or delete a program step, the key **INS/DEL** should be operated (**fig. 30**). The cursor must point to the program step number.

```
EDIT>P1 <EMPT> S2/2 0030V 000.5mA 001W->|
SAVE  INS/DEL  ->|      +      -      EXIT
```

Fig. 30: Display, when the cursor points to the program step

If the number of program steps is neither 1 nor 9, a program step may be inserted before the actual program step or the actual program step may be deleted (**fig. 31**).

```
EDIT> Insert or Delete a STEP ?
      DEL  INS      EXIT
```

Fig. 31: display insert/delete program step

The inserted program step will be displayed as the actual program step. As parameter the minimal operation values of the device are preset.

If a program step is deleted, the following program step or the last program step is displayed.

If the maximal number of 9 program steps is reached, no more program steps may be inserted. After pressing the key **INS/DEL** a program step may only be deleted (**fig. 32**). Press key **DEL**.



**Fig. 32: Display delete program step**

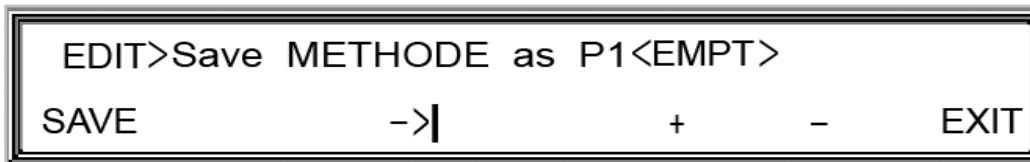
If the minimal number of a program step is reached, no more program steps may be deleted. After operating the key **INS/DEL** a program step may only be inserted (**fig. 33**). Press key **INS**.



**Fig. 33: Display insert program step**

## 7.5 Save program

In order to save a program, press the key **SAVE**. In the display a menu to save programs appears (**fig. 34**).



**Fig. 34: Display save program**

The edited program may be saved under a number from 1 to 9. To choose the program number, follow **table 8** (see **paragraph 7.1.**). In addition each program may be given a name of up to 4 characters. As characters you may use the letters from a to z, the numbers from 0 to 9 and the space bar. Follow **table 10** to enter a name.

If the program was changed and the function **EDIT** is left with **EXIT** without saving the program, the user automatically gets the possibility to repeat the program saving.

Step	Action	Description
1.	Cursor to program name	Pressing the key →  <sup>1)</sup>
2.	Cursor to the sign	Pressing the key →
3.	Change the sign	Operating of the keys +/-
4.	Change next sign	Repeat from 2

<sup>1)</sup> The cursor changes in the order: Program number→ program name

**Table 10: Change program name**

## 8 Options

The function **OPTION** allows the user to change certain device settings.

### 8.1 Display and change of options

Starting with the optional **NO LOAD DETECTION** (fig. 35) the other options are shown in the display by pressing the key →|. With **ON** resp. **OFF** the optional modes may be switched on or off.



**Fig. 35: Display of the OPTION no load detection: ON**



**Fig. 36: Display of the OPTION signal tone: ON**



**Fig. 37: Display of the OPTION quiescent run: ON**



**Fig. 38: Display of the OPTION resume run: OFF**



Fig. 39: Display of the OPTION serial port RS-232: OFF



Fig. 40: Display of the OPTION data protocol program: OFF

## 8.2 No load detection

The **NO LOAD DETECTION** stops a run automatically, if the output has been started and no load (electrophoresis unit) is connected to the device.

## 8.3 Signal tone

A repeatedly acoustic signal indicates the end of a time limited run or program. At start, interruption or discontinuation of a run a single tone sounds. Errors are reported by a continuous tone.

## 8.4 Quiescent run (SAP)

If quiescent run was set to on, the device changes into a minimal output **SAP** (**S**TEP **A**FTER **P**ROGRAM) when the run or program end has been reached (end through reaching a break off parameter). Time and volt hours product are measured.

The preset electrical parameters of the quiescent run are:

Voltage: 100 V  
 Current: 5 mA  
 Output: 5 W

## 8.5 Run resume

**ATTENTION: Voltage sockets may carry voltage after switching on the device (see paragraph 8.5.)!**

The resumption of a run (**RESUME**) allows the continuation of a run or a program after a power failure occurred. The run or program will be restarted automatically upon resumption of power. The same is true, if working the main switch erroneously shuts off a run. **RESUME ON** will start the program again upon turning on the main switch.

## 8.6 RS-232 and data protocol

A protocol of preset limits/actual values of the parameters (**PROGRAM DOWNLOAD**) via the serial port RS-232 (Option **RS232**) enables the visualisation and analysis of the progress of the actual values over time on a PC.

