



产品说明书 Instruction Manual

PS 2000 B Triple



PS 2342-06B:	39 200 120
PS 2342-10B:	39 200 121
PS 2384-03B:	39 200 125
PS 2384-05B:	39 200 126



关于

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严禁再版、复印或部分错误地使用该说明书，否则将承担该行为导致的法律后果。



安全须知

- 请仅在铭板标示电压下操作该仪器！
- 请勿将任何机械零件，特别是金属件，插入仪器通风孔内！
- 请避免在仪器周围使用液体物质，因有可能进入仪器内部并损坏它！
- 请勿将可能产生高于产品额定输出电压的设备连接到本产品上！
- 请勿将电压源反接到输出端上！
- 即使输出端甚至产品已经关闭，输出端仍有可能存在危险电压！至少在一段时间内都存在。
- 注意！产品外壳在操作过程中会变热，甚至可能变得很热！

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1. 简介

PS 2000 B Triple系列实验室电源供应器，结构紧凑，坚固耐用，在其小巧外形下具有很多有意思的功能。其遥控设计使之成为学校、教育机构、工厂或实验室的理想之选。

本系列提供2x 100W和2x 160W两个功率级别。

每款产品都有两组输出，输出电压和电流可调，另外还有一组辅助输出，通过电位器可在3...6V范围内调节。

除去电源供应器的基本功能外，用户还可锁定操作按钮和旋钮以防止非有意的操作，或者当过流或过压出现时定义一输出自动中断极限值。

本系列所有型号都配有一内置USB接口，可用之通过电脑远程控制和监控产品。

2. 安装

2.1 与市电的连接

本产品通过电源线接地。故仅可与带接地触点的电源插座相连。且连线中间不可接无接地触点的延伸线！

它还装有一个5 x 20mm的保险丝，从位于小“抽屉”的电源插座内可触及并能进行拆装更换。保险丝具体数值请看它上面的印字或铭板标贴。

2.2 与负载的连接

功率输出端位于产品前端。

输出端没有装保险丝！为了避免损坏负载应用，需随时注意负载的额定数值。

2.2.1 第1 & 2组输出 (Output 1, Output 2)

第1组输出在最底下，第2组输出在在中间（见第page 7页,图 1 “）。第1组输出由左边的控制面板控制，第2组输出则由右边的控制面板控制。

用那些旋钮可在0...100%范围内调节电压与电流，或0...110%范围内调节对应的过流与过压关断极限。调节可持续进行，调节步宽见章节4.4。

各输出端的电压，电流和功率是有限制的，且永久短路保护。它们可串联或并联，以便形成更高的输出电压或电流。

Tracking模式（见章节„4.6 Tracking模式“）对串联和并联中的各输出端非常有用。

2.2.2 第3组输出 (Output 3)

第1组这组输出为辅助性输出，完全与其它两组分开。只能通过前板上两插座间的孔调节电位器才能调节。电压可调范围约为3...6V。速出功率约为12W，即输出6V时，电流为2A，或输出3V时，电流为4A。如果超过这个极限值，LED会灭，电压会下降，随负载而定。

 可将它与 (1 & 2) 组输出的其中一组或两组输出并联！

3. 技术参数

	PS 2342-06B	PS 2342-10B	PS 2384-03B	PS 2384-05B
电源输入				
输入电压	100...240V ±10%	100...240V ±10%	100...240V ±10%	100...240V ±10%
频率	45...65 Hz	45...65 Hz	45...65 Hz	45...65 Hz
保险丝	MT 4 A	MT 6,3 A	MT 4 A	MT 6,3 A
功率因素	> 0.99	> 0.99	> 0.99	> 0.99
输出关闭时的功耗	24W	24W	24W	24W
输出1 & 2 - 电压				
可调范围	0...42 V	0...42 V	0...84 V	0...84 V
市电波动±10% ΔU_{IN} 时的稳定度	< 0.02%	< 0.02%	< 0.02%	< 0.02%
负载由0...100%变化的稳定度	< 0.15%	< 0.15%	< 0.15%	< 0.15%
纹波 BWL 20MHz	< 100mV _{PP} / < 4mV _{RMS}	< 63mV _{PP} / < 5mV _{RMS}	< 48mV _{PP} / < 4mV _{RMS}	< 96mV _{PP} / < 24mV _{RMS}
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
过压保护	0...46.2 V	0...46.2 V	0...92.4 V	0...92.4 V
带载10-90%时的调整需时	< 2 ms	< 2 ms	< 2 ms	< 2 ms
软启动需时	max. 200 ms	max. 200 ms	max. 200 ms	max. 200 ms
输出1 & 2 - 电流				
可调范围	0...6 A	0...10 A	0...3 A	0...5 A
市电波动±10% ΔU_{IN} 时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%
0...100% ΔU_{OUT} 时的稳定度	< 0.15%	< 0.15%	< 0.15%	< 0.15%
纹波	< 25mA _{PP} / < 4mA _{RMS}	< 13mA _{PP} / < 5mA _{RMS}	< 6mA _{PP} / < 2mA _{RMS}	< 9mA _{PP} / < 3mA _{RMS}
精确度*	≤ 0.3%	≤ 0.3%	≤ 0.3%	≤ 0.3%
输出1 & 2 - 功率				
效率	≤ 85%	≤ 85%	≤ 85%	≤ 85%
额定功率P _{nom}	2x 100 W	2x 160 W	2x 100 W	2x 160 W
输出3 - 电压				
可调范围	3...6 V	3...6 V	3...6 V	3...6 V
功率	10 W (max. 12 W)	10 W (max. 12 W)	10 W (max. 12 W)	10 W (max. 12 W)
市电波动±10% ΔU_{IN} 时的稳定度	< 0.02%	< 0.02%	< 0.02%	< 0.02%
带载 0...100%时的稳定度	< 1.2%	< 1.2%	< 1.2%	< 1.2%
纹波	< 100 mVpp	< 100 mVpp	< 100 mVpp	< 100 mVpp
额定电流	>2 A @ 5 V >3.3 A @ 3 V	>2 A @ 5 V >3.3 A @ 3 V	>2 A @ 5 V >3.3 A @ 3 V	>2 A @ 5 V >3.3 A @ 3 V
其它				
工作温度	0...50°C	0...50°C	0...50°C	0...50°C
储存温度	-20...70°C	-20...70°C	-20...70°C	-20...70°C
相对湿度	< 80%	< 80%	< 80%	< 80%
尺寸 (WxHxD)	282x82x241 mm	282x82x241 mm	282x82x241 mm	282x82x241 mm
重量	3.3kg	3.5kg	3.3kg	3.5kg
制冷方式	无风扇, 自然对流冷却			
安规标准	EN 60950			
EMC标准	EN 61326, EN 55022 等级 B			
过压等级	等级 II			
保护等级	等级 I			
产品编号	39200120	39200121	39200125	39200126

