Elektro-Automatik GmbH

operation manual
Instruction Manual

PS 8000 2U
Laboratory Power Supply

Picture shows standard device 2HE / Picture shows standard 2U version

PS 8032-20 2U:	09 230 130	PS 8360-15 2U:	09 230 137
PS 8065-10 2U:	09 230 131	PS 8360-30 2U:	09 230 138
PS 8160-05 2U:	09 230 132	PS 8720-15 2U:	09 230 139
PS 8080-40 2U:	09 230 133	PS 8040-60 2U:	09 230 144
PS 8080-60 2U:	09 230 134	PS 8040-120 2U:	09 230 145
PS 8080-120 2U:	09 230 135		
PS 8160-60 2U:	09 230 136		

imprint

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Risk of death!

Dangerous output voltage

With some models, the output voltage can reach values of >60V that are dangerous to touch$_{DC}$ to reach!

All live parts must be covered. All work on the connection terminals must be carried out with the device de-energized (mains switch switched off) and may only be carried out by persons who are familiar with the dangers of electrical current or who have been instructed. The connections of the loads or consumers connected to the device must also be safe to touch. Equipment that is connected to the device must be protected in such a way that there is no danger from the connected equipment in the event of a possible overload due to incorrect operation or malfunction.

Danger!

A dangerously high voltage can still be present at the DC output for an indefinite period after the output or the device has been switched off!

Important to note:

- The device is only to be operated at the specified mains voltage
- Do not insert any mechanical parts, especially metal ones, into the device through the ventilation slots
- Avoid using liquids of any kind near the device, they could get into the device
- Never touch the prongs on the power cord or power jack immediately after removing the cord from the outlet, as there is a risk of electric shock
- Never connect loads, especially low-impedance ones, when the power output is switched on, sparks can occur and burn your hands as a result, as well as damage the device
- In order to equip interfaces in the intended slots, the relevant ESD regulations must be observed.
- An interface card may only be removed from the slot or fitted when it is switched off. It is not necessary to open the device.
- Aging of the device and very frequent use can mean that the control elements (buttons, rotary knobs) no longer react as expected.
- Do not connect any external voltage sources with reversed polarity to the DC output! This will destroy the device.
- If possible, do not connect any external voltage sources to the DC output, but never ones that can generate a higher voltage than the nominal voltage of the device!

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EN

1 Introduction

The laboratory power supplies of the PS 8000 2U series are particularly suitable for test systems and industrial controls thanks to their 19” rack.

In addition to the common functions of power supplies, 5 different set value specifications can be set, saved and called up when required. There is also a permanently integrated analog interface that serves the common voltage ranges of 0...5V and 0...10V. On the one hand, this enables monitoring of the device and, on the other hand, complete remote control.

Using optional interface cards, almost all functions of the device can be controlled and monitored from a PC.

Devices from 1000W output power offer the possibility of series connection in master-slave operation or parallel connection in share bus operation with a "system bus", as well as an adjustable power limit (with two exceptions, see technical data).

Integration into existing systems is easily possible using an interface card. The configuration is easy and is done on the device, if at all necessary. The laboratory power supplies can be used e.g. B. operated via the digital interface in combination with other laboratory power supplies or controlled by a PLC or another device with an analog interface or control this.

The device is microprocessor controlled, which allows accurate and fast measurement and display of actual values.

The main functions at a glance:

- Set current and voltage, each 0...100%
- Adjustable overvoltage protection 0...110% voltage
- Interchangeable interface cards (CAN, USB, RS232, IEEE/GPIB, Ethernet/LAN, Profibus)
- Analog interface for external control and measurement with 0...5V or 0...10V (switchable) for 0...100%
- Power classes 640W, 1000W, 1500W and 3000W
- Temperature-controlled fan control
- Status display (OT, OVP, CC, CV, CP)
- 5 storable setpoint sets
- Master-slave operation (series connection) (devices from 1kW, except 720V model)
- Share bus operation (parallel connection) (devices from 1kW)
- Vector™ compatible CAN system
- Free Windows software
- LabView™ VIs

2. Specifications

2.1 Operating and display unit

execution

Advertisement:	Graphic display 202 x 32 dots, divided into three areas
Controls:	2 knobs, 9+2 buttons

display formats

The nominal values determine the maximum adjustable range.

Actual values are always displayed simultaneously for voltage and current, the target values for overvoltage protection, voltage, current, power (devices from 1kW) and undervoltage threshold separately.

Display of voltage values

Resolution:	4 digits
Formats:	0.00V...99.99V
	0.0V...999.9V

Display of current values

Resolution:	4 digits
Formats:	0.000A...9.999A
	0.00A...99.99A
	0.0A...999.9A

Display of power values (devices from 1kW)

Resolution:	4 digits
Format:	0,000kW...9,999kW

2.2 Device Specific Data

	PS 8032-20 2U	PS 8065-10 2U	PS 8160-04 2U	PS 8080-40 2U
power input				
input voltage range	90...264VAC	90...264VAC	90...264VAC	90...264VAC
- with additional derating	-	-	-	-
Input current at 230V	3.2A max	3.4A max	3.2A max	4.8A max
Input current at 100V	7.5A max	7.5A max	7.5A max	11.4A max
input frequency	45...65Hz	45...65Hz	45...65Hz	45...65Hz
entrance security	T8A	T8A	T8A	T16A
power factor	> 0.99	> 0.99	> 0.99	> 0.99
output - voltage				
Rated voltage $U_{nominal}$	32V	65V	160V	80V
adjustment range	0V...$U_{nominal}$	0V...$U_{nominal}$	0V...$U_{nominal}$	0V...$U_{nominal}$
Stability Mains regulation ±10% ΔU_E	<0.02%	<0.02%	<0.02%	<0.02%
Stability at 0...100% load	<0.05%	<0.05%	<0.05%	<0.05%
Residual ripple @ BWL 20MHz	< 100mV_{pp} < 8mV_{RMS}	< 150mV_{pp} < 10mV_{RMS}	< 120mV_{pp} < 20mV_{RMS}	< 10mV_{pp} < 4mV_{RMS}
Accuracy*	≤0.2%	≤0.2%	≤0.2%	≤0.2%
display resolution	10mV	10mV	100mV	10mV
scythe adjustment	2V max	2V max	2V max	2.5V max
Overvoltage protection (adjustable)	0...35.2V	0...71.5V	0...176V	0....88V
Output - current				
Rated current $I_{nominal}$	20A	10A	4A	40A
adjustment range	0...$I_{nominal}$	0...$I_{nominal}$	0...$I_{nominal}$	0...$I_{nominal}$
Stability Mains regulation ±10% ΔU_E	<0.05%	<0.05%	<0.05%	<0.05%
Stability at 0...100% ΔU_A	<0.15%	<0.15%	<0.15%	<0.15%
Residual ripple @ BWL 20MHz	< 65mA_{pp}	< 25mA_{pp}	< 3mA_{pp}	< 19mA_{pp}
Accuracy*	≤0.7%	≤0.7%	≤0.7%	≤0.2%
display resolution	10mA	10mA	1mA	10mA
Settling time 10....90% load	< 2ms	< 2ms	< 2ms	< 2ms
output - performance				
Rated power $P_{nominal}$	640W	650W	640W	1000W
Nominal power with derating	-	-	-	-
adjustment range	-	-	-	0...$p_{nominal}$
Accuracy*	-	-	-	≤ 1%
adjustment resolution	-	-	-	1w
efficiency max.	90.5%	91.0%	92.0%	93.0%
various				
ambient temperature	0....40°C	0....40°C	0....40°C	0....40°C
storage temperature	- 20....70°C	- 20....70°C	- 20....70°C	- 20....70°C
relative humidity	< 80%	< 80%	< 80%	< 80%
Dimensions standard (WxHxD)	19" 2U 380mm	19" 2U 380mm	19" 2U 380mm	19" 2U 460mm
Dimensions with option ZH (WxHxD)	-	-	-	19" 2U 460mm
weight standard	9.5kg	9.5kg	9.5kg	11.5kg
Weight with ZH option	-	-	-	13kg
Isolation voltage +output<->housing	500V	700V	1500V	950V
Isolation voltage -output<->housing	300Vdc			
Isolation voltage input<->output	2500V			
cooling	Fan, front air inlet, rear air outlet			
norms	EN 60950, EN 61326, EN 55022 class B			
overvoltage category	2			
protection class	1			
degree of pollution	2			
operating altitude	<2000m			
series connection	possible (with restrictions)			
master slave	no			
parallel circuit	yes, via Share-BIrishandrightsdom		nm	
master slave	yes, via analogue interface			
Analog programming				
entrance area	0...5V or 0...10V, switchable			
accuracy	≤ 0.2%			
item number	09230130	09230131	09230132	09230133

* Based on the nominal value, the accuracy defines the maximum deviation between the target value and the actual value.

Example: an 80V device has a voltage accuracy of at least 0.2%, that is 160mV. With a target value of 5V, the actual value should deviate by a maximum of 160mV, i.e. it should be 4.84V...5.16V.

	PS 8040-60 2U	PS 8080-60 2U	PS 8360-15 2U	PS 8040-120 2U
power input				
input voltage range	90...264VAC	90...264VAC	90...264VAC	180...264VAC
- with additional derating	90...150V AC	90...150V AC	90...150V AC	180...207VAC
Input current at 230V	7.5A max	7.5A max	7.5A max	15A max
Input current at 100V	11.4A max	11.4A max	11.4A max	-
input frequency	45...65Hz	45...65Hz	45...65Hz	45...65Hz
entrance security	T16A	T16A	T16A	T16A
power factor	> 0.99	> 0.99	> 0.99	> 0.99
output - voltage				
Rated voltage $U_{nominal}$	40V	80V	360V	40V
adjustment range	0V...$U_{nominal}$	0V...$U_{nominal}$	0V...$U_{nominal}$	0V...$U_{nominal}$
Stability Mains regulation ±10% ΔU_E	<0.02%	<0.02%	<0.02%	<0.02%
Stability at 0...100% load	<0.05%	<0.05%	<0.05%	<0.05%
ripple	< 10mV_{pp} < 4mV_{RMS}	< 10mV_{pp} < 4mV_{RMS}	< 50mV_{pp} < 8mV_{RMS}	< 10mV_{pp} < 5mV_{RMS}
Accuracy*	≤0.2%	≤0.2%	≤0.2%	≤0.2%
display resolution	10mV	10mV	100mV	10mV
scythe adjustment	2.5V max	2.5V max	8V max	2.5V max
Overvoltage protection (adjustable)	0....44V	0....88V	0...396V	0....44V
Output - current				
Rated current $I_{nominal}$	60A	60A	15A	120A
adjustment range	0...$I_{nominal}$	0...$I_{nominal}$	0...$I_{nominal}$	0...$I_{nominal}$
Stability Mains regulation ±10% ΔU_E	<0.05%	<0.05%	<0.05%	<0.05%
Stability at 0...100% ΔU_A	<0.15%	<0.15%	<0.15%	<0.15%
ripple	< 19mA_{pp}	< 19mA_{pp}	< 1mA_{pp}	< 25mA_{pp}
Accuracy*	≤0.2%	≤0.2%	≤0.2%	≤0.2%
display resolution	10mA	10mA	10mA	100mA
Settling time 10....90% load	< 2ms	< 2ms	< 2ms	< 2ms
output - performance				
Rated power $P_{nominal}$	1500W	1500W	1500W	3000W
Nominal power with derating	1000W	1000W	1000W	2500W
adjustment range	0...$p_{nominal}$	0...$p_{nominal}$	0...$p_{nominal}$	0...$p_{nominal}$
Accuracy*	≤ 1%	≤ 1%	≤ 1%	≤ 1%
adjustment resolution	1w	1w	1w	1w
efficiency max.	93.0%	93.0%	93.0%	93.0%
various				
ambient temperature	0....40°C	0....40°C	0....40°C	0....40°C
storage temperature	- 20....70°C	- 20....70°C	- 20....70°C	- 20....70°C
relative humidity	< 80%	< 80%	< 80%	< 80%
Dimensions standard (WxHxD)	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm
Dimensions with option ZH (WxHxD)	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm	19" 4U 460mm
weight standard	11.5kg	11.5kg	11.5kg	14.7kg
Weight with ZH option	13kg	13kg	13kg	17kg
Isolation voltage +output<->housing	500V	950V	2100V	500V
Isolation voltage -output<->housing	300Vdc			
Isolation voltage input<->output	2500V			
cooling	Fan, front air inlet, rear air outlet			
norms	EN 60950, EN 61326, EN 55022 class B			
overvoltage category	2			
protection class	1			
degree of pollution	2			
operating altitude	<2000m			
series connection	possible (with restrictions)			
master slave	no			
parallel circuit	yes, via share bus with power distribution			
master slave	yes, via analogue interface			
Analog programming				
entrance area	0...5V or 0...10V, switchable			
accuracy	≤ 0.2%			
item number	09230144	09230134	09230137	09230145

* Based on the nominal value, the accuracy defines the maximum deviation between the target value and the actual value.

Example: an 80V device has a voltage accuracy of at least 0.2%, that is 160mV. With a target value of 5V, the actual value should deviate by a maximum of 160mV, i.e. it should be 4.84V...5.16V.