To connect the BlueLine™ Power Supply with an IBM compatible PC (Windows 98 or higher), you can order the BluePower Supply Control Kit. The kit (Kat.No.: BP-PCSV01) contains:

- 1 High-speed USB-serial converter
- 1 Gender Changer for serial port
- 1 USB stick containing the software

The software allows to create, monitor, save and load the settings of the device. Multistep programming is possible. During the time course of an electrophoresis run, voltage, current, and power can be made visual in a graphical display. After the run, these datasets can be documented.

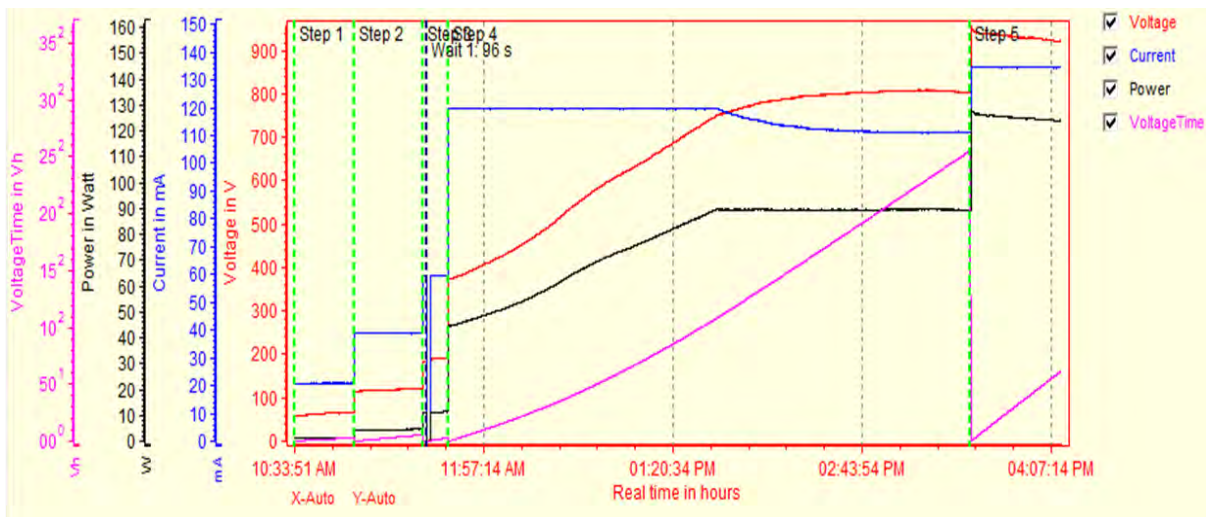


Fig. 41: Example of a chart of an electrophoresis run using the BP1500x4

## 9 Error reporting

Number	Mistake	Measure
F0	<u>Earthing</u> e.g. incorrect earthing of the electrophoresis chamber.	Shut off the power supply. Check the voltage cables and the electrophoresis chamber for an earthing error.
F1	<u>Too high load resistance</u> The load resistance must not exceed 1 Megaohm.	Check if the electrophoresis chamber has been connected correctly to the power supply.
F2	<u>Too rapid change of resistance during an electrophoresis run.</u>	Check the electrophoresis chamber for leaks.
F3	<u>Power failure</u> The run has been interrupted through a power failure.	The mode resume is active. The run has been carried out to the end.
F4	<u>Power failure</u> The run has been interrupted through a power failure.	The mode resume is not active. The run was disrupted.
F5	<u>Incorrect break off condition</u> In the mode program the actual program step has no valid break off condition.	Change at least one break off parameter of the actual program step to a value unequal zero.

## 10 Technical Data

Product	BluePower 200x4	BluePower 500x4	BluePower 1500x4	BluePower 3000x4
Regulation	const. Voltage / const. current/ const. power / programming			
Load End				
Voltage	5 V – 200 V	10 V – 500 V	30 V – 1500 V	30 V – 3000 V
Current	10 mA – 2000 mA	10 mA – 1000 mA	3 mA – 400 mA	0,3 mA – 20 mA (LCu) 3 mA – 200 mA (HCu)
Power	1 W – 200 W	1 W – 200 W	1 W – 300 W	1 W – 300 W
Resolution				
Voltage	1 V	1 V	1 V	1 V
Current	1 mA	1 mA	1 mA	0,1 mA (LCu) 1 mA (HCu)
Power	1 W	1 W	1 W	1 W
Time	1 min / 1Vh	1 min / 1Vh	1 min / 1Vh	1 min / 1Vh
Accuracy				
Voltage	±1 %, ±2 Digit	±1 %, ±2 Digit	±1 %, ±2 Digit	±1 %, ±2 Digit
Current	±1 %, ±2 Digit	±1 %, ±2 Digit	±1 %, ±2 Digit	±1 %, ±2 Digit
Power	±1 %, ±2 Digit	±1 %, ±2 Digit	±1 %, ±2 Digit	±1 %, ±2 Digit
Net Voltage	200 V – 260 V 50/60 Hz Optional: 90 V – 130 V 50/60 Hz	200 V – 260 V 50/60 Hz Optional: 90 V – 130 V 50/60 Hz	200 V – 260 V 50/60 Hz Optional: 90 V – 130 V 50/60 Hz	200 V – 260 V 50/60 Hz Optional: 90 V – 130 V 50/60 Hz
Operating Conditions				
Temperature	5 °C – 35 °C	5 °C – 35 °C	5 °C – 35 °C	5 °C – 35 °C
Humidity	0 % - 95 %	0 % - 95 %	0 % - 95 %	0 % - 95 %
Security Measures	Recognition of load / Earthing output jackets / Power error test			