* 与额定值有关, 该精确度决定设定值与实际值间允许的最大误差。

举例: 一台43V型号产品的电压精确度最少为0.2%, 即为84mV。当设定5V电压时, 且允许最大误差为84mV, 故得出实际值可能在4.92V和5.08V之间。

3.1 送货清单

- 1 x 电源供应器
- 1 x 印刷版说明书
- 1 x 电源线 (带IEC, Schuko插头)

3.2 各面视图

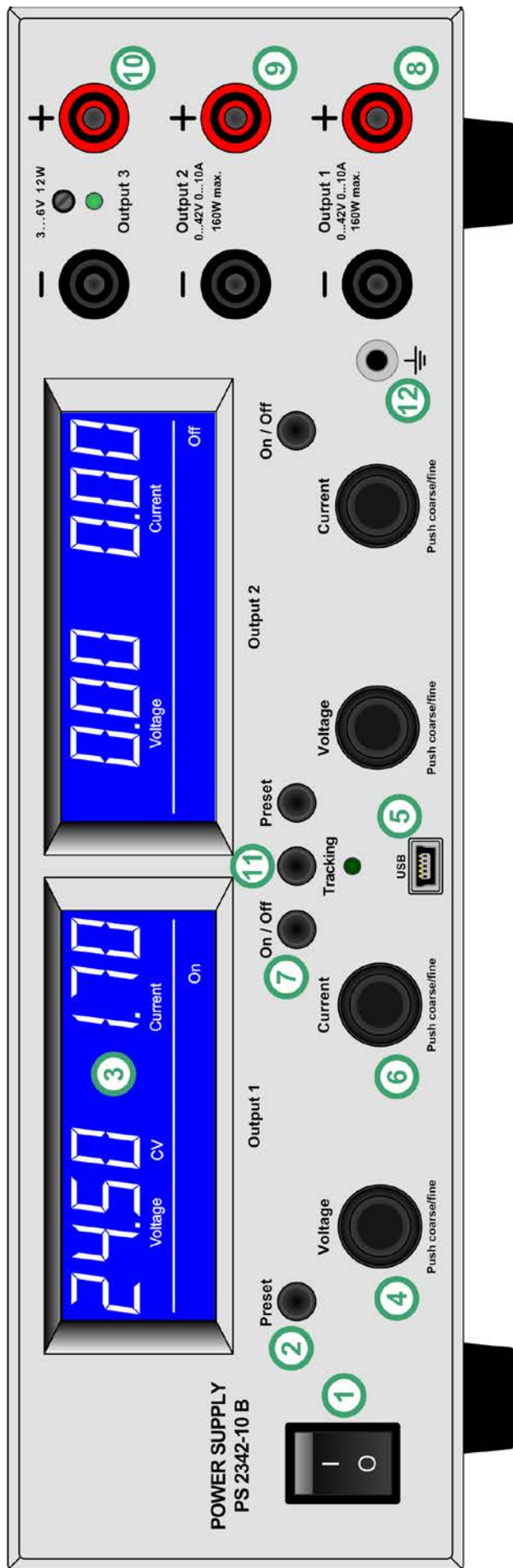


图 1

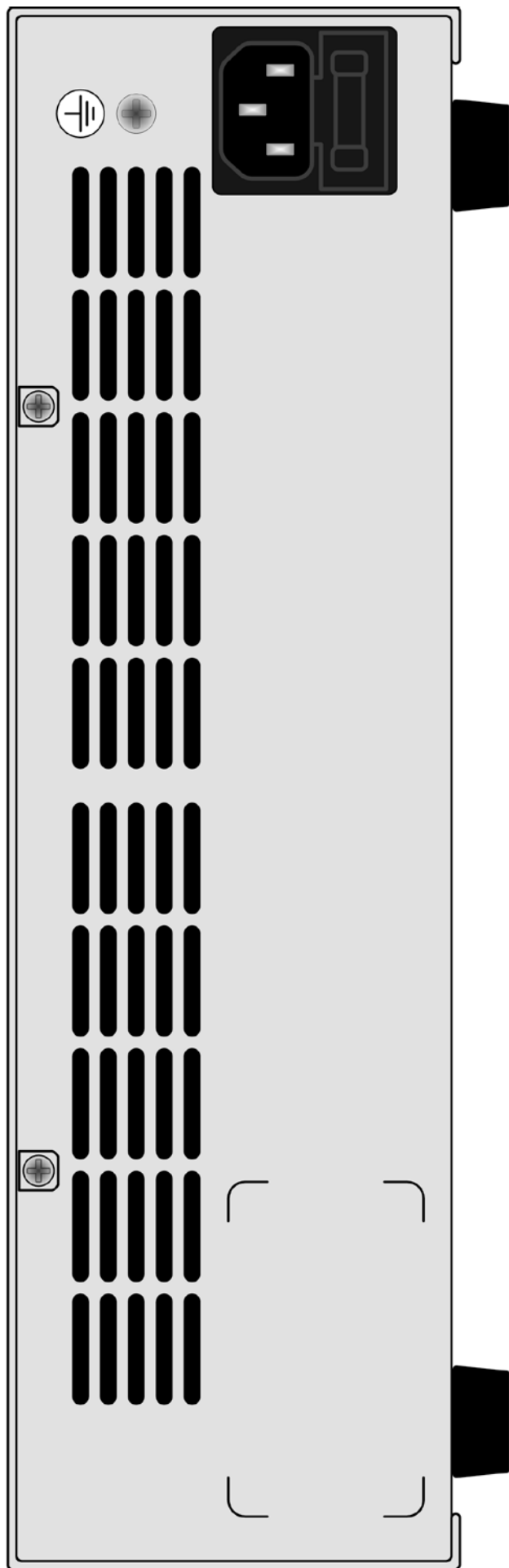


图 2

3.3 各控制件和插座功能说明

① 电源开关

该开关用于完全打开或关闭产品。

② „Preset“按钮

该按钮用于将实际值显示转至设定值显示。也可用来激活控制面板锁定功能。详情请见章节4.4和4.5。

③ 显示器

这两个蓝色背光的LCD显示器一次性显示所有信息。

④ „Voltage“旋钮

这些旋钮用于调节1和2路输出的电压值，或在预设模式下调节OVP阈值。

⑤ 迷你USB插座

产品通过该插座可接到电脑上，从而监控、远程控制或更新产品。见章节6.5。

⑥ „Current“旋钮

这些按钮用于调节1和2路输出的电流值，或在预设模式下调节OCP阈值。

⑦ „On/Off“按钮

该按钮用于打开或关闭1和2路输出。

⑧ 1路输出安全插座，有极性

这些插座可插4mm开路或安全型Büschels插头。控制面板左边指定控制这路输出。

⑨ 2路输出安全插座，有极性

这些插座可插4mm开路或安全型Büschels插头。控制面板右边指定控制这路输出。

⑩ 3路输出，安全插座，有极性

这些插座可插4mm开路或安全型Büschels插头。这路输出只能调节电压，且仅能通过电位器调节输出插座间的孔来完成。

⑪ „Tracking“按钮

该按钮用来激活或停止Tracking模式，详情见章节„4.6 Tracking模式“。

⑫ 接地插座

这些插座可插4mm开路或安全型Büschel插头，并与外壳相连。还可用来将连接负载接地。

4. 操作

4.1 显示器 ③



图 3

4.1.1 状态符号

显示屏上的状态符号指示如下：

CV - 电压调整激活（仅当输出被打开时）

CC - 电流调整激活（仅当输出被打开时）

Preset V/C - 电压/电流设定值显示被激活

Preset OVP/OCP - OVP/OCP设定值显示被激活

OT - 过温错误

OCP - 过流保护

OVP - 过压保护

Remote - 远程控制被激活（经USB端口）

Lock - 控制面板被锁定

Fine - 指示细调模式已被激活

4.1.2 错误指示

若出现过压、过流或过温类似错误，其中一个显示器上以„Error“文字和一(OT, OVP, OCP)符号指示出来，且输出电压被切断。该文字一直保留在显示器上，直到用户按下„On/Off“按钮确认该错误方消失，同时它也关闭输出。

过温错误消失后，输出电压会自动恢复，„Error“文字被清除，除非用户之前已关闭输出。其它错误则需用户再次打开输出，才能让产品继续工作。




显示器上其它元素与特定操作模式相连，在后面章节中有详细解释。


第1和第2路主输出是分开工作的，所以假如其中有一路出现错误，另外一路仍可继续工作。第3路输出不会引起任何错误。

4.2 各按钮描述

4.2.1 Preset按钮 ②

这些按钮用于转至预设模式，以及激活/终止LOCK模式，只要产品未在远程控制模式。

按下次数	显示	模式
1x	Preset 	显示设定U/I值
2x	Preset 	显示设定OVP/OCP值
3x	Preset 	激活/终止LOCK模式（见章节4.5）
4x		显示实际值

 在Tracking模式下，控制面板右手边的预设值的显示可由左边的控制面板来控制。详情可见“4.6 Tracking模式”。

4.2.2 On/Off按钮 ⑦

只要产品未处于遥控模式，这些按钮可分别手动打开或关闭路1和2路功率输出。具体哪一路输出的状态以

 或  指示于显示器上。