	PS 8080-120 2U	PS 8160-60 2U	PS 8360-30 2U	PS 8720-15 2U
power input				
input voltage range	180...264VAC	180...264VAC	180...264VAC	180...264VAC
- with additional derating	180...207VAC	180...207VAC	180...207VAC	180...207VAC
Input current at 230V	15A max	15A max	15A max	15A max
Input current at 100V	-	-	-	-
input frequency	45...65Hz	45...65Hz	45...65Hz	45...65Hz
entrance security	T16A	T16A	T16A	T16A
power factor	> 0.99	> 0.99	> 0.99	> 0.99
output - voltage				
Rated voltage $U_{nominal}$	80V	160V	360V	720V
adjustment range	0V...$U_{nominal}$	0V...$U_{nominal}$	0V...$U_{nominal}$	0V...$U_{nominal}$
Stability Mains regulation ±10% ΔU_E	<0.02%	<0.02%	<0.02%	<0.02%
Stability at 0...100% load	<0.05%	<0.05%	<0.05%	<0.05%
ripple	< 10mV_{pp} < 5mV_{RMS}	< 20mV_{pp} < 10mV_{RMS}	< 30mV_{pp} < 12mV_{RMS}	< 50mV_{pp} < 20mV_{RMS}
Accuracy*	≤0.2%	≤0.2%	≤0.2%	≤0.2%
display resolution	10mV	100mV	100mV	100mV
scythe adjustment	2.5V max	5V max	8V max	16V max
Overvoltage protection (adjustable)	0....88V	0...176V	0...396V	0...792V
Output - current				
Rated current $I_{nominal}$	120A	60A	30A	15A
adjustment range	0...$I_{nominal}$	0...$I_{nominal}$	0...$I_{nominal}$	0...$I_{nominal}$
Stability Mains regulation ±10% ΔU_E	<0.05%	<0.05%	<0.05%	<0.05%
Stability at 0...100% ΔU_A	<0.15%	<0.15%	<0.15%	<0.15%
ripple	< 25mA_{pp}	< 18mA_{pp}	< 60mA_{pp}	< 2mA_{pp}
Accuracy*	≤0.2%	≤0.2%	≤0.2%	≤0.2%
display resolution	100mA	10mA	10mA	10mA
Settling time 10....90% load	< 2ms	< 2ms	< 2ms	< 2ms
output - performance				
Rated power $P_{nominal}$	3000W	3000W	3000W	3000W
Nominal power with derating	2500W	2500W	2500W	2500W
adjustment range	0...$p_{nominal}$	0...$p_{nominal}$	0...$p_{nominal}$	0...$p_{nominal}$
Accuracy*	≤ 1%	≤ 1%	≤ 1%	≤ 1%
adjustment resolution	1w	1w	1w	1w
efficiency max.	93.0%	93.0%	93.0%	93.0%
various				
ambient temperature	0....40°C	0....40°C	0....40°C	0....40°C
storage temperature	- 20....70°C	- 20....70°C	- 20....70°C	- 20....70°C
relative humidity	< 80%	< 80%	< 80%	< 80%
Dimensions standard (WxHxD)	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm
Dimensions with option ZH (WxHxD)	19" 4U 460mm	19" 4U 460mm	19" 4U 460mm	-
weight standard	14.7kg	14.7kg	14.7kg	14.7kg
Weight with ZH option	17kg	17kg	17kg	-
Isolation voltage +output<->housing	950V	1500V	2100V	2950V
Isolation voltage -output<->housing	300Vdc			
Isolation voltage input<->output	2500V			
cooling	Fan, front air inlet, rear air outlet			
norms	EN 60950, EN 61326, EN 55022 class B			
overvoltage category	2			
protection class	1			
degree of pollution	2			
operating altitude	<2000m			
series connection	possible (with restrictions)			
master slave	no			
parallel circuit	yes, via Share-B©us2m			
master slave	yes, via analogue interface			
Analog programming				
entrance area	0...5V or 0...10V, switchable			
accuracy	≤ 0.2%			
item number	09230135	09230136	09230138	09230139

* Based on the nominal value, the accuracy defines the maximum deviation between the target value and the actual value.

Example: an 80V device has a voltage accuracy of at least 0.2%, that is 160mV. With a target value of 5V, the actual value should deviate by a maximum of 160mV, i.e. it should be 4.84V...5.16V.

3. Device Description

3.1 Views

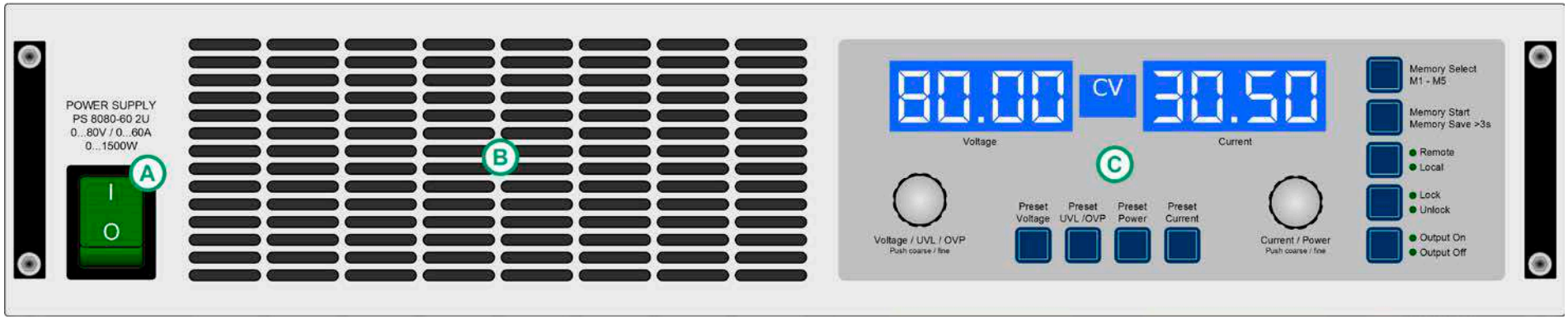


Figure 1. Front view 2U standard version, models with ZH option may vary

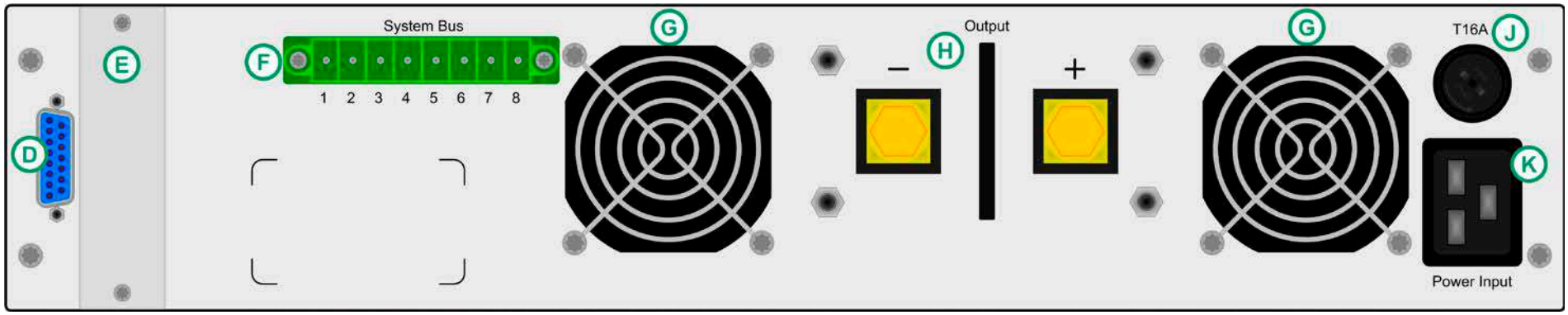


Figure 2. Rear view 2U standard version

Explanations:

A - Power button

B - Air Intake Slots

C - control panel

D - Analog interface, 15-pin, female E - Slot for digital expansion cards

F - system bus

G - fan

H - power output, M8 screws

J - Mains fuse (value see "2. Technical data") K - Mains socket, 3-pin, IEC 60320

Pinout System Bus (See section 11.1 for important details): 1 - remote sense positive (Sense +)

2 - Remote sense negative (Sense -)

3 - Master output current

4 - Master output voltage 5 - Slave input current

6 - Slave Input Voltage 7 - Share Bus

8 - mass

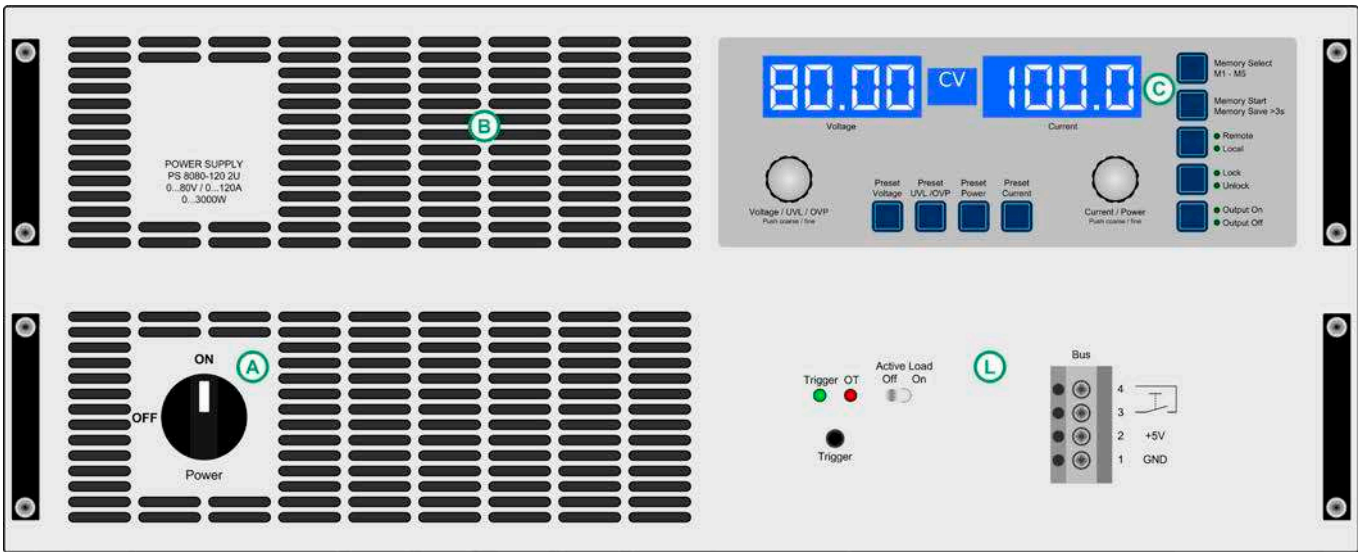


Figure 3. Front view 4U version

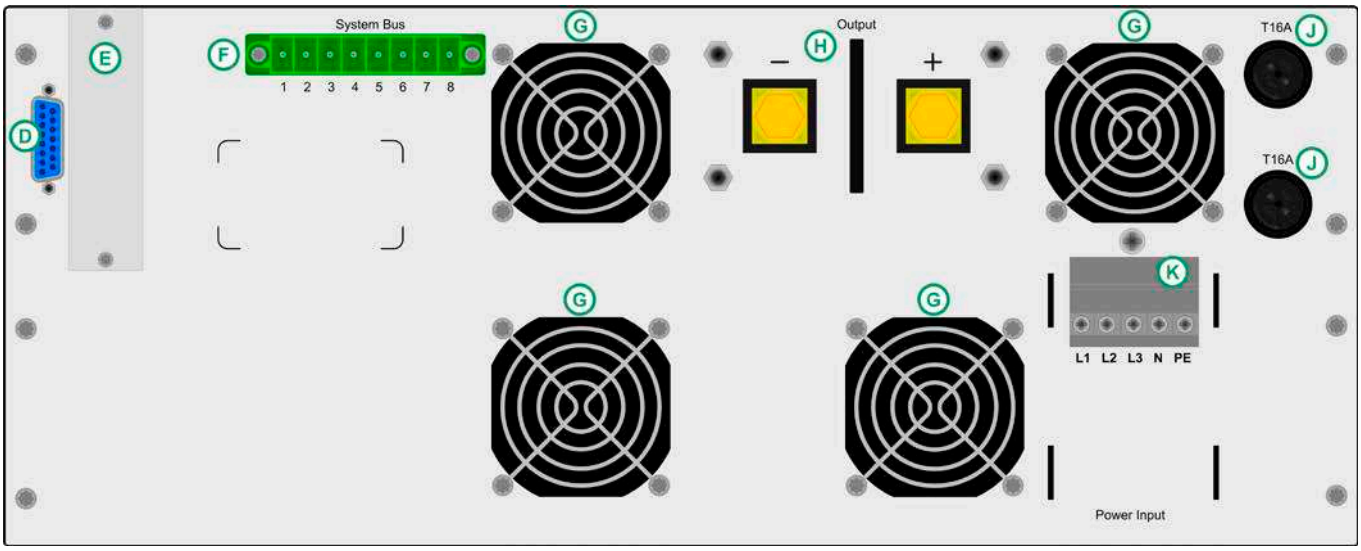


Figure 4. Rear view 4U version

Explanations:

A - Power button

B - Air Intake Slots

C - control panel

D - Analog interface, 15-pin, female E - Slot for digital expansion cards

F - system bus

G - fan

H - power output, M8 screws

J - Mains fuses (value see "2. Technical data") K - Mains connection (see section 5.3)

L - Control panel ZH option

Pinout System Bus (See section 11.1 for details): 1 - Remote sense positive (Sense +)

2 - Remote sense negative (Sense -)

3 - Master output current

4 - Master output voltage 5 - Slave input current

6 - Slave Input Voltage 7 - Share Bus

8 - mass

3.2 Scope of Delivery

1 x power supply

1 x Printed Instruction Manual(s)

1 x mains cable (only for 2U devices) 1 x connector for system bus (plugged in)

4. General information about the device

4.1 Foreword / Warning

These operating instructions and the associated device are intended for users who are familiar with the function of a power supply unit and its application. The operation of the device should not be left to persons who are unfamiliar with the basic terms of electrical engineering, as they are not explained in these instructions. Improper operation and non-compliance with the safety regulations can lead to damage to the device, the operator and loss of warranty!

4.2 Cooling

The air inlets in the front and the air outlets in the back must always be kept free and clean, and a minimum distance of 20 cm behind the rear wall must be kept free to ensure sufficient air supply.

4.3 Maintenance / Repair

The device must not be opened by the user. Parts in the device that carry dangerous voltage can be touched. Work on the opened device may only be carried out by a qualified electrician who is informed about the associated dangers.

5.Installation

5.1 Visual Inspection

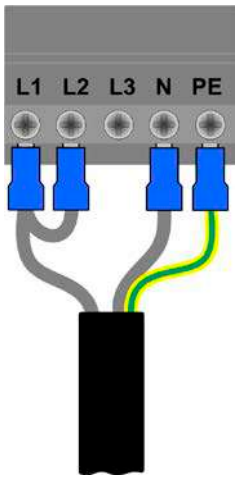
The device must be checked for damage after delivery. If damage or technical errors are evident, the device must not be connected. In addition, the dealer who supplied the device should be notified immediately.