## 11 Short description of operational modes

### 11.1 Operational mode “Manual”

Step	Action	Description
1.	Connect electrophoresis chamber(s) to the power supply.	
2.	Switch on power supply.	Work main switch at the rear of the device
3.	Choose the mode “ <b>Manual</b> ”.	Press key <b>MANUAL</b> .
4.	Set maximal voltage.	Put cursor to voltage with the key → . Put cursor on number with the key →. Change number with the keys +/-.
5.	Set maximal current.	Put cursor to current with the key → . Put cursor on number with the key →. Change number with the keys +/-.
6.	Set maximal output.	Put cursor to output with the key → . Put cursor on number with the key →. Change number with the keys +/-.
7.	Set hours.	Put cursor to hours with the key → . Put cursor on number with the key →. Change number with the keys +/-.
8.	Set minutes.	Put cursor to minutes with the key → . Put cursor on number with the key →. Change number with the keys +/-.
9.	Set volt hours product.	Put cursor to volt hours with the key → . Put cursor on number with the key →. Change number with the keys +/-.
10.	Start run.	By pressing the key <b>RUN</b> , start a run.
11.	Interrupt run.	By pressing the key <b>WAIT</b> , a run is interrupted.
12.	Continue run.	By pressing the key <b>RUN</b> , continue run.
13.	Disrupt run.	By pressing the key <b>STOP</b> , disrupt run.



## 11.2 Operational mode “Program”

Step	Action	Description
1.	Connect electrophoresis chamber(s) to the power supply.	
2.	Switch on power supply.	Work the switch at the rear of the power device.
3.	Choose the mode “ <b>Program</b> ”.	Press key <b>PRGM</b> .
4.	Choose program.	Put cursor on program number with the key → . Change program number with the keys +/-.
5.	Start run.	By pressing the key <b>RUN</b> , start run.
6.	Interrupt run.	By pressing the key <b>WAIT</b> , interrupt run.
7.	Continue run.	By pressing the key <b>RUN</b> , continue run.
8.	Disrupt run.	By pressing the key <b>STOP</b> , disrupt run.

### 11.3 Operational mode “Edit”

Step	Action	Description
1.	Switch on power supply.	Work switch at the rear of the device.
2.	Choose mode “ <b>Edit</b> ”.	Press the key <b>EDIT</b> .
3.	Choose program.	Change the program number with the keys <b>+/-</b> .
4.	Set maximal voltage.	Put cursor to voltage with the key <b>→ </b> . Put cursor on number with the key <b>→</b> . Change number with the keys <b>+/-</b> .
5.	Set maximal current.	Put cursor to current with the key <b>→ </b> . Put cursor on number with the key <b>→</b> . Change number with the keys <b>+/-</b> .
6.	Set maximal output.	Put cursor to output with the key <b>→ </b> . Put cursor on number with the key <b>→</b> . Change number with the keys <b>+/-</b> .
7.	Set maximal hours.	Put cursor to hours with the key <b>→ </b> . Put cursor on number with the key <b>→</b> . Change number with the keys <b>+/-</b> .
8.	Set maximal minutes.	Put cursor to minutes with the key <b>→ </b> . Put cursor on number with the key <b>→</b> . Change number with the keys <b>+/-</b> .
9.	Set maximal volt hours.	Put cursor to volt hours with the key <b>→ </b> . Put cursor on number with the key <b>→</b> . Change number with the keys <b>+/-</b> .
10.	Eventually add program step.	Press key <b>+</b> . With the key <b>APPEND</b> , add program step.
11.	Edit next program step.	Continue with 4.
12.	Call up storage menu.	By pressing the key <b>SAVE</b> , call up the storage menu.
13.	Choose program number.	Change the program number with the keys <b>+/-</b> .
14.	Choose program name.	Put cursor on program name with the key <b>→ </b> . Put cursor on digit with the key <b>→</b> . Change program digit with the keys <b>+/-</b> .
15.	Save program.	Press key <b>SAVE</b> .
16.	Stop “ <b>Edit</b> ”.	Press key <b>EXIT</b> .