这些按钮在LOCK状态下可被锁定。可参考“4.5 控制面板的锁定(LOCK)”。

他们还可确认错误。详情请见章节4.1.2。

4.3 其它控制件

Voltage ④ & Current ⑥ 旋钮

这些旋钮无终止点，可用来调节设定值，并按如下规则工作：

- 控制面板左旋钮：
特定输出的电压 (U) 或过压极限 OVP，随操作模式而定
 - 控制面板右旋钮：
特定输出的电流 (U) 或过流极限 OVP，随操作模式而定
- 详情请阅读后面的描述。


4.4 调节设定值


同时调节电压(U)和电流(I)设定值时，它遵循一个规则，即两设定值相互调节，根据公式 $P_{\max} = U_{\text{Ist}} * I_{\text{Ist}}$ ，从而不会超出产品最大功率值。

它适用于预设与正常操作模式：

a) 如果输出打开，恒压调整激活（显示“CV”），且设定电流超过这个公式（设定电流=最大功率 / 设定电压）定义的某极限，则设定电压会根据此公式自动减小，从而始终维持在最大功率值。

b) 如果输出打开，恒流调整激活（显示“CC”），且设定电压超过这个公式（设定电压=最大功率 / 设定电流）定义的某极限，则设定电流会根据此公式自动减小，从而始终维持在最大功率值。

 如果OCP值与电流极限值相同，达到该值时，OCP会优先工作，并关闭输出。

 每隔10秒钟所有设定值会进行内部存储，并在下次重启后时恢复。故建议对某数值进行最后调整后等待至少10秒再关机，否则下次开机后恢复的是其它数值。

4.4.1 细调

输出参数也可手动精调或粗调完成。转动相关旋钮可在精调和粗调之间转换。产品打开后默认为粗调模式。

固件版本在3.xx以下的产品适用如下：

如果已选为细调，且超过10秒钟未有任何数值更改，调节模式会自动返回粗调。这同样适用于正常操作模式到预设模式的转换，反之亦然。


固件版本在4.xx以下的产品适用如下：

激活细调模式后，它会在显示器上显示FINE。知道该模式被取消或者产品被关闭才停止显示。

4.4.2 调节步宽


下面为额定数值可应用的调节步宽（也可参考技术规格表）：

电压			电流		
额定值	粗调	精调	额定值	粗调	精调
42V	1V	0.05V	3A	0.1A	0.01A
84V	1V	0.1V	5A	0.1A	0.01A
			6A	0.1A	0.01A
			10A	0.1A	0.01A

 第3路输出的调节仅能以这样的方式完成，一边用外用表测量，一边用螺丝刀调节。

4.5 控制面板的锁定 (LOCK)

控制面板的锁定意在阻止按钮和旋钮的非有意操作。按下 **preset** 按钮可激活或终止 LOCK 功能。LOCK 被激活时，只有特定的预设按钮才能再次终止此功能。左边和右边的控制面板的 LOCK 条件可分开设定。例外：如果在 Tracking 模式下右边的控制面板被锁定，则只有退出 Tracking 模式才能解锁。

 LOCK 被激活后，不可手动关闭输出，即使紧急关闭也不可！

按三下 **preset** 按钮，直到显示器显示如下，才算**激活**：



图 4

同时倒计时开始。倒计时过程中您有两个选择：

- 你可等到倒计时完成，然后控制面板 LOCK 被激活。
- 你可再按一下该按钮，终止倒计时，则 LOCK 未被激活。

再次按下“Preset”按钮，则**终止** LOCK 功能。倒计时再次开始。若倒计时结束，**LOCK**保持激活状态。若再次按下按钮，倒计时终止，**LOCK**未被激活。

4.6 Tracking 模式

Tracking 模式用来同时控制两组主输出，并且只通过左边的控制面板就能设定相同的设定值。这对于并联或串联时的应用是非常有用的，且遵循下列规则：

- 只有当两组输出都关闭时，方能激活或终止 Tracking
- 在 Tracking 模式下，右边的控制面板被停用
- 左边的控制面板（输出 1）可用来调节两组输出的设定值和极限值。这些参数也会传递到右边面板
- 输出 2 的设定值根据输出 1 的变化，而实际值则根据负载而变化可
- 可在远程控制操作下发送一直令激活或停用 Tracking 模式
- 并联连接情况下，两组输出的实际值都显示于对应的显示屏上