5.2 Mains connection 2U versions

The device is grounded via the enclosed mains connection cable. For this reason, the device may only be operated on a protective contact socket. This measure must not be rendered ineffective by using a connecting cable without a protective conductor. The device is protected by a 5 x 20mm fuse, which is located in the fuse holder on the back.

5.3 Mains connection 4U versions

Although the device has a connection block for a three-phase connection, it is operated with a normal 230V supply (L + N + PE). Three-phase connection is not permitted for safety reasons. The input must be connected like this:



5.4 DC output connection

The load output is on the back of the device.

The exit is**not**protected by a fuse. In order to avoid damage to the consumer, the nominal values permissible for the consumer must always be observed.

The cross-section of the output lines depends, among other things, on the power consumption, the line length and the ambient temperature.

For load leads up to 1.5m we recommend: up

to**10A**:	0.75mm²	until**15A**:	1.5mm²
until**30A**:	4mm²	until**40A**:	6mm²
until**60A**:	16mm²	until**120A**:	35mm²

per connection line(stranded wire, freely laid) to be used at least.

The "+" and "-" outputs are floating so that one of the two can be grounded if required.

Danger!

When grounding one of the output poles, it must be noted whether an input pole is also grounded at the consumer (e.g. electronic load). This can lead to a short circuit!

Danger!

When several power supplies are connected in series, the potential shift of the output poles must be taken into account! Grounding is then only recommended at the output with the lowest potential.

5.5 Terminal for remote sensing

If the voltage drop on the supply lines (max. 1V per line) from the power supply unit to the consumer is to be compensated for, the power supply unit can measure the voltage at the consumer and then correct it.

The connections for the remote sensing are located at the terminal "**system bus**' on the back, pins 1 and 2. See also section '3.1 Views'.

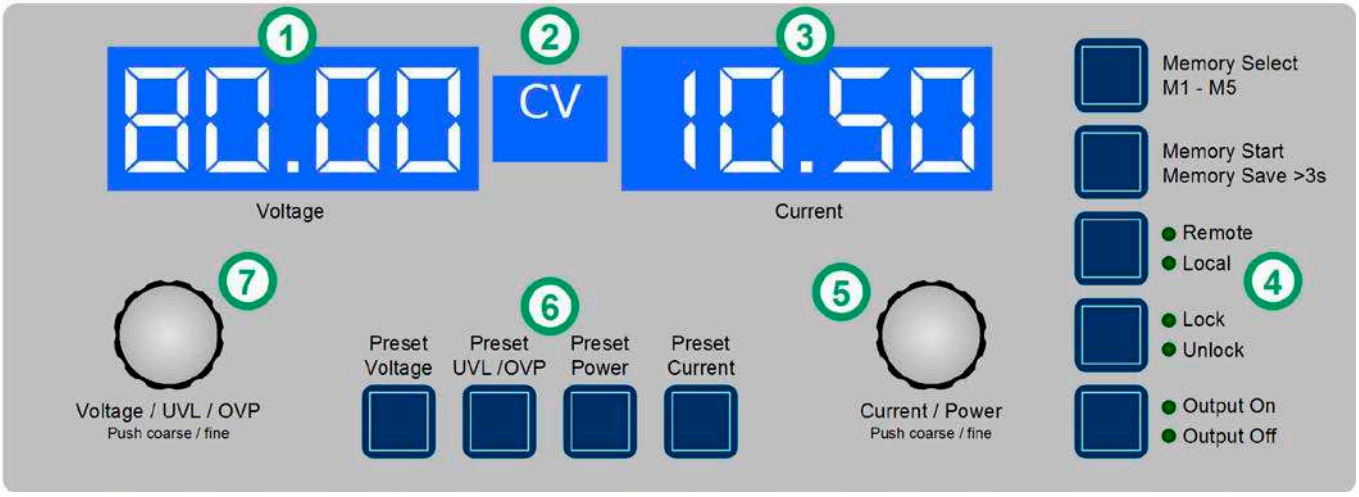
Danger!

(+) Sense may only be connected to the (+) of the consumer and (–) Sense only to the (–) of the consumer. Otherwise both systems can be damaged.

See Section “7.7 Remote Sensing Operation” for more information on remote sensing operation.

5.6 slot for expansion card

The device can optionally be equipped with a plug-in card. The connection for this is on the back of the device. Further information about the expansion cards, also called interface cards here, can be found in section “9. Digital interface cards”.



picture 5

6. Service

6.1 The display and control unit

Legend:

(1) - Display on the left: Actual voltage value or setpoint value U, UVL, OVP

(2) - Status Field: Status indicators such as CC, CV, etc.

(3) - Display on the right: Actual current value or setpoint value I, P

(4) - Control buttons: Operation of the device status, etc

(5) - Rotary knob on the right: Setpoint adjustment I, P, as well as setting values in the setup

(6) - Preset buttons: Switch to setpoint display

(7) - Left-hand rotary knob: Set value setting U, UVL, OVP, as well as select parameters in the setup

Figure 5 shows an overview of the dot matrix display and control panel. In normal operation, the displays show the actual values for voltage (left) and current (right). In preset mode, the desired values for voltage (Preset Voltage), overvoltage threshold (Preset OVP) and undervoltage limit (Preset UVL) are displayed on the left side and on the right-hand side optionally the target values for current (Preset Current) or power (Preset Power, only devices from 1kW). In the device setup, the display is used to show adjustable parameters.

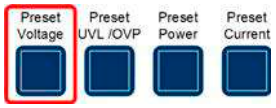
The status field is in the middle of the display. This can show the following:

CV-Voltage control active (only with output "on") **OT**-over temperature error **original packaging**-overvoltage error

CC-Current control active (only with output "on") **CP**-Power control active (only with output "on") **Fine**-Fine adjustment mode active for both knobs **PF**-Power fail (mains undervoltage error, from firmware 6)

6.2 Keys on the control panel

6.2.1 Preset Voltage button



The button is used to switch the actual voltage value display to the voltage set value (preset mode). When pressed, the display on the left changes to:

With the left knob**Voltage / UVL / OVP**can the setpoint U_{Should}, as in normal operation, can be set in the range from 0...100%. The set value is accepted immediately.

Notice

The voltage setpoint setting can be limited downwards by the undervoltage limit UVL. See also 6.2.2.

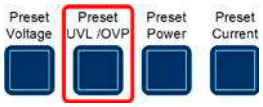
Pressing the button again ends the preset mode for voltage immediately or it is ended automatically if no other preset button is pressed for 5s or a setpoint is changed.

In remote control mode via analog or digital interface, the setpoint specified via the currently used interface can be checked here.

The button can by state**LOCK**be blocked. See 6.2.8.

In the setpoint set selection (memory select), the button is also used to switch to the voltage setpoint associated with the setpoint set, a©b2e0r0d6e, rEhleie nugteosmta wiCdo,**nKi.eGhey** taken over immediately. Dt Aerui

6.2.2 Preset UVL / OVP button



The button is used to switch the actual voltage display to the setpoint for the undervoltage limit (press once) or to the setpoint for the overvoltage threshold (press twice).

The display on the left changes to:

or.

.

The undervoltage limit (UVL) is only a setting limit for the voltage setpoint. This means that the voltage cannot be set lower than the UVL if the UVL is not equal to 0. Likewise, the UVL cannot be set higher than the voltage setpoint.

With the left knob**Voltage / UVL / OVP**the value can be set in the range of 0...voltage setpoint.

A second press of the button changes to the setting of the overvoltage threshold. This value can be in the range of 0...110% $U_{nominal}$to be set.

A third press of the button ends the preset mode for links immediately or it is ended automatically if no other preset button is pressed for 5s or a setpoint is changed.

In remote control mode (digital interface), the OVP or UVL target value specified via a command can be checked here.

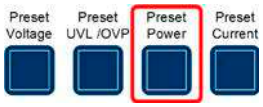
The button can by state**LOCK**be blocked. See 6.2.8.

In the setpoint set selection (memory select), the button is also used to switch to the undervoltage or overvoltage threshold associated with the setpoint set, but the values set here are not accepted immediately. The display then looks like this:

or.

.

6.2.3 Preset Power button



In normal operation, the button is used to switch the actual current value display to the power setpoint (preset mode). Since devices with an output power below 1000W do not have a power control, the setpoint cannot be set for these and a corresponding information text is displayed instead.

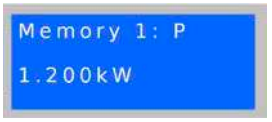
For devices**from 1000W**the display on the right changes to:

With the knob on the right (**Current / Power**) can the setpoint from 0...100% $P_{nominal}$to be set. The set value is accepted immediately.

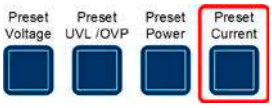
Another press of the button exits preset mode immediately or it is ended automatically if no other preset button is pressed for 5s or a setpoint is changed. The button can by state**LOCK**be blocked. See 6.2.8.

In remote control mode (analogue or digital interface), the power setpoint specified via the currently used interface can be checked here.

In the setpoint set selection (memory select), the button is also used to switch to the power setpoint associated with the setpoint set, but the value set here is not accepted immediately. The display then looks like this:



6.2.4 Preset Current button



In normal operation, the button is used to switch the current actual value display to the current setpoint (preset mode).

The display changes to the right:

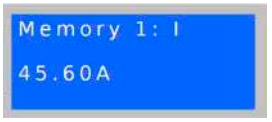
With the knob on the right (**Current / Power**) the setpoint I_{Should}can be set from 0...100%. The set value is accepted immediately.

Pressing the button again ends the preset mode for right immediately or it is ended automatically if no other preset button is pressed for 5s or a setpoint is changed.

In remote control mode (analogue or digital interface), the current setpoint specified via the currently used interface can be checked here.

The button can by state**LOCK**be blocked. See 6.2.8.

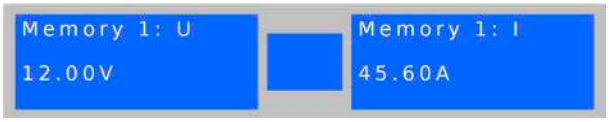
In the setpoint set selection (memory select), the button is also used to switch to the current setpoint associated with the setpoint set, but the value set here is not accepted immediately. The display then looks like this:



6.2.5 Memory Select button M1-M5

Memory Select
M1 - M5

This button selects one of 5 sets of setpoints, each with U, I and P setpoints, as well as UVL and OVP values to accept or change. The button works only when the output***switched off*** is. The memory mode and the currently selected setpoint set are then displayed as follows:



The following operating options:

a) Selecting and changing

Output off, button pressed briefly once, the display changes to the first setpoint set M1, as shown above.

The setpoints for U (left) and for I (right) of the selected setpoint set can be changed here. Switching to the setting values for OVP, UVL or P is done with the preset buttons.

If you press the button again**M1-M5**is switched through to the 5th setpoint set and the memory mode is then ended.

The set values remain, but are not applied to the output setpoints**and are not saved yet! For saving see 6.2.6.**

The button can by state**LOCK**be blocked. See 6.2.8.

6.2.6 Memory Start / Memory Save button >3s

Memory Start
Memory Save >3s

This button is used to accept the with button**Memory Select M1-M5**selected setpoint set or to save all setpoint sets. The button works only when the output ***switched off***s.

The following operating options:

b) Take over only

Output off, setpoint set selected (1-5), button**short**actuate - - > the setpoints of the selected set of setpoints are accepted as the initial setpoints and the memory mode is ended. In order to use the adopted values, the output is set as usual with the key**Output On**or remote control switched on.

Notice

The setpoint sets are not saved here!

c) Save only

Output off, select one or more setpoint sets, set setpoints, then press the button**>3s**-->all setpoint sets are saved, but none are accepted. The output remains off, after saving, the memory mode is terminated.

The setpoint sets can also be specified via the digital interface using appropriate commands and are saved in the process.

The button can by state**LOCK**be blocked. Please refer 6.2.8.

6.2.7 Local button

Remote
Local

This button enables or disables LOCAL mode. LOCAL mode locks the device against remote control as long as it is activated. The activated mode is indicated by the lighting of the "Local" LED.

The button can by state**LOCK**be blocked. See 6.2.8.

Notice

Activating the LOCAL mode results in the immediate termination of external control (remote) and locks the device against renewed remote control. Only after release, i.e. deactivation of LOCAL, is remote control possible again.

Notice

The LOCAL state is temporary and is not saved when the device is switched off.

6.2.8 Lock / Unlock button

Lock
Unlock

This button enables or disables LOCK mode. LOCK mode locks all buttons except the lock button itself and the knobs against unintentional use. The status of the lock is indicated by the "Lock" and "Unlock" LEDs. "Lock" means that the lock is active.

Notice

Activating LOCK mode exits preset or memory mode if currently active. The display then returns to the actual value display.

Notice

The LOCK state is saved from firmware 6.02 and restored after switching on the device.

6.2.9 Output On/Off button

Output On
Output Off

This button is used to manually switch the power output on or off if the device is not in remote control mode. However, the status of the output is always displayed with the "Output On" and "Output Off" LEDs. Only when switched on

CV or CP (nuIrrrtber ätA ally atkiktuGI R& umieGuenrd emutnLgeeinstvuonro al) displayed in the status box in the center of the display.

The button can by state**LOCK**be blocked. See 6.2.8.

Switching on the output can be blocked by pin 13 (REM-SB) of the analogue interface! See section “10. The analog interface".

The button also acknowledges errors. See sections 7.4 and 7.5 for details.

6.3 Other controls

6.3.1 Knobs

The two rotary knobs have an additional button function. Pressing one or both rotary knob buttons can trigger:

a) Fine adjustment mode (Fine)

In manual mode, a short press on one of the two buttons activates or deactivates the "Fine" adjustment mode. When "Fine" mode is activated, all setpoints can be set with the smallest possible increment, regardless of whether the device is in preset, memory or actual value mode. The fine adjustment mode is indicated by the text "Fine" in the status field (middle). See also section “6.4 Setting setpoints” below.

b) Device Setup

Simultaneous pressing**in the**keys for >3s**switched off**Exit changes to the device setup. The setup is finished in the same way.

