Elektro-Automatik GmbH

Labornetzgeräte
Laboratory Power Supplies

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

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 to nominal voltage and current 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 max. 12W, resulting in approx. 2A at 6V or approx. 4A at 3V. If the power limit is exceeded, the LED will go out and the voltage will drop to almost zero.

☞ ***Parallel connection of output 3 with one or both main outputs (1 & 2) is <u>not</u> 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…65Hz	45…65Hz	45…65Hz	45…65Hz
Fuse	MT 4A	MT 6,3A	MT 4A	MT 6,3A
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...42V	0...42V	0...84V	0...84V
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…46.2V	0…46.2V	0…92.4V	0…92.4V
Regulation time 10-90% load	< 2ms	< 2ms	< 2ms	< 2ms
Softstart	max. 200ms	max. 200ms	max. 200ms	max. 200ms
Output 1 & 2- Current	0	0	0	0
Adjustable range	0…6A	0…10A	0…3A	0…5A
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*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
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…6V	3…6V	3…6V	3…6V
Power	10W (max. 12W)	10W (max. 12W)	10W (max. 12W)	10W (max. 12W)
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	< 100mVpp	< 100mVpp	< 100mVpp	< 100mVpp
Nominal current	>2A @ 5V >3.3A @ 3V	>2A @ 5V >3.3A @ 3V	>2A @ 5V >3.3A @ 3V	>2A @ 5V >3.3A @ 3V
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)	282x82x241mm	282x82x241mm	282x82x241mm	282x82x241mm
Weight	3,3kg	3,5kg	3,3kg	3,5kg
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)

1x UK adpater (included in UK deliveries only)

3.2 Views

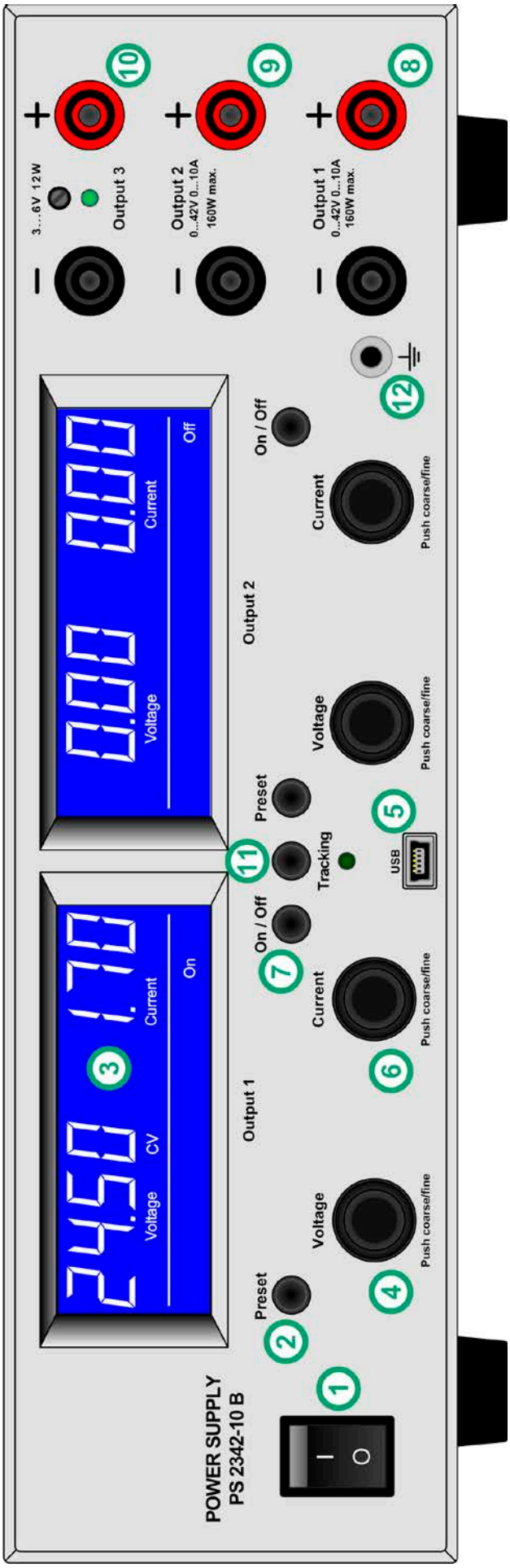

Figure 1

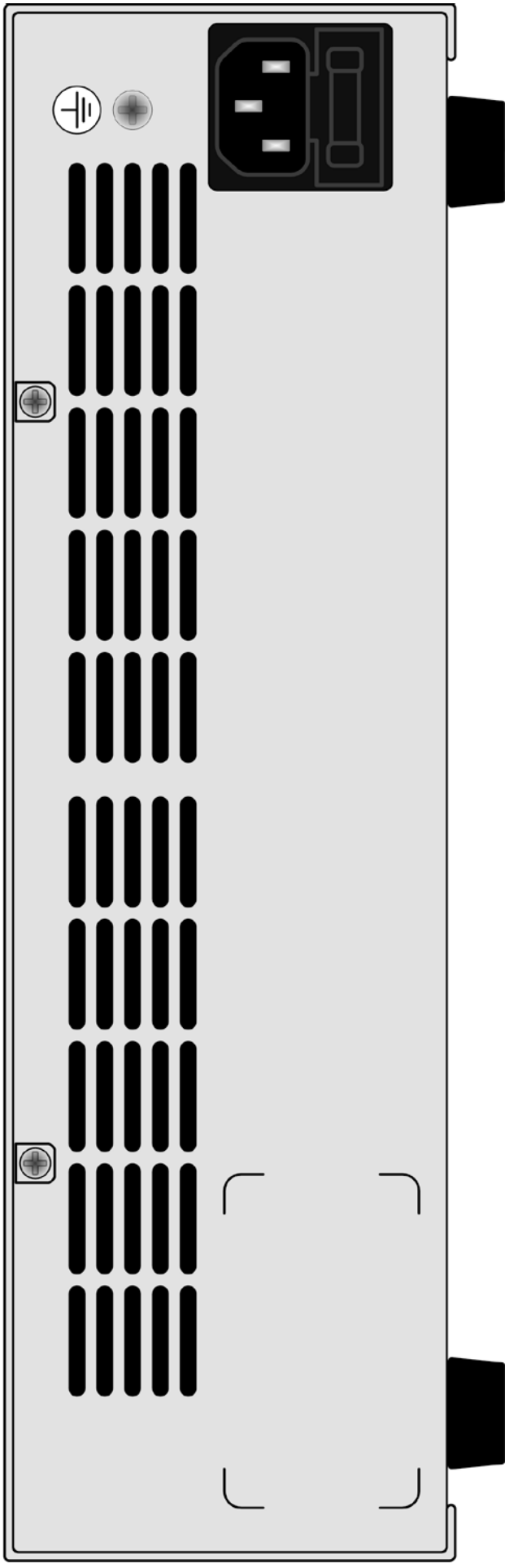

Figure 2

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 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 other output will continue working. Output 3 does not cause any error indication.

4.2 Pushbuttons

4.2.1 Pushbuttons Preset (2)

These button 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	Preset V / C	Display of U/I set values
2x	Preset OVP / OCP	Display of OVP/OCP set values
3x	Preset Lock	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

On or Off 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.

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 ist 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-depending
- 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. Behavior 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 is the sum of the single output voltages
- 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 <u>not</u> 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 positive 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 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 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.

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