5. 产品特性

5.1 用电源开关开机

电源开关位于产品前端。产品启动后，可设定下列状态：


- 输出关闭
- 设定值被保存，调节模式重设为粗调
- REMOTE, LOCK 或 TRACKING 类状态都会被重设。

5.2 过压

因内部元件不良或外部电压太高会导致过压错误出现。过压保护 (OVP) 将关闭对应的那组输出（只有输出 1 或 2），并在显示器上以“Error”文本指示该错误。该错误需先用 **On/Off** 按钮确认，显示器才回到正常显示。也可参考章节 4.2.2。

应避免加载于输出端的外部电压超过额定电压的 120%，否则产品内部元件会受损！

如果过压原因消除，输出会再次打开。

 当 1 和 2 组输出并联时，如果其中一组输出的 OVP 极限设得较低，则另外一组的正常输出电压会引起这组产生 OV 错误。在此情况下，建议将两组输出的 OVP 极限调为相同值，胡转到 Tracking 模式，也可解决此问题。

5.3 过温

若因内部过热出现一般不可能发生的过温 (OT) 错误，对应组的输出电压会被切断，且 „OT“ 状态符号与 „Error“ 文字一同出现于显示屏上。当产品冷却后输出方自动打开。若不需要该操作，可在过温期间手动关闭输出。

5.4 过流

对于过载和过流，产品可能以下面两种不同的方式响应：

- 关闭对应的输出 (OCP) 或
- 限制输出电流 (CC)

要关闭输出，需将 OCP 值（见章节 4.4）调到低于限流值的数值，否则电流会被限定。


6. 其它应用

6.1 1 & 2 路输出之间的串联

1 和 2 路主输出可以串联，以获得更高的总输出电压。并适用如下规则：

- 串联后形成的总输出电压不会显示于任一显示器上
- 总电压为两组输出的电压值的总和
- 最大输出电流被限定为两组输出中输出最小电流的那一组。意思是，如果一组输出设为 0A，那么在串联条件下，产品不会输出任何电压和电流。


此时建议使用 Tracking 模式（见 4.6），从而将两组输出的电压和电流调节为相同值。


 **绝不允许将第 1 路或第 2 路，或者两路输出与第 3 路输出串联。**

6.2 多台产品的串联

多个同型号产品，或者至少同额定输出电流的产品可以串联在一起，以获得更高的总输出电压。

串联时，第一台产品的直流输出正极要与第二台的负极相连，然后最后那台产品的直流输出正极则成为整个串联的输出正极，这样就可获得高电压。

 鉴于安全和隔离原因，不能随意串联任意数量的产品。任意一台产品的直流输出正极（黑色）的对地电压不能超过300V DC。故允许最大的串联电压，42V型号为342V，84V型号的为384V。若以如此高的电压操作时，需采取额外的安全保护措施。

 若将不同额定电流的产品串联在一起，最低输出电流的产品将决定整个系统的最大输出电流。


 串联时，只有第一台产品（带最低电位的产品）的直流输出正极或负极可以接地。

6.3 1 & 2路输出之间的并联

1和2路主输出可以并联，以获得更大的总输出电流。并适用如下规则：

- 并联后形成的总输出电流不会显示于任一显示器上
- 总电流为两组输出的电流值的总和

此时建议使用Tracking模式（见4.6），从而将两组输出的电压和电流调节为相同值。

 1路和2路主输出并联时，某组输出端的电压可能会给另外一组带来OV错误。详情请见5.2。

6.4 多台产品的并联

多个同型号产品，或者至少同额定输出电压的产品可以并联在一起，以获得更高的总输出电流。

并联后，需分别调节（手动或通过电脑远程调节）每台产品。此时，建议将输出电流调到最大值，输出电压调为相同值。

6.5 用EasyPS2000进行远程控制

本产品经USB端口可用电脑和EasyPS2000软件进行远程控制。这个软件和USB线装于另外的套件内。本产品需要一许可证编码来解锁软件。该编码作为一选购件可另外购买。按用户需求还可提供其他更多信息，或者在EasyPS2000软件的说明书，以及我们的网站上可查到。若想购买该套件和许可证编码，可联系您的经销商或发送邮件至2000bsoft@elektroautomatik.de，并注明您购买产品的产品编号以及系列号。。

6.6 编程

产品可经USB端口利用特定软件给产品编程并进行远程控制。该端口在某些操作系统（目前：仅为Windows）下列为虚拟COM端口。这可使用户轻易将产品应用到目标应用中。

从产品制造商的网站上可下载编程文件，或向他们申请可获取。制作特定的编程软件时不需注册码。

利用迷你USB线将产品连到电脑上。

本公司不提供其它操作系统的USB驱动程序，比如Linux或MacOS。这类操作系统网络上有免费的或商用驱动程序。USB程序可以是CDC类型（通讯设备级别）。

7. 疑难解答

7.1 硬件问题

问题：产品打开后无任何反应

原因：输入保险丝坏，或其它不良

解决方案：如果显示屏也不亮，则检查下输入保险丝。可以目视检查或者通过外用表测量。如果保险丝坏，用同型号同规格的来替换，然后再试着开机。如果输入保险丝是完好的，产品内还有另外两个保险丝，每块功率板上一个。此种情况下两个应该都烧坏了。这时只能由技术人员来更换，因为需要打开产品。只能用同尺寸（5x20mm）与同型号（见保险丝印字）的保险丝来更换。

如果错误仍然存在，请联络您的供货商。在此情况下一般需退回维修。

问题：打开产品后显示器上仅显示“PS 2000”

原因：产品固件更新时出现错误

解决方案：关闭产品然后再打开，如果仍未有任何帮助，则尝试下重新更新固件。

问题：产品通电后，其中一个显示屏一直指示“ERROR”

原因：内部保险丝坏

解决方案：本产品有两块功率板，每个上面都有其自己的保险丝，在这种情况下可能有其中一个被烧坏。此时只能由技术人员进行更换，因为需要打开产品。只能用同尺寸（5x20mm）与同型号（见保险丝印字）的保险丝来更换。

问题：产品打开后，显示器一直出现“ERROR”与“OV”

原因：触动过压保护

解答：关闭产品，然后再打开，如果没有任何帮助，请尝试重复固件更新步骤。检查设定值。可在预设模式“OVP/OCP”下进入过压保护值，然后将其设定为高于输出电压的值。也可见章节5.2。

About

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Safety instructions

- Only operate the device at a mains voltage as stipulated on the type plate!
- Never insert mechanical parts, especially from metal, through the air ventilation slots!
- Avoid any use of liquids of any kind in the proximity of the device! They might get into it.
- Do not connect voltage sources to the device which are able to generate voltages higher than the nominal voltage of the device!
- Do not connect a voltage source with reversed polarity to the output!
- After the output or even the device has been switched off there can still be dangerous voltage on the output for a certain time!
- Attention! The enclosure can heat up during operation and may be hot!