6.4 Set target values

1. In manual mode

In manual operation and actual value display, as well as with Preset Voltage or Preset Current, the two rotary knobs can be used to continuously set the setpoints for voltage and current from 0% to 100% nominal value in the specified increments (see table below). To set the OVP and UVL values, the button must be pressed**Preset UVL/OVP** be pressed once or twice. To set the power setpoint (only devices from 1kW), the button must be pressed**preset power**be actuated.

Notice

The OVP setpoint can also be smaller than the voltage setpoint and in such a case trigger an OVP error when the output is switched on!

Manual set point adjustment can be coarse or fine, coarse being the default setting type and fine having to be activated using one of the rotary knob buttons. At**fine**an increment of 1 always applies, this corresponds to the last (right) digit of the displayed setpoint.

At**rough**the following constant increments apply depending on the nominal value (see device data):

Voltage / OVP / UVL			Electricity		
face value	Rough	Fine	face value	Rough	Fine
32V	0.2V	0.01V	4A	0.05A	0.001A
40V	0.25V	0.01V	10A	0.1A	0.01A
65V	0.5V	0.01V	15A	0.1A	0.01A
80V	0.5V	0.01V	20A	0.2A	0.01A
160V	1V	0.1V	30A	0.2A	0.01A
360V	2V	0.1V	40A	0.5A	0.01A
720V	5V	0.1V	60A	0.5A	0.01A
			120A	1A	0.1A

Performance		
face value	Rough	Fine
1000W	0.01kW	0.001kW
1500W	0.01kW	0.001kW
3000W	0.02kW	0.001kW

Notice

With some models, the adjustable increment of a setpoint is smaller than what is actually feasible at the output. It can therefore happen that a reaction at the output only takes place every 2-3 steps when setpoint values are set.

2. In remote control mode via analogue interface

See section “10. The analog interface".

3. In remote control mode via digital interface See section “9. Digital Interface Cards”.

7. Behavior of the device

7.1 Switching on with the mains switch

The power switch is on the front panel. After switching on, the device shows the manufacturer's name and logo, as well as the address, device type and firmware version in the display for about two seconds and is then ready for operation. In the setup (see section "8. Device setup") there is an option that determines the status of the device after it is switched on. This is activated at the factory (=on). This means that the setpoints (U, I, P) and the state of the output (on or off) are restored as they were when the power was last switched off. If the option is not activated (=off), the setpoints for U, UVL and I are set to 0 after switching on, OVP to max. and the setpoint P to 100% and the output is switched on.

7.2 Switching off with the mains switch

When switching off with the mains switch, the device saves the state of the output and the last setpoints set. After a short time, the power output and fan are switched off, and the device is then completely off after a few more seconds.

7.3 Switching to remote control (remote)

a)*Analog interface* : Pin "Remote" switches to analog remote control, provided this is not prevented by the LOCAL status or an existing digital remote control. The setpoint pins VSEL, CSEL and PSEL (only necessary for devices from 1kW), as well as REM-SB now determine the output values. The status of the DC output and the setpoints specified via the pins are set immediately. After returning from remote control to manual control, the output is automatically switched off.

b)*digital interface* : Switching to digital remote control mode by means of a corresponding command, unless prevented by the LOCAL status or existing analog remote control, accepts the setpoints last set and the status of the output. After returning from remote control to manual control, the output is automatically switched off.

7.4 Over Voltage Alarm

An overvoltage (OV) alarm can occur due to an internal error (output voltage ramping up) or external overvoltage. In both cases, the overvoltage protection will switch off the power unit and thus the output voltage and the device will display the alarm with the status text "OV" or report it via the pin "OVP" at the analog interface.

If there is no longer any overvoltage and the output is to be switched on again, the alarm must first be acknowledged. In manual mode, this is done with the button**Output On/Off**, with analog remote control with the pin "Rem-SB" and with digital remote control with the corresponding command. The "OV" display and the signal at the "OVP" pin then go out. If the alarm persists, the output cannot be turned on.

OV alarms are entered in the internal alarm buffer, which can be read out via a digital interface (except those using SCPI language).

Notice

The OVP alarm takes precedence over an OT alarm and if the display writes "OT", both alarms should occur at the same time.

7.5 Over temperature alarm

As soon as an overtemperature alarm (OT) occurs due to internal overheating, the output is switched off and the status "OT" is shown on the display. At the same time, the "Output On" LED flashes to indicate that the output is automatically switched on again after it has cooled down. If this is not to happen, the output can be switched off manually with the button during the overtemperature phase**Output On/Off**be switched off. The "Output On" LED then stops flashing and the output does not switch on automatically after it has cooled down. If the output is off after the device has cooled down, normal switching on with a button, pin or command is sufficient. If the output is on, the button**Output On/Off**, the "REM-SB" pin or a command is first acknowledged and switched off the second time.

OT alarms are entered in the internal alarm buffer, which can be read out via a digital interface (except those using SCPI language).

Notice

An OT alarm has lower priority than an OV alarm. If an OV alarm also occurs during an OT alarm, the status display "OT" is overwritten with "OV".

7.6 Voltage, current and power control

The voltage set at the output and the resistance of the consumer determine the output current. If this is lower than the current limit set on the device, the device works in voltage control mode (CV) and keeps the output voltage constant. The operating mode is indicated by the status text "CV".

If the output current is limited by the current setpoint or the rated current of the device, the device switches to current control mode (CC), which keeps the output current constant. This operating mode is indicated by the status text "CC".

For devices with an output power of 1000W or more, there is also an adjustable power limit of 0...$P_{nominal}$. This superimposes voltage and current control operation. That is, if an additional power setpoint is less than 100% $P_{nominal}$is set, the desired output voltage and/or current may not be achieved. The power limitation primarily affects the output voltage. The current resulting from the load resistance, together with the output voltage, results in the desired output power. Since current, voltage and power control influence each other, e.g. B. the following behaviors:

Example 1: Device is in voltage control mode, then the power is limited. As a result, the output voltage decreases and as a result, the output current decreases. Now, if the load's resistance were reduced, the current would increase and the voltage would decrease.

Example 2: Device is in current limitation, the output voltage is determined by the resistance of the consumer. The power is now limited, i.e. power control mode.

This reduces A getegn on the values resulting from the formula P = U * I. If the current setpoint were now further reduced, the output current would continue to fall and so would the voltage. The product of both would thus be below the setpoint of the power limitation and the device switches from power control mode (CP) to current control mode (CC).

7.7 Remote Sensing Operation

Remote sense operation is intended to compensate as far as possible for voltage dropping across the load lines to the consumer. This is not always fully possible. For this reason, the line cross-section of the load lines must always be adapted to the current to be drawn in order to keep the voltage drop as low as possible.

On the back, on the clamp**system bus**, there is a remote sensing input that is connected to the consumer with the correct polarity. The device recognizes this automatically and regulates the voltage at the consumer instead of at the output as before. As a result, the voltage at the output increases by the amount of the voltage drop between the device and consumer, but no more than the value specified in the technical data for the respective device. See also picture 6 below.

7.8 Grid Over/Under Voltage

The devices have a wide-range input. This means they can be operated with mains voltages of around 90V to 264V AC. Input voltages outside of this range are treated as if the device were switched off and result in the last setpoint values being saved and the output being switched off.

Danger!

Constant mains undervoltage or overvoltage must be avoided at all costs!

Notice

For devices with a nominal power of 1500W, the power is reduced (derating) to 1000W under an input voltage of 150V.

7.9 Connection of different load types

Ohmic loads (incandescent lamp, resistor), electronic loads or inductive loads (motor) behave differently and can affect the power supply unit. For example, motors can generate a reverse voltage when starting, which can trigger an overvoltage fault in the power supply. Electronic loads also work with control circuits for current, voltage and power and these control circuits can counteract those of the power supply unit and possibly cause increased output residual ripple or other undesirable effects. Ohmic loads, on the other hand, behave almost neutrally. The behavior of the loads must therefore always be taken into account in the operating concept of the application.

8. Device Setup

The device setup is used to configure some operating parameters. It can only be reached when the output is "off" by simultaneously pressing both rotary knobs (see also section 6.3) for longer than 2 seconds. Leaving and saving the settings is done in the same way. Three basic parameters are always available, see below. Other parameters are only displayed if there is an interface card in the slot. The interface-specific parameters, such as e.g. B. baud rate, are retained when changing the interface card.

basic parameters:

parameter:AutoPwrOn	Default value:on
Value range:on, off	

Meaning: "on" --> Restoration of the status of the DC output and the setpoints to the status at the time of the last switch-off or power failure. This means that the device can continue to work automatically with the previous setpoints after a power failure.
"off" --> Output is switched on after mains recovery and the setpoints of U, UVL and I are at 0%, P at 100% and OVP at 110%.

parameter:Al range	Default value:0-10
Value range:0-5, 0-10	

Meaning: Selects the voltage range of the command value inputs for remote control operation via analog interface. See Section 10 for more.

parameter:contrast	Default value:70
Value range:50...100	

Meaning: Sets the contrast of the LCD display.

For**all** Interface cards with the following parameters:

parameter:Device node	Default value:1
Value range:1...30	

Meaning: Selects the device address (device node, taken from CAN terminology) for the device. When using several devices on a bus (CAN or GPIB), each address may only be assigned once.

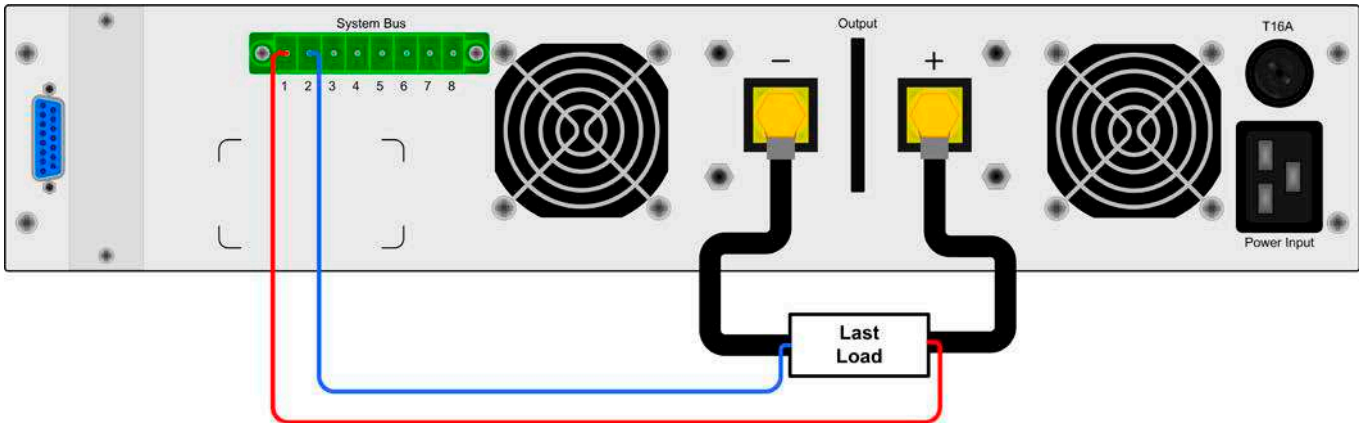


Figure 6. Remote sensing (Sense) wiring

The following parameters only for**CAN interface IF-C1:**

parameter:baud	Default value:100k
Value range:10k,25k,50k,100k,125k,250k,500k,1M	

Meaning: Transmission speed setting in kilobaud (k) or megabaud (M).

parameter:BaseID	Default value:0x000
Value range:0x000...0x7FC (0...2044)	

Meaning: Setting of the base ID for the CAN ID system with three IDs (Vector compatible, dbc files). Based on the basic ID, three CAN IDs are reserved per device, so this value can only be set in increments of four. If the parameter is selected, the display can be switched between decimal and hexadecimal by pressing one of the rotary knobs.

Only available ifID Sys=Vectorwas chosen. See parameters belowID Sys.

parameter:BroadID	Default value:0x7FF
Value range:0x000...0x7FF (0...2047)	

Meaning: Broadcast ID setting for the CAN ID system with three IDs (Vector compatible, dbc files). This additional CAN ID represents a fourth ID of the device to which only setting values can be sent. The purpose of this ID is to set it at the same time as other devices on the bus and to send them the same setpoint or status at the same time via a broadcast message. This enables synchronous control of several devices.

If the parameter is selected, the display can be switched between decimal and hexadecimal by pressing one of the rotary knobs.

Only available ifID Sys=Vectorwas chosen. See parameters belowID Sys.

parameter:RID	Default value:0
Value range:0...31	

Meaning: Setting of the relocatable address segment (RID). See CAN terminology or the IF-C1 CAN interface card manual for more information.

parameter:Bus term	Default value:yes
Value range:yes, no	

Meaning: Activation/deactivation of the bus termination resistor (bus termination) of the CAN card. Termination is required when the device is at the end of the bus.

parameter:ID Sys	Default value:Vector
Value range:vector, normal	

Meaning: Selection of the CAN ID system (ID Sys). With " Normal" the previous CAN ID system with two CAN IDs per device is used, which consists of "Device node' (see above) and 'RID“ (see above). See also the manual for the interface card regarding the calculation of the CAN IDs.

The other system is compatible with three CAN IDs, e.g. B. software from Vector Informatik and enables the use of so-called dbc files that integrate the power supply into the software. If you select "VectorThis system is activated and the user only sets a basic ID on the device, from which the three CAN IDs result. See parameters above.

The following parameter for**RS232 interface IF-R1**:

parameter:baud	Default value:57600
Value range:9600, 19200, 38400, 57600	

Meaning: Transmission speed setting. Other parameters for the serial interface cannot be set, but are defined as follows:

Parity = odd
stop bits = 1
data bits = 8

All parameters must be specified on the PC side for the respective port in exactly the same way.

The following parameter for the**Profibus interface IF-PB1**:

parameter:Profibus	Default value:1
Value range:1...125	

Meaning: Specifies the Profibus address for the device. Independent of the device address, this address isDevice node', used by the device to register and integrate with a fieldbus system.