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1. Introduction

The laboratory power supplies of the series PS 2000 B Triple are very compact and rugged devices and incorporate interesting features within small dimensions. The contactless design makes them ideally suited for operation in schools, educational facilities, workshops or laboratories.

The series offers models with 2x 100W or 2x 160W nominal power.

Every model offers two separated outputs with adjustable output voltage and current, plus an auxiliary output which can be adjusted in a range of 3...6V by a trimmer.

Apart from standard functions of power supplies the user can lock pushbuttons and knobs against unintentional use or define thresholds for an automatic output cut-off in case of overcurrent or overvoltage.

All models feature a built-in USB interface, which can be used to remotely control and monitor the device by a PC.

2. Installation

2.1 Mains connection

The unit is grounded via the mains cord. Thus it must only be operated at a mains socket with grounding contact. This connection must not be interrupted by an extension cable without ground conductor!

The unit is fused with a 5 x 20mm safety fuse, which is accessible inside the mains socket in a small „drawer“. For value see fuse imprint or device type label.

2.2 Connecting loads

The power outputs are located on the front of the device.

The outputs are **not** fused! In order to avoid damage to the load application, always mind for the supply voltage of the load.

2.2.1 Outputs 1 & 2

Main output 1 is the lowermost one and main output 2 is the middle one of the three outputs (see „Figure 1“ on page 17). Output 1 is controlled with the left-hand control panel and output 2 with the right-hand one.

Voltage and current, as well as the related overcurrent and overvoltage cut-off thresholds can be adjusted with the rotary knobs within 0...100% nominal values (for set values) and 0...110% nominal values (for thresholds). The adjustment works continuously and with the step width as given in section 4.4.

The outputs are limited by voltage, current and power and are permanently short-circuit-proof. They can be connected in series or parallel in order to achieve a higher output voltage or output current.

The tracking mode (see section „4.6 Tracking mode“) can be helpful for parallel or series operation of the outputs.

2.2.2 Output 3

This output is auxiliary and totally separated from the other two outputs. It can only be adjusted by the trimmer that is accessible through the hole in the front, between the output sockets. The voltage is adjustable in a range of approx. 3...6V. The output power is approx. 12W, resulting in approx. 2A at 6V or approx. 4A at 3V. If the limit is exceeded, the LED will go out and the voltage will drop, depending on the load.

 **Parallel connection with one or both main outputs (1 & 2) is not allowed!**

3. Technical specifications

	PS 2342-06B	PS 2342-10B	PS 2384-03B	PS 2384-05B
Mains input				
Input voltage	100...240V ±10%	100...240V ±10%	100...240V ±10%	100...240V ±10%
Frequency	45...65 Hz	45...65 Hz	45...65 Hz	45...65 Hz
Fuse	MT 4 A	MT 6,3 A	MT 4 A	MT 6,3 A
Power factor	> 0.99	> 0.99	> 0.99	> 0.99
Power consumption at output off	24W	24W	24W	24W
Output 1&2 - Voltage				
Adjustable range	0...42 V	0...42 V	0...84 V	0...84 V
Stability at mains fluctuation ±10% ΔU _{IN}	< 0.02%	< 0.02%	< 0.02%	< 0.02%
Stability at 0...100% load	< 0.15%	< 0.15%	< 0.15%	< 0.15%
Ripple BWL 20MHz	< 100mV _{PP} / < 4mV _{RMS}	< 63mV _{PP} / < 5mV _{RMS}	< 48mV _{PP} / < 4mV _{RMS}	< 96mV _{PP} / < 24mV _{RMS}
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Overvoltage protection	0...46.2 V	0...46.2 V	0...92.4 V	0...92.4 V
Regulation time 10-90% load	< 2 ms	< 2 ms	< 2 ms	< 2 ms
Softstart	max. 200 ms	max. 200 ms	max. 200 ms	max. 200 ms
Output 1 & 2 - Current				
Adjustable range	0...6 A	0...10 A	0...3 A	0...5 A
Stability at mains fluctuation ±10% ΔU _{IN}	< 0.05%	< 0.05%	< 0.05%	< 0.05%
Stability at 0...100% ΔU _{OUT}	< 0.15%	< 0.15%	< 0.15%	< 0.15%
Ripple	< 25mA _{PP} / < 4mA _{RMS}	< 13mA _{PP} / < 5mA _{RMS}	< 6mA _{PP} / < 2mA _{RMS}	< 9mA _{PP} / < 3mA _{RMS}
Accuracy*	≤ 0.3%	≤ 0.3%	≤ 0.3%	≤ 0.3%
Output 1 & 2 - Power				
Efficiency	≤ 85%	≤ 85%	≤ 85%	≤ 85%
Nominal power P _{nom}	2x 100W	2x 160W	2x 100W	2x 160W
Output 3				
Adjustable range	3...6 V	3...6 V	3...6 V	3...6 V
Power	10 W (max. 12 W)	10 W (max. 12 W)	10 W (max. 12 W)	10 W (max. 12 W)
Stability at mains fluctuation ±10% ΔU _{IN}	< 0.02%	< 0.02%	< 0.02%	< 0.02%
Stability at 0...100% load	< 1.2%	< 1.2%	< 1.2%	< 1.2%
Ripple	< 100 mVpp	< 100 mVpp	< 100 mVpp	< 100 mVpp
Nominal current	>2 A @ 5 V >3.3 A @ 3 V	>2 A @ 5 V >3.3 A @ 3 V	>2 A @ 5 V >3.3 A @ 3 V	>2 A @ 5 V >3.3 A @ 3 V
Miscellaneous				
Operation temperature	0...50°C	0...50°C	0...50°C	0...50°C
Storage temperature	-20...70°C	-20...70°C	-20...70°C	-20...70°C
Humidity rel.	< 80%	< 80%	< 80%	< 80%
Dimensions (WxHxD)	282x82x241 mm	282x82x241 mm	282x82x241 mm	282x82x241 mm
Weight	3,3 kg	3,5 kg	3,3 kg	3,5 kg
Cooling	fanless, natural convection			
Safety	EN 60950			
EMC standards	EN 61326, EN 55022 Class B			
Overvoltage class	Class II			
Protection class	Class I			
Article number	39200120	39200121	39200125	39200126

* Related to the nominal value, the accuracy defines the maximum allowed deviation between set value and actual value.

Example: a 42V model has min. 0.2% voltage accuracy, this is 84mV. When setting a voltage of 5V and with an allowed maximum deviation of 84mV, the resulting actual value could be between 4.92V and 5.08V.

3.1 Scope of delivery

- 1 x Power supply device
- 1 x Printed instruction manual
- 1 x Mains cord (Schuko, IEC)

3.2 Views

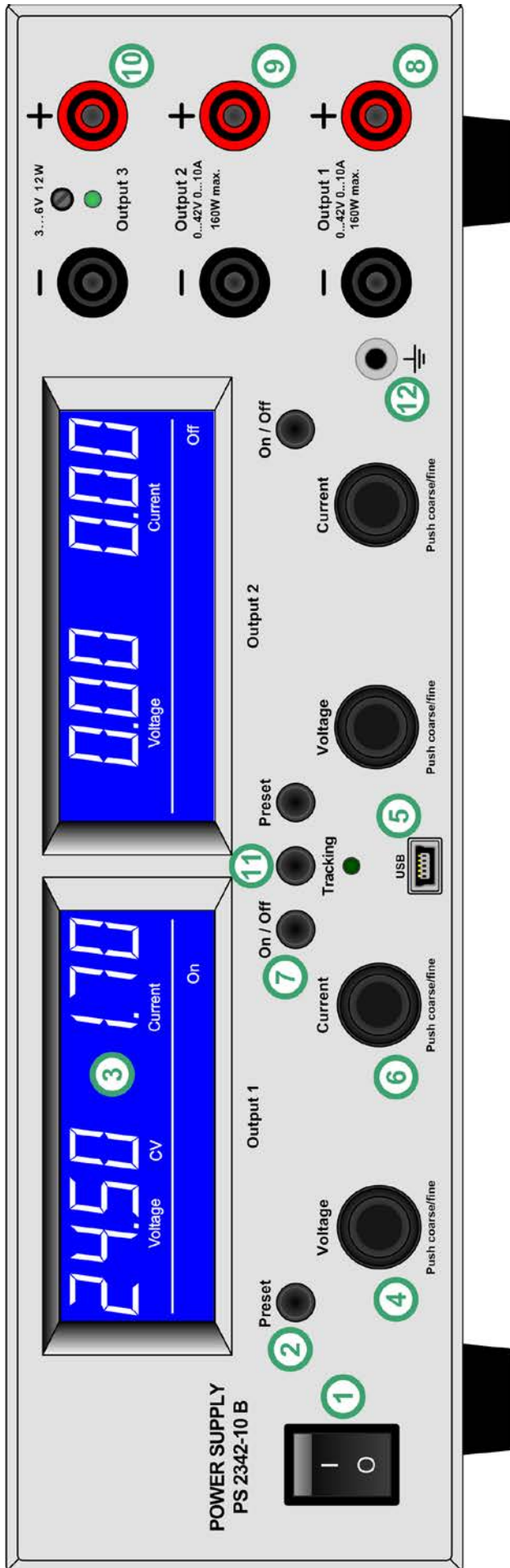


Figure 1

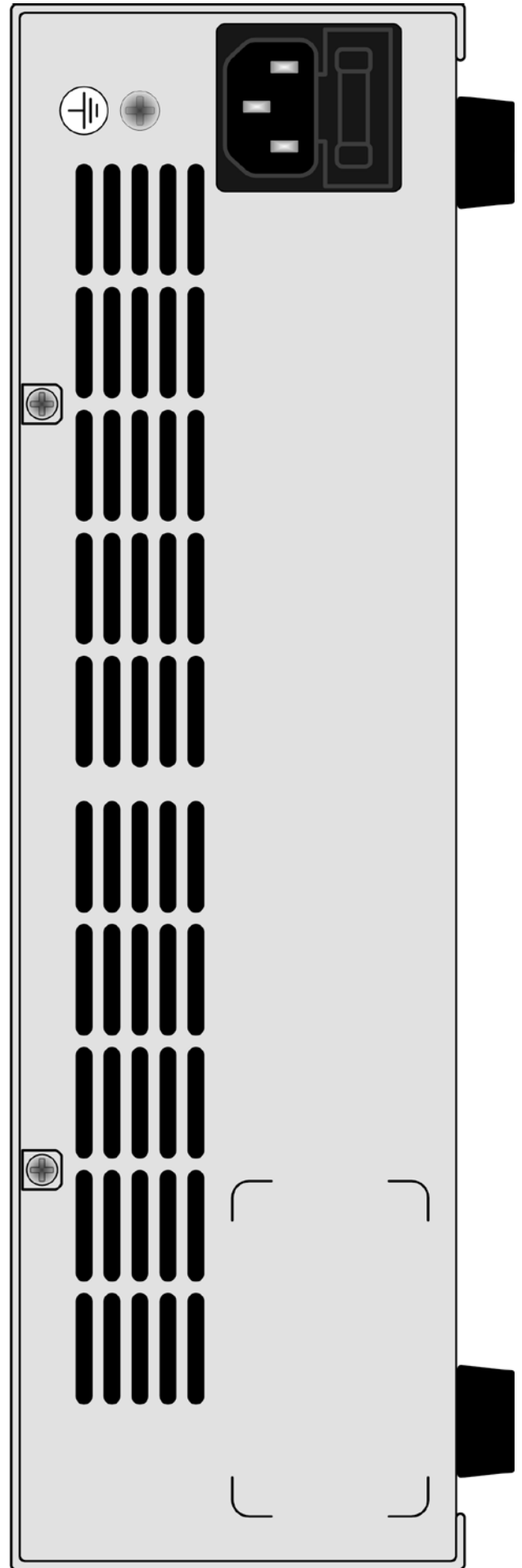


Figure 2

3.3 Controls & sockets

1 Power switch

This is used to switch the device completely on or off.

2 Pushbuttons „Preset“

These buttons are used to switch the actual values display to set values display. It is also used to activate the control panel lock. See sections 4.4 and 4.5 for details.

3 Displays

These blue LCDs present all information at one glance.

4 Knobs „Voltage“

These knobs are used to adjust the voltage of the outputs 1 and 2 or, in preset mode, to adjust the OVP threshold.

5 Mini USB socket

Here the device is connected to a PC, in order to monitor, remotely control or update the device. See section 6.5.

6 Knobs „Current“

These knobs are used to adjust the current of the outputs 1 and 2 or, in preset mode, to adjust the OCP threshold.

7 Pushbuttons „On/Off“

Are used to switch the outputs 1 and 2 on or off.

8 Power output 1, safety sockets, poled

The sockets can be used to plug 4mm open or safety Bueschel plugs. The left-hand control panel is dedicated to control this output.