9. Digital Interface Cards

The device supports the following interface cards:

IF-U1 (USB)

IF-R1 (RS232)

IF-C1 (CAN)

IF-G1 (GPIB/IEEE)

IF-E1 / IF-E1B (Ethernet/LAN + USB)

IF-PB1 (Profibus + USB)

The interface cards require little or no setup to operate. The card-specific settings are saved permanently and do not have to be reconfigured when used again after changing the card. Details about the technical conditions and handling of the interface cards, as well as instructions for integration into your own applications (including LabView) can be found in the interface card manual.

Danger!

Only insert or remove the interface card when it is switched off (mains switch)!

For the configuration of the interface and its transmission parameters see section “8. Device Setup”.

Current, voltage and power setpoints, as well as UVL and OVP can be set via the digital interfaces. When changing to remote control, the values last set on the device are retained until they are changed. This would be pure voltage control by specifying a voltage setpoint©

whoa im gim Hs&re nKSetpoints
we2r0t0e6n, Emleökgtrloic-X Prantntnik unbaHn&re G
unchanged blIerrbtüem n.er and subject to change

Target values that are specified via the digital interfaces (except GPIB) are always percentage values and correspond to the nominal values of the device at 100% (hex: 0x6400) or at 110% (hex: 0x6E00) for the OVP value. With GPIB, setpoints are always specified as real values.

Many other functions of the device can be controlled and values can be set or queried via the digital interface become. More information can be found in the manual for the interface cards.

10. The analog interface

10.1 General

The built-in, non-galvanically isolated, 15-pin analogue interface (AS) is located on the rear of the device and offers the following options, among others:

- Remote control of current and voltage
- Remote control of power (for devices from 1kW)
- Remote status monitoring (OT, OVP, CC, CV)
- Remote monitoring of the actual values
- Remote on/off of the output

Current, voltage and power can be set via the analogue interface. This always happens at the same time. This means that you cannot specify voltage via the AS and set current and power on the device using a rotary knob or vice versa. Devices with an output power below 1kW do not have an adjustable power and therefore the setpoint input PSEL is not effective and does not have to be specified.

The OVP target value cannot be set via analogue and must therefore be set on the device. Switching to the preset display shows the analog setpoints on the displays. The analog setpoints can be fed in by an external voltage or generated by the reference voltage output at pin 3.

The AS can be operated with the common voltage ranges 0...5V or 0...10V for 0...100% nominal value. The voltage range is selected in the device setup, see section “8. Device Setup”. The reference voltage output at pin 3 is adjusted and is then, depending on the choice, 5V or 10V.

The following then applies:

0-5V: Reference voltage = 5V, 0...5V setpoint corresponds to 0...100% nominal value, 0...100% actual value corresponds to 0...5V at the actual value outputs (CMON, VMON).

0-10V: Reference voltage = 10V, 0...10V setpoint corresponds to 0...100% nominal value, 0...100% actual value corresponds to 0...10V at the actual value outputs (CMON, VMON).

Specification of setpoints that are too high (e.g. >5V in the selected 5V range) is intercepted by keeping the respective setpoint at 100%.

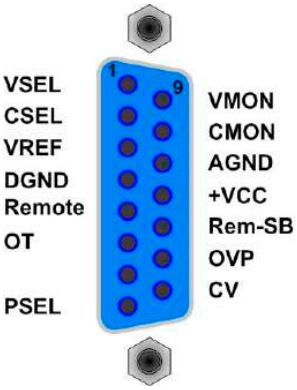
Notes on use:

- Controlling the device with external setpoints requires switching to remote control mode with pin "REMOTE" (5).
- Before the hardware that is to operate the analog interface is connected, all the necessary lines must be laid and the hardware checked to ensure that it cannot generate voltages >12V.
- The Rem-SB (Remote Standby, pin 13) input overrides the button**Output On**. That is, the device cannot be switched on with the button when the pin specifies the signal "off" unless LOCAL mode is active. This blocks all interfaces from accessing the device. See also "6.2.7 Local button".

- **The masses of the AS are related to the minus output**.

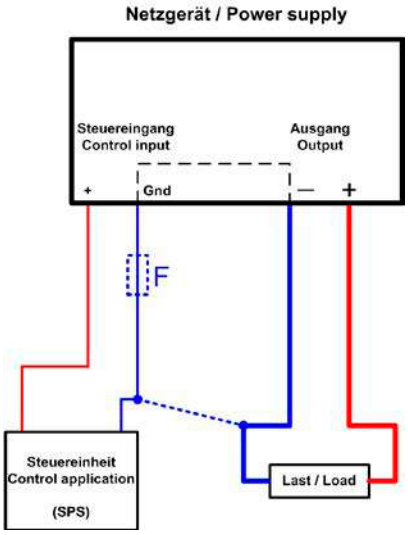
10.2 Application examples

Overview of the connections

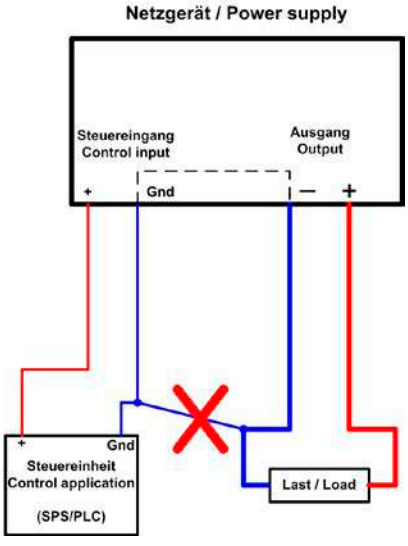


Danger!

Never connect the grounds DGND or AGND of the analogue interface to the minus output of an external control unit if this is already connected to the minus output of the device! A ground loop is created and load current can flow via the control lines, damaging the device and the control unit! To avoid this, a fuse can be integrated into the "weak" ground line.



picture 7



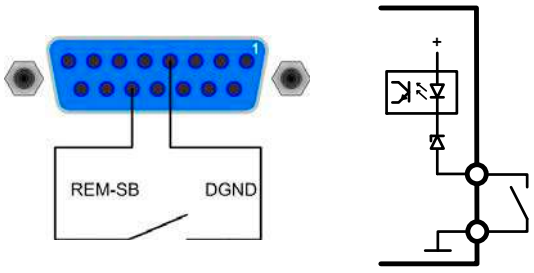
picture 8

exit off

The "REM-SB" pin is an exception and, as a controlling input, does not depend on the "Remote control active" state and can therefore be used to switch off the output without further measures, except when the LOCAL state is activated, which only allows manual operation. It is recommended to use a low resistance contact such as a switch, relay or transistor to switch the pin to ground (DGND).

Notice

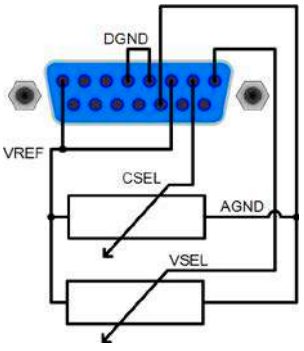
A digital output, e.g. B. from a PLC, may not be able to drive this input cleanly, as it is not low-impedance enough. Check the specification of the respective controlling application.



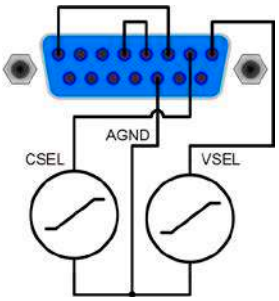
Remote control of current and voltage

The setpoint values VSEL and CSEL are generated from the reference voltage VREF via a potentiometer each. The power supply unit can thus work either with current limitation or voltage limitation. According to the specification of max. 3mA for the VREF output, potentiometers of at least 10kOhm must be used here.

For devices with power setting, the power setpoint is fixed at VREF and is therefore set at 100%.

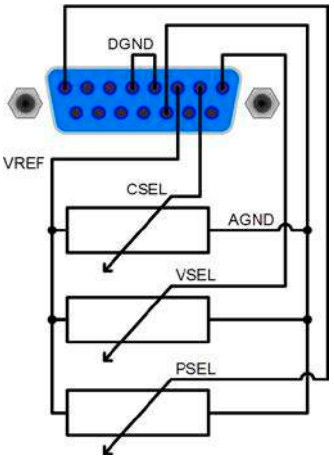


or



Remote control with power

As with the remote control of current and voltage, together with adjustable power (only applicable to models with power adjustment).



10.3 Specification of Connections

Pin code	Surname	Type(1	Designation	level	Electrical Properties
1	VSEL	AI	setpoint voltage	0...10V or 0...5 V correspond to 0..100% of $U_{nominal}$	Accuracy < 0.2% Input impedance R_i>100k
2	CSEL	AI	setpoint current	0...10V or 0...5 V correspond to 0..100% of $I_{nominal}$	
3	VREF	oh	reference voltage	10V or 5V	Accuracy < 0.2% at I_{Max}= +5mA short-circuit proof against AGND
4	DGND	POT	Reference potential for digital control signals		For +Vcc, control and status signals
5	REMOTE	TUE	switching internal / External control	External = LOW, U_{Low}<1V internal = HIGH, U_{High}>4V Internal = Open	Voltage range = 0...30V I_{Max}= +1.5mA at 0V Recommended transmitter: open collector against DGND
6	OT/PF	DO	over temperature error / Power fail(4	Error = HIGH, U_{High}> 4V no error = LOW, U_{Low}<1V	Quasi-open collector with pull-up against Vcc(2 With 5V at the pin, a maximum of +1mA flow I $_{Max}$ = -10mA at U_{CE}= 0.3V = u_{Max} 0...30V Short-circuit proof to DGND
7	NC				Not connected
8th	PSEL(3	AI	setpoint performance	0...10V or 0...5 V correspond to 0..100% of $P_{nominal}$	Accuracy < 0.5% Input impedance R_i>100k
9	VMON	oh	Actual voltage	0...10V or 0...5 V correspond to 0..100% of $U_{nominal}$	Accuracy < 0.2% at I_{Max}= +2mA short-circuit proof against AGND
10	CMON	oh	Actual current	0...10V or 0...5 V correspond to 0..100% of $I_{nominal}$	
11	AGND	POT	Reference potential for analog signals		For -SEL, -MON, VREF signals
12	+ Vcc	oh	auxiliary voltage (Reference: DGND)	11...13V	I_{Max}= 20mA Short-circuit proof to DGND
13	REM SB	TUE	exit off	Off = LOW, U_{Low}<1V On = HIGH, U_{High}>4V On = Open	Voltage range = 0...30V I_{Max}= +1mA at 5V Recommended transmitter: open collector against DGND
14	original packaging	DO	overvoltage error	OVP = HIGH, U_{High}> 4V no OVP = LOW, U_{Low}<1V	Quasi-open collector with pull-up against Vcc(2 With 5V at the pin, a maximum of +1mA flow I_{Max}= -10mA at U_{CE}= 0.3V U $_{Max}$= 0...30V Short-circuit proof to DGND
15	CV	DO	Voltage re-successful active	CV = LOW, U_{Low}<1V CC = HIGH, U_{High}>4V	

(1AI = analog input, AO = analog output, DI = digital input, DO = digital output, POT = potential

(2Internal Vcc, approx. 14.3V

(3Only for models from 1kW nominal power

(4Failure of mains or PFC (is reported from firmware 6.01)

11. Other applications

11.1 Functions of the System Bus terminal

The 8-pin terminal located on the back**system bus**Used to connect remote sensing lines and to connect control lines between similar devices for series or parallel connection. pinout:

1 : Remote sense positive (Sense +) 2 :

Remote sense negative (Sense -) 3 :

Master output current

4 : Master output voltage 5 :

Slave input current

6 : Slave input voltage 7 :

Share bus

8 : mass

Notice

The functions of pins 3-8, described below, are only available on units from 1000W power, except for the 720V model where they are omitted for safety reasons.

11.1.1 Series connection as master-slave

Notice

Series connection is not available for 3000W.

Devices with different output voltages and, if possible, the same rated current can be connected in series.

In the case of devices with different rated currents, the device with the lowest rated current determines the max. current of the series connection. One device is always the master of the next device (slave) and so on.

If there are more than two devices, one should be the master and all be viewed as slaves by others. The master can specify current or voltage individually or both together. The separate signals on pins 3 and 4 of the terminal are for this **system bus** intended. An example wiring can be found in Figure 9. Here voltage and current are specified simultaneously by the master.

The voltage and current setpoints on the slaves should be set to 0 so that the slaves can follow the master in the full range between 0...100%.

If only one setpoint (U or I) is to be determined by the master, the other setpoint on the slaves should then be set to 100%. In order to remotely control the entire system, it is then sufficient to address the master via its analogue or digital interface. The actual current value then applies to all devices in the series connection, the actual voltage value becomesnot automatically totaled and must therefore be multiplied by the number of devices by the user.

Power control or limitation of the series connection on the master can also take place if this is a model with power control. The slaves are then also subsequently power-limited via the setpoint values that are set as a result. In this case, the current and voltage setpoint pins are interconnected at the terminal**system bus**absolutely necessary.

Danger!

The master must always be the device with the lowest potential!

Danger!

If one of the output poles is to be earthed, it is recommended for safety reasons to earth the pole with the lowest potential, in this case minus (-) from the master.