9 Power output 2, safety sockets, poled

The sockets can be used to plug 4mm open or safety Bueschel plugs. The right-hand control panel is dedicated to control this output.

10 Auxiliary output 3, safety sockets, poled

The sockets can be used to plug 4mm open or safety Bueschel plugs. This output can only be adjusted by voltage and only via a trimmer which is located behind the hole between the output sockets.

11 Pushbutton „Tracking“

This button used to activate or deactivate the tracking mode. See section „4.6 Tracking mode“ for details.

12 Grounding socket

This socket can be used to plug 4mm open or safety Bueschel plugs and is connected to the enclosure. It can be used to ground a connected load.

4. Handling

4.1 The display 3



Figure 3

4.1.1 Status tokens

The status tokens in the display indicate following:

CV - Voltage regulation active (only if output is „on“)

CC - Current regulation active (only if output is „on“)

Preset V/C - Set value display of voltage/current active

Preset OVP/OCP - Set value display of OVP/OCP active

OT - Overtemperature error

OCP - Overcurrent protection

OVP - Overvoltage protection

Remote - Remote control active (via USB)

Lock - Control panel lock active

Fine - Indicates activated fine adjustment mode

4.1.2 Error indication

If an error like overvoltage, overcurrent or overtemperature occurs it is displayed in one of the LCDs by the text „Error“ and a token (OT, OCP, OVP) and the output voltage is cut off. The text remains in the display until the user has acknowledged the error with the „On/Off“ button, which will also switch the output off.

After an overtemperature error, the output voltage will return automatically and „Error“ will be cleared, unless the output has been switched off by the user meanwhile. Other errors require the user to switch the output on again, in order to continue working with the device.







Other display elements are connected to certain operation modes and are explained in the following sections.


The main outputs 1 and 2 are working separately, so in case of an error the output will continue working. Output 3 does not cause any error indication.

4.2 Pushbuttons

4.2.1 Pushbuttons Preset ②



These buttons are used to switch to preset mode and for activation/deactivation of the LOCK mode, as long as the unit is not in remote control.

Push	Display	Mode
1x	 	Display of U/I set values
2x	 	Display of OVP/OCP set values
3x	 	Activation/Deactivation of LOCK mode (also see 4.5)
4x		Display actual values again

 In tracking mode, the preset button of the right-hand control panel is inactive. The preset display of the right-hand display is then controlled via the left-hand control panel. Also see section „4.6 Tracking mode“.

4.2.2 Pushbuttons On/Off ⑦

These pushbuttons are used to manually and separately switch the power outputs 1 and 2 on or off, as long as the device is not in remote control. The state of the particular output is indicated by

 or  in the related display.

The pushbuttons might be locked by the **LOCK** state. See „4.5 Control panel lock (LOCK)“.

The buttons also acknowledge errors. See section 4.1.2 for details.

4.3 Further control elements

Knobs Voltage ④ & Current ⑥

These rotary knobs have no stop and are used to adjust set values. Assignment:

- Left knob on the control panel:
Voltage (U) or overvoltage threshold of the dedicated output, depending on preset mode
- Right knob on the control panel:
Current (I) or overcurrent threshold of the dedicated output, depending on preset mode,

For details read below.


4.4 Adjusting set values


When adjusting the set values of voltage (U) and current (I), a rule becomes active where both set values adjust each other in order to not exceed the max. power of the device according to $P_{max} = U_{set} * I_{set}$.

It applies for preset mode and normal operation:

a) If the output is on and **constant voltage** regulation is active (CV in the display) and if the **current** set value is adjusted beyond a certain limit which is defined by the formula: current set value = maximum power / voltage set value, then the voltage set value will be reduced automatically according to the same formula, in order to maintain the maximum power.

b) If the output is on and **constant current** regulation is active („CC“ in the display) and if the **voltage** set value is adjusted beyond a certain limit which is defined by the formula: voltage set value = maximum power / current set value, then the current set value will be reduced automatically according to the same formula, in order to maintain the maximum power.

 If the OCP value is identical to the current limitation value and if that limitation is reached, the OCP will have priority and switch the output off.

 All set values are internally stored every 10 seconds and restored after powering the device next time. Thus it is recommended to wait at least 10 seconds after the last adjustment of any value and before switching the device off, else other values are restored the next time.

4.4.1 Fine adjustment

Adjusting values manually can be done in **fine** or **coarse** steps. Switching between coarse and fine adjustment mode is done by pushing the corresponding knob. Coarse adjustment mode is default when switching the device on.

For devices with firmware up to 3xx applies:

If fine adjustment is selected and if no value has been changed for more than 10 seconds, the adjustment mode will automatically return to coarse. The same happens when switching from normal operation to preset mode or vice versa.

For devices with firmware from 4.xx applies:

Activated fine adjustment mode is indicated in the display with FINE. It remains until it is deactivated again or the device is switched off.

4.4.2 Adjustment step width

Following step widths apply in dependency of the nominal values (also refer to technical specs):

Voltage			Current		
Nom. value	coarse	fine	Nom. value	coarse	fine
42V	1V	0.05V	3A	0.1A	0.01A
84V	1V	0.1V	5A	0.1A	0.01A
			6A	0.1A	0.01A
			10A	0.1A	0.01A

Adjusting the output voltage of output 3 can only be done by measuring it with a multimeter.

4.5 Control panel lock (LOCK)

The control panel LOCK is intended to prevent unintentional use of the pushbuttons and knobs. LOCK is activated or deactivated using the **preset** button. While LOCK is active, only the particular preset button can be used to deactivate LOCK again. The LOCK condition can be set separately for the left-hand and right-hand control panels. Exception: the right-hand control panel is locked during tracking mode and can only be unlocked by leaving tracking mode.

While LOCK is activated, the output can not be switched off manually, not even in an emergency!

Activation is done by pushing the **preset** button three times until the display shows following:



Figure 4

A countdown will be running. During this countdown you have two options:

- a) Wait until the countdown has finished. After this, the control panel **LOCK is active**.
- b) Push the preset button once again and abort the countdown. **LOCK is then not activated**.

Deactivation is done by pushing button „Preset“, which causes the countdown to run again. If it runs out, LOCK remains active. If the countdown is aborted by pushing the button again, LOCK will be deactivated.