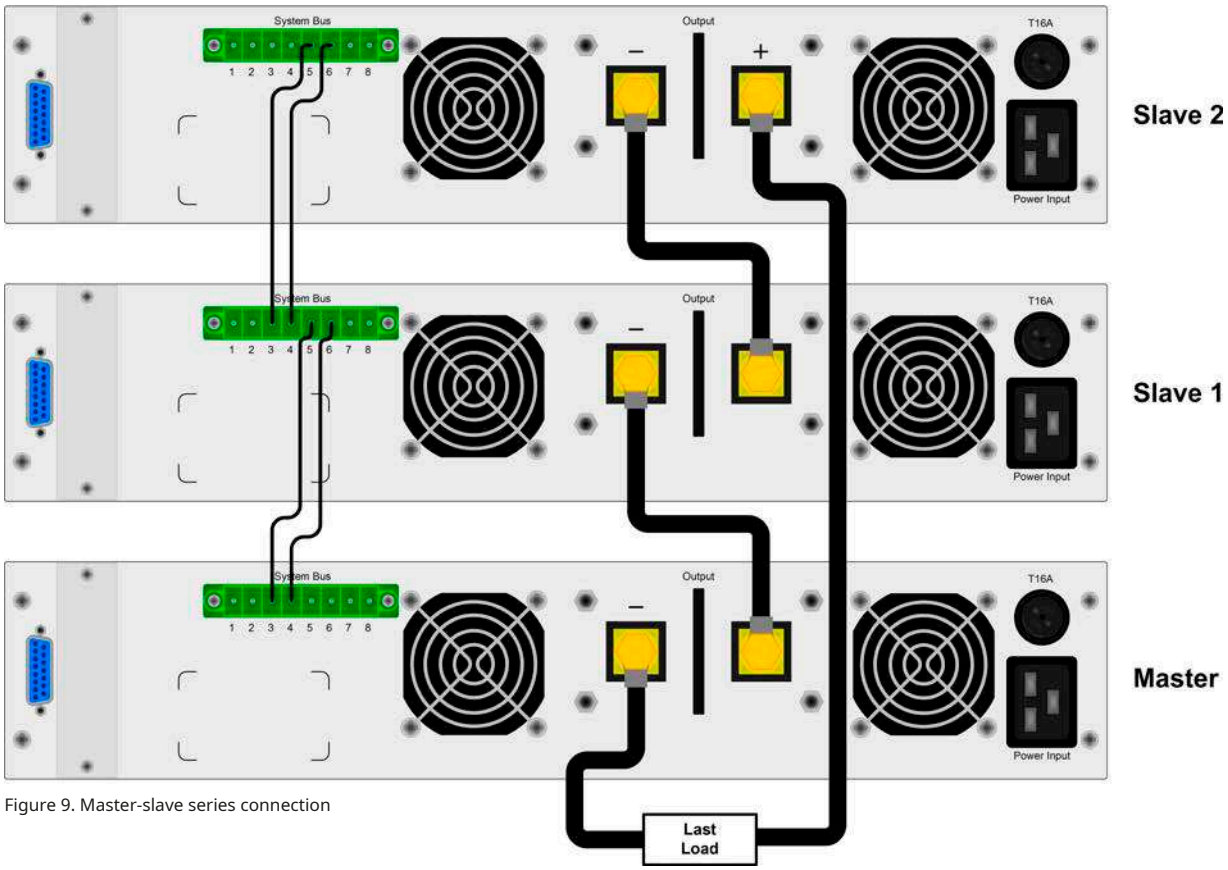
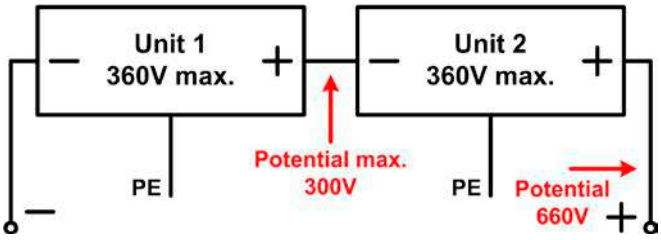


Figure 9. Master-slave series connection

For safety and isolation reasons, some things are closed observe:

- **No DC negative pole of a device in the series connection may be raised to a potential >300V compared to earth (PE)!**
- **The Sharebus must not be wired!**
- **The grounds (AGND, DGND) of the analog interfaces of the devices involved must not be connected to each other!**
- **Remote sensing must not be wired!**

Example: Two identical devices with 360V nominal voltage, e.g. B. PS 8360-15 2U can be connected in series. Arithmetically, the possible total voltage would be 720V. If you look at the potentials of the DC negative poles of the individual devices, then the second device would already be 360V higher than the first at full output voltage. This is not allowed! Therefore, the first device would have to be voltage-limited or permanently set to a maximum. The clarification would then result in a total voltage of up to 660V:



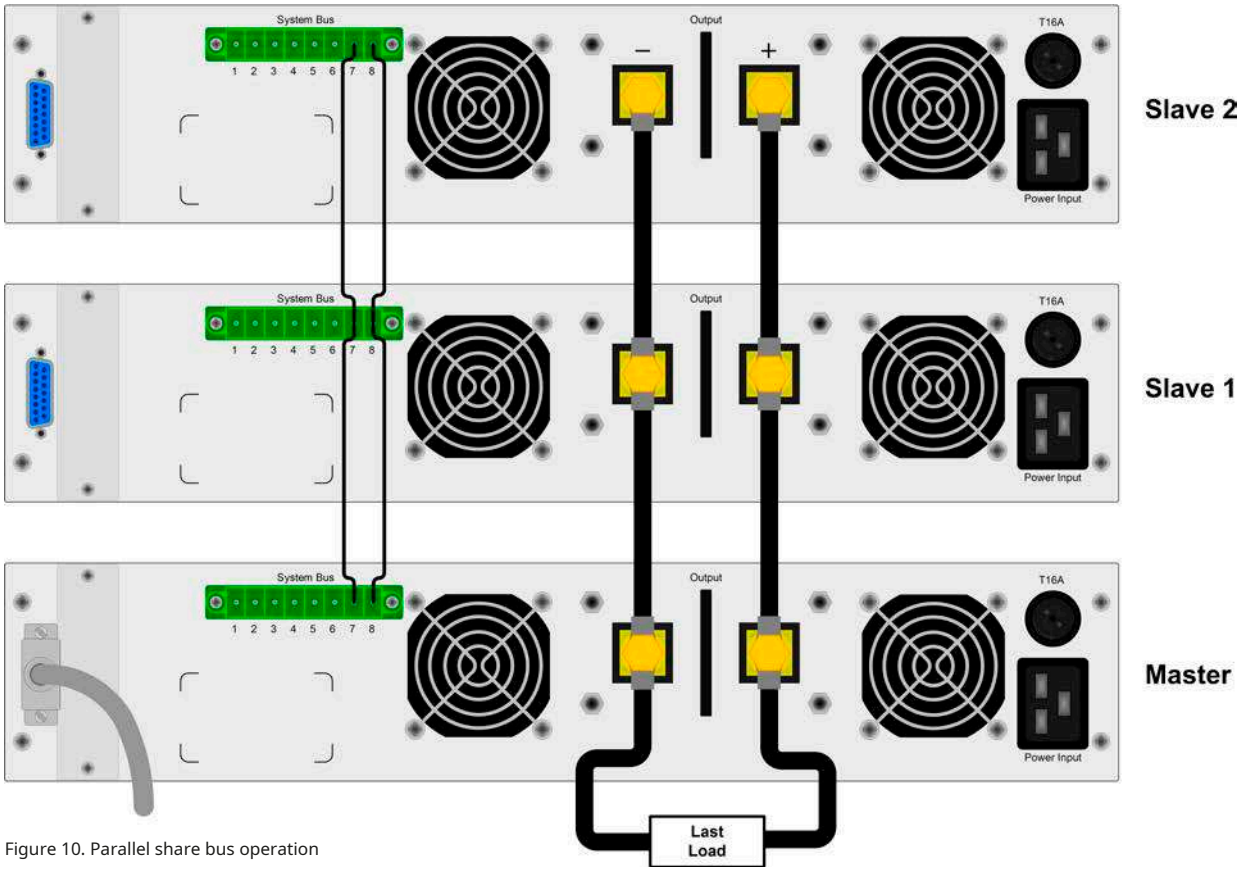


Figure 10. Parallel share bus operation

11.1.2 Parallel connection in share bus operation

Note: only available for devices from 1kW nominal power!

Danger!

Only devices of the same type may be connected together.

The Sharebus connection is used for symmetrical current distribution when several devices are connected in parallel.

The following connections must be made: All + DC outputs and all – DC outputs are connected to each other. Pin 7 (share bus) and pin 8 (ground) of the terminal **system bus**are connected in parallel to all devices. If remote sensing operation is desired at the load, all +Sense and all -Sense must be connected and connected to the load. See also the example in Figure 9.

Important: with this connection, the device determines with the ***lowest*** Output voltage the total output voltage of the parallel circuit. This means that each device, depending on the setting, could determine the output voltage. It is therefore recommended to select one device to be set and the others to set the setpoints of current, voltage and power to the desired maximum.

Notice

In the event that a device fails due to Over Temperature (OT) or Over Voltage (OVP) faults, the system will no longer output any output voltage.

In order to remotely control the entire system, it is sufficient to address the master via its analogue or digital interface. The actual voltage value then applies to all devices in the parallel connection. The actual current value isnot automatically totaled and must therefore be multiplied by the number of devices by the user. Alternatively, of course, all individual devices can also be monitored analogously or digitally in order to record all actual values.

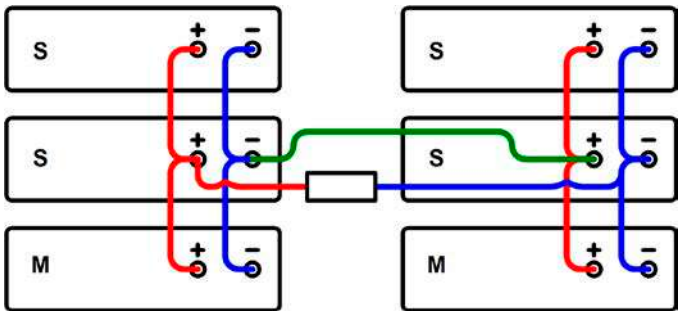
11.1.3 Mixed interconnections

Mixed connection (parallel and series in one system) is possible, but should not be implemented arbitrarily.

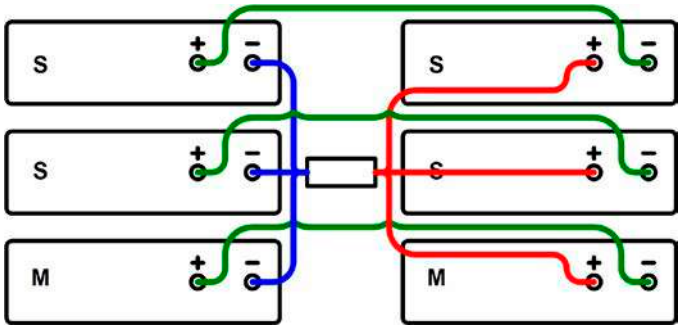
It is recommended to always set up the parallel connection first, e.g. B. three devices with 65V and 10A, including system bus wiring. Only then is the series connection to be established with another, identical parallel system, e.g. B. to get a system with 130V and 30A.

For high currents, it is appropriate to center the load if there is an odd number of devices connected in parallel.

Recommended



Not recommended



11.2 Networking

The pictures below show examples for the digital remote control of several network devices simultaneously in a star (USB, RS232, Ethernet) or bus (CAN, GPIB) network.

The specifications and restrictions for the interfaces and bus systems apply.

Over**USB**up to 30 devices can be controlled from one PC, provided that they have the appropriate hubs with their own power supply. In principle, this also applies to**RS232**. The only differences here are the maximum cable length and handling.

For**CAN**applies that up to 30 of our devices per address segment can be connected to other bus participants and integrated by Device Node and RID (see "Device Setup").

At**GPIB**there is only a limitation of max. 15 devices on the bus.

12. Miscellaneous

12.1 Accessories and Options

The following accessories are available:

a) USB to analog interface UTA12

External module for galvanically isolated remote control via USB (PC side) and the internal analogue interface.

b) Digital interface cards

Pluggable and retrofittable interface cards for USB, RS232, CAN, GPIB/IEEE (SCPI only), Profibus or Ethernet/LAN (SCPI only) are available. For details on the interface cards, see the interface card manual.

The following options are available:

a) High-speed ramping

Higher output voltage dynamics due to reduced output capacitance. It should be noted that other output values, such as the residual ripple, also increase! Danger! This is a permanent mod that cannot be turned off.

b) Internal active load with car start curve

Also known as a two-quadrant module, this internal load module offers up to 150W continuous power and approx. 2400W pulse power. It is used for the targeted, faster discharge of the output capacities, which improves the dynamics without worsening other output values. In addition, a car start curve according to DIN 40839 can be driven by pressing a button or by remote signal. This is suitable for use in test applications in the automotive industry. The module can be switched off.

This option is only available for models from 1000W nominal power and up to 400V nominal voltage.

12.2 Substitute leakage current measurement according to DINVDE0701

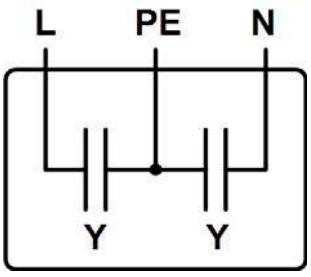
The substitute leakage current measurement carried out according to DIN VDE 0701-1 sometimes leads to results that are outside the norm. Reason: the measurement is primarily carried out on so-called mains filters at the AC voltage input of the devices. These filters are**symmetrical**constructed, that is, among other things, a Y-capacitor is routed from N and L1/2/3 to PE. Since N and L1/2/3 are connected during the measurement and the current flowing to PE is measured, there are therefore**two**Capacitors in parallel, resulting in the measured leakage current**doubled**.

This is permissible according to the applicable standard, but means for the measurement that the determined value**halved**must be checked in order to determine whether it conforms to the standard.

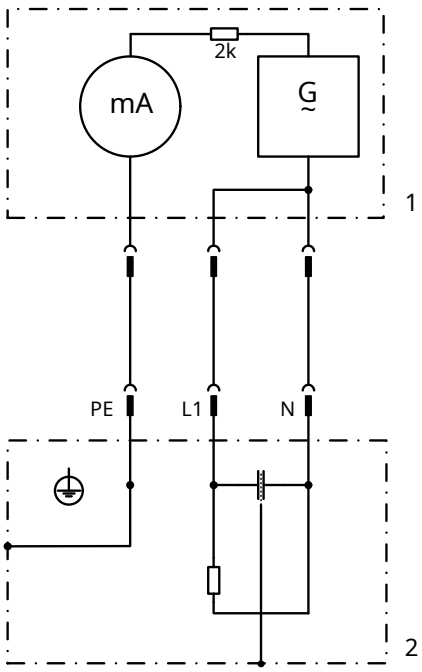
Quote from the standard, section 5.7.4:

"...*In the case of devices with two-pole disconnection and symmetrical capacitive switching, the measured value may be halved when using this method*..."

Graphical explanation of the symmetrical circuit:



Example representation from the standard, Figure C.4a, portable Devices of protection class I:



12.3 Firmware Update

A firmware update should only be performed if there are proven errors in a specific version of the firmware that are corrected by a newer version, or if new functions have been integrated.

To update a dig. interface card, a new firmware file and an update tool, a software called "Update Tool".

The following interface cards are qualified for firmware update:

- IF-U1 (USB)
- IF-R1 (RS232)
- IF-E1 (Ethernet/USB)
- IF-PB1 (Profibus/USB)

If none of the above is available, no update can be carried out. In such a case, please contact the supplier of your device.

This software and the firmware suitable for the device can be found on the manufacturer's website or will be sent to you on request. The "Update Tool" guides you through the update, which runs almost automatically.

About

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Danger to live!

Hazardous voltage

The output voltage of some models can rise to hazardous levels of >60V$_{DC}$!

All live parts have to be covered. All actions at the output terminals have to be done while the unit is switched off from the mains (mains switch OFF) and may only be executed by personnel which is instructed about the hazards of electrical current. Any connection between the load and the unit (at the output terminals) have to be scoop-proof. Applications connected to the power output must be configured and fused in a way that prevents the use of these to cause a damage or worse to the unit by overload or malfunction.

Warning!

The DC output can still have hazardous voltage for a certain time after the output or the device has been switched off!

Keep in mind:

- 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
- In order to equip interface cards into the slot at the rear, the common ESD provisions have to be followed
- The interface card may only be plugged and unplugged while the unit is completely switched off (mains switch OFF)
- Aging of the device, as well as heavy use may result in unpredictable behavior of control elements like pushbuttons and rotary knobs.
- Do not connect external voltage sources with reversed polarity to the DC output! The device will be damaged.
- Avoid connecting external voltage sources to the DC output, especially those who can generate voltages higher than specified for the device!

Table of contents

EN

1. Introduction

The laboratory power supplies of the PS 8000 2U series are ideally suited for test systems and industrial control facilities by their 19" draw-out case.

Apart from standard functions of power supplies the user can define and recall 5 different presets of set values or make use of the integrated analogue interface, that can handle the common voltage ranges of 0...5V or 0...10V. This offers a way of easily monitoring the device as well as total remote control.

The optionally available digital interface cards provide an even wider spectrum of control and monitoring functions by means of a PC.

Models from 1000W feature an adjustable power regulation circuit (with two exceptions, see technical specs), as well as a "System Bus" terminal which enables series connection as master-slave or parallel connection with share bus.

The integration into existent systems is done very comfortably by using an interface card, while there is no need to configure the card at all or with only a few settings.

Via the analogue interface, a power supply can als be operated in connection to other power supply units, controlling these via the interface. Or they can be controlled and monitored by an external control system, like a PLC.

The devices are microprocessor-controlled and thus delivers fast and accurate measurement and indication of actual values.

The main functions at a glance:

- Set voltage and current, each with 0...100%
- Adjustable overvoltage threshold 0...110% U_{noun}
- Pluggable interface cards (CAN, USB, RS232, IEEE/GPIB, Ethernet/LAN, Profibus)
- Analogue interface for external control and monitoring with 0...5V or 0...10V (selectable) for 0...100%
- Power ratings of 640W, 1000W, 1500W and 3000W
- Temperature controlled fan
- Status indication (OT, OVP, CC, CV, CP)
- 5 selectable memory sets
- Series connection (models from 1kW, except the 720V model)
- Share bus for parallel operation (models from 1kW)
- Vector™ compatible CAN system
- Free Windows software
- LabView™ VIs

2.Technical Specifications

2.1 Control panel and display

Type

Display:	Dot matrix display 202 x 32 dots, separated into three areas
Knobs:	2 rotary knobs, 9+2 pushbuttons

display formats

The nominal values define the maximum adjustable range.

Actual values of voltage and current are displayed simultaneously, the set values of the overvoltage threshold, the undervoltage limit, voltage, current and power (models from 1kW) are displayed separately.

Display of voltage values

Resolution:	4 digits
format:	0.00V...99.99V
	0.0V...999.9V

Display of current values

Resolution:	4 digits
format:	0.000A...9.999A
	0.00A...99.9A
	0.0A...999.9A

Display of power values (models from 1kW)

Resolution:	4 digits
format:	0,000kW...9,999kW

2.2 Technical specifications

	PS 8032-20 2U	PS 8065-10 2U	PS 8160-04 2U	PS 8080-40 2U
Mains input				
Input voltage range	90...264VAC	90...264VAC	90...264VAC	90...264VAC
- with derating	-	-	-	-
Input current at 230V	3.2A max	3.4A max	3.2A max	4.8A max
Input current at 100V	7.5A max	7.5A max	7.5A max	11.4A max
input frequency	45...65Hz	45...65Hz	45...65Hz	45...65Hz
Input fuse	T8A	T8A	T8A	T16A
power factor	> 0.99	> 0.99	> 0.99	> 0.99
Output - Voltage	0	0	0	0
Nominal voltage U_{noun}	32V	65V	160V	80V
Adjustable range	0V...U_{noun}	0V...U_{noun}	0V...U_{noun}	0V...U_{noun}
Stability at mains fluctuation ±10%ΔU_{IN}	<0.02%	<0.02%	<0.02%	<0.02%
Stability at 0...100% load	<0.05%	<0.05%	<0.05%	<0.05%
Ripple @ BWL 20MHz	< 100mV_{pp} < 8mV_{RMS}	< 150mV_{pp} < 10mV_{RMS}	< 120mV_{pp} < 20mV_{RMS}	< 10mV_{pp} < 4mV_{RMS}
Accuracy*	≤0.2%	≤0.2%	≤0.2%	≤0.2%
Resolution of display	10mV	10mV	100mV	10mV
Remote sense compensation	2V max	2V max	2V max	2.5V max
Overvoltage protection threshold (adjustable)	0...35.2V	0...71.5V	0...176V	0....88V
Output - Current				
Nominal current I_{noun}	20A	10A	4A	40A
Adjustable range	0...I_{noun}	0...I_{noun}	0...I_{noun}	0...I_{noun}
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 @ BWL 20MHz	< 65mA_{pp}	< 25mA_{pp}	< 3mA_{pp}	< 19mA_{pp}
Accuracy*	≤0.7%	≤0.7%	≤0.7%	≤0.2%
Resolution of display	10mA	10mA	1mA	10mA
Transient recovery time 10....90% load	< 2ms	< 2ms	< 2ms	< 2ms
output - power				
Nominal power P_{noun}	640W	650W	640W	1000W
Nominal power at derating	-	-	-	-
Adjustable range	-	-	-	0...p_{noun}
Accuracy*	-	-	-	≤ 1%
Resolution of adjustment	-	-	-	1w
Efficiency max.	90.5%	91.0%	92.0%	93.0%
Miscellaneous				
Ambient temperature	0....40°C	0....40°C	0....40°C	0....40°C
Storage temperature	- 20....70°C	- 20....70°C	- 20....70°C	- 20....70°C
humidity rel.	< 80%	< 80%	< 80%	< 80%
Dimensions normal (WxHxD)	19" 2U 380mm	19" 2U 380mm	19" 2U 380mm	19" 2U 460mm
Dimensions with option ZH (WxHxD)	-	-	-	19" 2U 460mm
normal weight	9.5kg	9.5kg	9.5kg	11.5kg
Weight with option ZH	-	-	-	13kg
Isolation +output<->enclosure	500V	700V	1500V	950V
Isolation -output<->enclosure	300Vdc			
Isolation input<->output	2500V			
cooling	by fans, air inlets on the front, air exhaust on the rear			
standards	EN 60950, EN 61326, EN 55022 Class B			
Overvoltage class	2			
protection class	1			
Pollution degree	2			
Operation altitude	< 2000m			
Series connection	possible (with restrictions)			
master slave	no			
Parallel connection	yes, with current distribution via Share bus			
master slave	yes, via aIrishnrtaulomGeirightnandenrfi.eacÄesubject to change			
analog programming				
input range	0...5V or 0...10V, selectable			
Accuracy	≤ 0.2%			
Article number	09230130	09230131	09230132	09230133

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

Example: a 80V model has at least 0.2% voltage accuracy. This is 160mV. When setting a voltage of 5V and with an allowed maximum deviation of 160mV, the resulting actual value could be between 4.84V and 5.16V.

	PS 8040-60 2U	PS 8080-60 2U	PS 8360-15 2U	PS 8040-120 2U
Mains input				
Input voltage range	90...264VAC	90...264VAC	90...264VAC	180...264VAC
- with derating	90...150V AC	90...150V AC	90...150V AC	180...207VAC
Input current at 230V	7.5A max	7.5A max	7.5A max	15A max
Input current at 100V	11.4A max	11.4A max	11.4A max	-
input frequency	45...65Hz	45...65Hz	45...65Hz	45...65Hz
Input fuse	T16A	T16A	T16A	T16A
power factor	> 0.99	> 0.99	> 0.99	> 0.99
Output - Voltage	0	0	0	0
Nominal voltage U_{noun}	40V	80V	360V	40V
Adjustable range	0V...U_{noun}	0V...U_{noun}	0V...U_{noun}	0V...U_{noun}
Stability at mains fluctuation ±10%ΔU_{IN}	<0.02%	<0.02%	<0.02%	<0.02%
Stability at 0...100% load	<0.05%	<0.05%	<0.05%	<0.05%
Ripple @ BWL 20MHz	< 10mV_{pp} < 4mV_{RMS}	< 10mV_{pp} < 4mV_{RMS}	< 50mV_{pp} < 8mV_{RMS}	< 10mV_{pp} < 5mV_{RMS}
Accuracy*	≤0.2%	≤0.2%	≤0.2%	≤0.2%
Resolution of display	10mV	10mV	100mV	10mV
Remote sense compensation	2.5V max	2.5V max	8V max	2.5V max
Overvoltage protection threshold (adjustable)	0....44V	0....88V	0...396V	0....44V
Output - Current				
Nominal current I_{noun}	60A	60A	15A	120A
Adjustable range	0...I_{noun}	0...I_{noun}	0...I_{noun}	0...I_{noun}
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 @ BWL 20MHz	< 19mA_{pp}	< 19mA_{pp}	< 1mA_{pp}	< 25mA_{pp}
Accuracy*	≤0.2%	≤0.2%	≤0.2%	≤0.2%
Resolution of display	10mA	10mA	10mA	100mA
Transient recovery time 10....90% load	< 2ms	< 2ms	< 2ms	< 2ms
output - power				
Nominal power P_{noun}	1500W	1500W	1500W	3000W
Nominal power at derating	1000W	1000W	1000W	2500W
Adjustable range	0...p_{noun}	0...p_{noun}	0...p_{noun}	0...p_{noun}
Accuracy*	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Resolution of adjustment	1w	1w	1w	1w
Efficiency max.	93.0%	93.0%	93.0%	93.0%
Miscellaneous				
Ambient temperature	0....40°C	0....40°C	0....40°C	0....40°C
Storage temperature	- 20....70°C	- 20....70°C	- 20....70°C	- 20....70°C
humidity rel.	< 80%	< 80%	< 80%	< 80%
Dimensions normal (WxHxD)	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm
Dimensions with option ZH (WxHxD)	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm	19" 4U 460mm
normal weight	11.5kg	11.5kg	11.5kg	14.7kg
Weight with option ZH	13kg	13kg	13kg	17kg
Isolation +output<->enclosure	500V	950V	2100V	500V
Isolation -output<->enclosure	300Vdc			
Isolation input<->output	2500V			
cooling	by fans, air inlets on the front, air exhaust on the rear			
standards	EN 60950, EN 61326, EN 55022 Class B			
Overvoltage class	2			
protection class	1			
Pollution degree	2			
Operation altitude	< 2000m			
Series connection	possible (with restrictions)			
master slave	no			
Parallel connection	yes, with current distribution via Share bus			
master slave	yes, via analogue interface			
analog programming				
input range	0...5V or 0...10V, selectable			
Accuracy	≤ 0.2%			
Article number	09230144	09230134	09230137	09230145

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

Example: a 80V model has at least 0.2% voltage accuracy. This is 160mV. When setting a voltage of 5V and with an allowed maximum deviation of 160mV, the resulting actual value could be between 4.84V and 5.16V.