4.6 Tracking mode

The tracking mode is used to control both main outputs 1 and 2 simultaneously and with identical set values by using only the left-hand control panel. This is especially useful when running these outputs in parallel or series connection. Following applies:

- Tracking can only be activated or deactivated if both outputs are **switched off**
- In tracking mode, the right-hand control panel is deactivated
- The left-hand control panel (output 1) is used to adjust set values (U, I) and thresholds (OVP, OCP) for both outputs. The values are submitted to the right-hand panel
- The set values of output 2 follow the set values of output 1, the actual values are load-dependent
- Tracking mode can also be activated or deactivated by a command during remote control
- In parallel connection, the actual values of the outputs are indicated on the related display

5. Behaviour of the device

5.1 Switching on by power switch

The power switch is located at the front. After the device is started, following situation will be set:

- The outputs are off
- The set values are restored, adjustment mode is reset to **coarse**
- Any condition like REMOTE, LOCK or TRACKING is reset.

5.2 Overvoltage

An overvoltage error can occur due to an internal defect (output voltage rises uncontrolled) or by a too high voltage from external. The overvoltage protection (OVP) will switch off the voltage of the corresponding output (main output 1 or 2 only) and indicate the error in the display by the text „Error“. This error has to be acknowledged first by the **On/Off** pushbutton. Then the display will change to normal display again. Also see section 4.2.2.

External voltages higher than 120% nominal voltage at the output must be avoided, or else internal components of the device might be destroyed!

If the cause of the overvoltage is removed, the output can be switched on again.

☞ In parallel connection of the main outputs 1 and 2, the output voltage of one output can cause an OV error on the other output if the OVP threshold of the effected output is set lower. In such a case it is recommended to either adjust the OVP thresholds of both outputs to the same value or to use tracking mode, which will handle this matter.

5.3 Overtemperature

If the unlikely event of an overtemperature (OT) error occurs by internal overheating, the voltage of the corresponding output is cut off and the status token „OT“ is shown in the related display, together with the text „Error“. The output will automatically switch on again after the unit has cooled down. In case this is not wanted, the output can be manually switched off during the overtemperature period.

5.4 Overcurrent

The device can react in two different ways to overload resp. overcurrent:

1. By switching the corresponding output off (OCP) or
2. By limiting the output current (CC)

In order to switch the output off, it is required to adjust the OCP threshold (see section 4.4) to lower than the current limitation, because else the current is just limited.

6. Other applications

6.1 Series connection of outputs 1 & 2

The main outputs 1 and 2 can be connected in series in order to gain a higher output voltage. Following applies:

- There will be no totals formation of the total output voltage on any display
- The total voltage builds from the output voltage of the single outputs
- The maximum current is limited to the lowest adjusted current of both outputs. It means, if one output is set to 0A, the unit will not put out voltage and no current during series connection

It is recommended to use tracking mode (see 4.6), in order to have the adjusted voltage and current at identical values.

☞ Series connection of any or both main outputs 1 and 2 with output 3 is not allowed.

6.2 Series connection of several units

Several units of preferably same type, but at least with identical nominal current, can be connected in series in order to gain a higher total output voltage.

To do so, the positive DC output of one unit is connected to the negative DC output of the next unit etc. The pos. DC output of the last unit will then be the positive output of the whole series connection and will have the high potential.

☞ Because of safety and insulation reasons it is not allowed to connect an arbitrary number of unit in series. The DC minus pole (black) of any output on any unit must not have a potential of higher than 300V DC against ground. The maximum allowed series connection voltage is 342V DC for 42V models and 384V DC for 84V models. Special safety measures are required when working with such high voltages!

☞ If units with different nominal current are connected in series, the unit with the lowest nominal current will determine the maximum current of the system.

☞ In a series connection, only the positive or negative DC output of the first unit (the one with the lowest potential) may be grounded.

6.3 Parallel connection of outputs 1 & 2

The main outputs 1 and 2 can be connected in parallel in order to gain a higher output current. Following applies:

- There will be no totals formation of the total output current on any display
- The total current builds from the output current of the single outputs

It is recommended to use tracking mode (see), in order to have the adjusted voltage and current at identical values.

☞ In parallel connection of the main outputs 1 and 2, the output voltage of one output can cause an OV error on the other output. See section 5.2 for details.

6.4 Parallel connection of several units

Several units of preferably same type, but at least identical nominal output voltage, can be connected in parallel in order to gain a higher total output current.

Every unit has to be adjusted separately (manually or remotely by a PC). It is recommended to adjust the output current to the maximum and the output voltage to identical values on every unit.

6.5 Remote control with EasyPS2000

The device can be remotely controlled via the USB port by means of a PC and a Windows software called EasyPS2000. The software and a USB cable are included in a separately available kit. The device requires a license code to be unlocked in the software. The code can be purchased as an option. Further information are available upon request or in the instruction manual of the EasyPS2000 software, as well as on our website. In order to purchase the kit and the license code, contact your dealer or send an e-mail to 2000bsoft@elektroautomatik.de and state article number and serial number of the device.

6.6 Programming

The device can be programmed and remotely controlled by custom software and via the USB port. This port is enumerated as virtual COM port on certain operation systems (currently: Windows only). This enables the user to easily implement the device into the target application.

The programming documentation is available on the website of the device manufacturer in the download section or upon request. When programming custom software no device license is required.

The connection to the PC is done a standard mini USB cable.

The manufacturer can not provide the USB driver for other operating systems such as Linux or MacOS. There are free or commercial drivers available from the Internet for those OS's. The USB driver has to be of type CDC (Communications Device Class).

7. Trouble-shooting

7.1 Hardware problems

Problem: After switching the device on nothing happens

Reason(s): Input fuse broken, other defect

Solution: If the display remains dark, check the input fuse. It is located inside the input socket on the rear, in a little „drawer“. It can be checked visually or by means of a multimeter. If the fuse is broken, replace with same type and value and try again. If the input fuse is OK, there are two more fuses inside the device, one each on the power stages. In this case both should be blown. Replacing the fuses must only be done by trained technical personnel, because the device has to be opened. The fuses must only be replaced by such of same size (5x20mm) and type (see fuse imprint).

If the error remains, contact your supplier. In such a case the unit usually has to be returned for repair.

Problem: The display only shows „PS 2000“ after switching the device on

Reason: An error occurred during a firmware update

Solutions: Switch off device and on again, if this does not help, try to repeat the firmware update procedure.

Problem: After the device was powered, one of the displays shows permanently „ERROR“

Reason: internal fuse broken

Solution: the device has two power stages. Each of them has its own internal fuse and one is very likely blown in this case. Replacing the fuse must only be done by trained technical personnel, because the device has to be opened. The fuse must only be replaced by one of the same size (5x20mm) and type (see fuse imprint).

Problem: After the device was powered, one or both displays show permanently „ERROR“, plus „OV“

Reason: the overvoltage protection has triggered

Solution: Check the set values. The one for overvoltage protection is accessible in preset mode „OVP/OCP“ and must be set higher than the output voltage. Also see section 5.2.

Otherwise, a voltage coming from an external source which is higher than the output voltage or even the OVP setting can also trigger the error OV.