	PS 8080-120 2U	PS 8160-60 2U	PS 8360-30 2U	PS 8720-15 2U
Mains input				
Input voltage range	180...264VAC	180...264VAC	180...264VAC	180...264VAC
- with derating	180...207VAC	180...207VAC	180...207VAC	180...207VAC
Input current at 230V	15A max	15A max	15A max	15A max
Input current at 100V	-	-	-	-
input frequency	45...65Hz	45...65Hz	45...65Hz	45...65Hz
Input fuse	T16A	T16A	T16A	T16A
power factor	> 0.99	> 0.99	> 0.99	> 0.99
Output - Voltage	0	0	0	0
Nominal voltage U_{noun}	80V	160V	360V	720V
Adjustable range	0V...U_{noun}	0V...U_{noun}	0V...U_{noun}	0V...U_{noun}
Stability at mains fluctuation ±10%ΔU_{IN}	<0.02%	<0.02%	<0.02%	<0.02%
Stability at 0...100% load	<0.05%	<0.05%	<0.05%	<0.05%
Ripple @ BWL 20MHz	< 10mV_{pp} < 5mV_{RMS}	< 20mV_{pp} < 10mV_{RMS}	< 30mV_{pp} < 12mV_{RMS}	< 50mV_{pp} < 20mV_{RMS}
Accuracy*	≤0.2%	≤0.2%	≤0.2%	≤0.2%
Resolution of display	10mV	100mV	100mV	100mV
Remote sense compensation	2.5V max	5V max	8V max	16V max
Overvoltage protection threshold (adjustable)	0....88V	0...176V	0...396V	0...792V
Output - Current				
Nominal current I_{noun}	120A	60A	30A	15A
Adjustable range	0...I_{noun}	0...I_{noun}	0...I_{noun}	0...I_{noun}
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 @ BWL 20MHz	< 25mA_{pp}	< 18mA_{pp}	< 60mA_{pp}	< 2mA_{pp}
Accuracy*	≤0.2%	≤0.2%	≤0.2%	≤0.2%
Resolution of display	100mA	10mA	10mA	10mA
Transient recovery time 10....90% load	< 2ms	< 2ms	< 2ms	< 2ms
output - power				
Nominal power P_{noun}	3000W	3000W	3000W	3000W
Nominal power at derating	2500W	2500W	2500W	2500W
Adjustable range	0...p_{noun}	0...p_{noun}	0...p_{noun}	0...p_{noun}
Accuracy*	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Resolution of adjustment	1w	1w	1w	1w
Efficiency max.	93.0%	93.0%	93.0%	93.0%
Miscellaneous				
Ambient temperature	0....40°C	0....40°C	0....40°C	0....40°C
Storage temperature	- 20....70°C	- 20....70°C	- 20....70°C	- 20....70°C
humidity rel.	< 80%	< 80%	< 80%	< 80%
Dimensions normal (WxHxD)	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm
Dimensions with option ZH (WxHxD)	19" 4U 460mm	19" 4U 460mm	19" 4U 460mm	-
normal weight	14.7kg	14.7kg	14.7kg	14.7kg
Weight with option ZH	17kg	17kg	17kg	-
Isolation +output<->enclosure	950V	1500V	2100V	2950V
Isolation -output<->enclosure	300Vdc			
Isolation input<->output	2500V			
cooling	by fans, air inlets on the front, air exhaust on the rear			
standards	EN 60950, EN 61326, EN 55022 Class B			
Overvoltage class	2			
protection class	1			
Pollution degree	2			
Operation altitude	< 2000m			
Series connection	possible (with restrictions)			
master slave	no			
Parallel connection	yes, with current distribution via Share bus			
master slave	yes, via			
analog programming				
input range	0...5V or 0...10V, selectable			
Accuracy	≤ 0.2%			
Article number	09230135	09230136	09230138	09230139

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

Example: a 80V model has at least 0.2% voltage accuracy. This is 160mV. When setting a voltage of 5V and with an allowed maximum deviation of 160mV, the resulting actual value could be between 4.84V and 5.16V.

3. Device description

3.1 Views

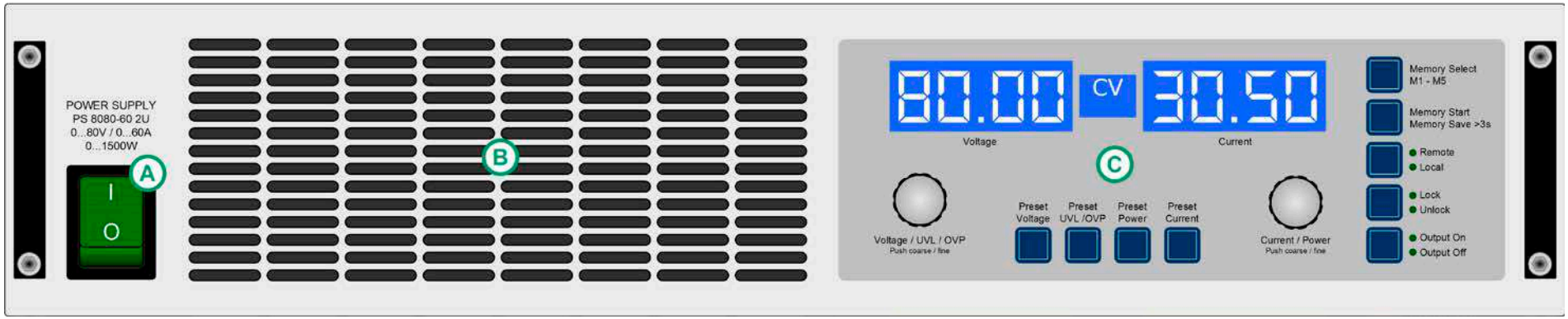


Figure 1. Front view of standard 2U model, models with ZH option can differ

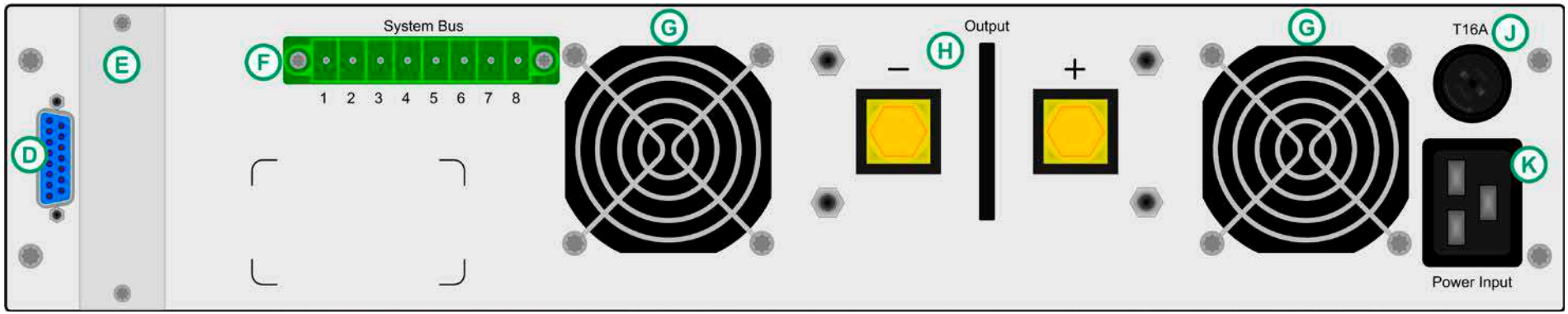


Figure 2. Rear view 2U model

Legend:
A - Power switch B - Air ventilation slots C - Control panel
D - Analogue interface, 15-pole, female E - Slot for digital extension cards
F - system bus
G - fans
H - Power output, M8 screw block
J - Input fuse (for value see "2. Technical specifications") K - Power input socket, 3-pole, IEC 60320

Pin assignment of System Bus (See section 11.1 for important details): 1 - Sense +
2 - scythe -
3 - Master output Current
4 - Master output Voltage 5 - Slave input Current 6 - Slave input Voltage 7 - Share Bus
8 - Ground

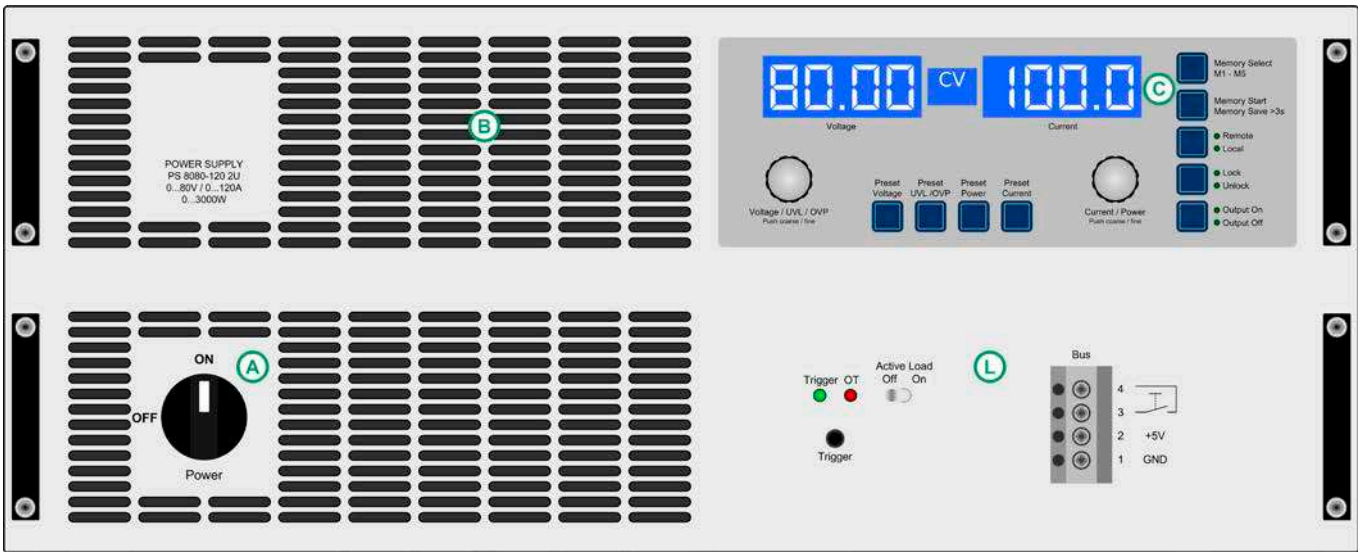


Figure 3. Front view 4U version with ZH option

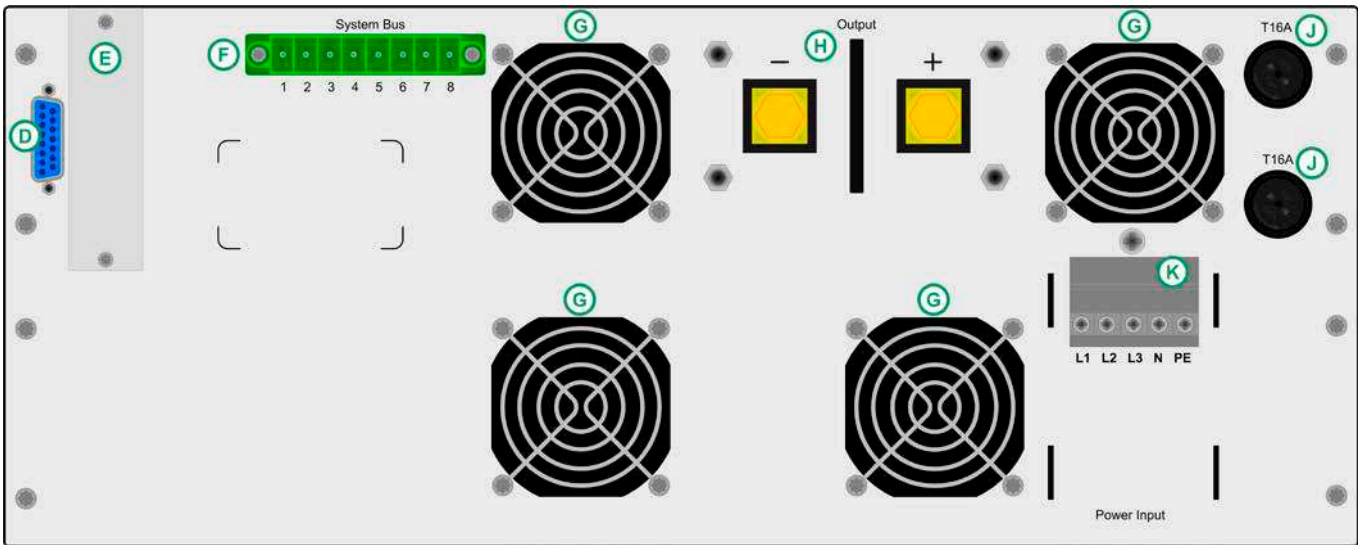


Figure 4. Rear view 4U version

Legend:
A - Power switch B - Air ventilation slots C - Control panel
D - Analogue interface, 15-pole, female E - Slot for digital extension cards
F - system bus
G - fans
H - Power output, M8 screw block
J - Input fuses (for value see "2. Technical specifications") K - Power input terminal (see section 5.3)
L - Control panel of ZH option

Pin assignment of System Bus (see section 11.1 for details): 1 - Sense +
2 - scythe -
3 - Master output Current
4 - Master output Voltage 5 - Slave input Current 6 - Slave input Voltage 7 - Share Bus
8 - Ground

3.2 Scope of delivery

1 x Power supply unit 1 x Printed user manual(s) 1 x Mains cord (2U models only)
1x Plug for System Bus

4. Generals

4.1 Prologue / Warning

This user instruction manual and the device are intended to be used by users who know about the principle of a power supply. The handling of the device should not be left to persons who are unaware of the basic terms of electrotechnology, because these are not described in this manual. Inappropriate handling and non-observance to the safety instructions may lead to a damage of the device or loss of warranty!

4.2 Cooling

The air inlets on the front and the air outlets at the rear have to be kept clean to ensure proper cooling. Take care of at least 10cm distance at the rear to any surrounding objects in order to guarantee unimpeded air flow.

4.3 Maintenance / repairs

When opening the unit or removing parts from the inside with tools there is risk of electric shock from dangerous voltages. Open the unit only at your own risk and disconnect it from the mains before.

Any servicing or repair may only be carried out by trained personnel, which is instructed about the hazards of electrical current.

5.Installation

5.1 Visual check

After receipt, the unit has to be checked for signs of physical damage. If any damage is found, the unit may not be operated. Also contact your dealer immediately.

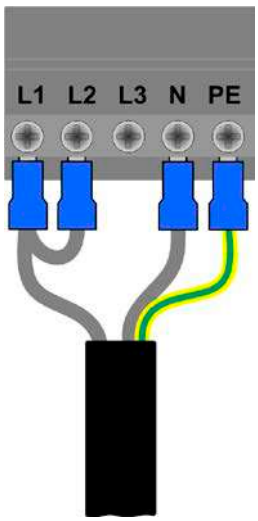
5.2 Mains connection 2U models

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

The unit is fused with a 5 x 20mm safety fuse (for value see technical specs table), which is located in the fuse holder at the rear.

5.3 Mains connection 4U models

Though the device features a three-phase input terminal, it is used with a normal 230V supply (L + N + PE). Three-phase input is not allowed because of security reasons. The input uses L1 and L2, plus N and PE. So the input connection has to be like this:



5.4 DC output terminal

The power output is located on the rear of the device.

The output is**not**fused! In order to avoid damage to the load application, always take care for the nominal values of the load.

The cross section of the load leads depends on several conditions, like the output current, the lead length and the ambient temperature.

Up to 1.5m lead length we recommend to use: up

to**10A**:	0.75mm²	up to**15A**:	1.5mm²
up to**30A**:	4mm²	up to**40A**:	6mm²
up to**60A**:	16mm²	up to**120A**:	35mm²

by cable(flexible wire).

The outputs "+" and "-" are not grounded, so that**one**of them may be grounded if necessary.

ATTENTION!

When grounding one of the output poles always check if one of the poles of the load (e.g. electronic load) is also grounded. This could result in a short circuit!

ATTENTION!

Watch the potential shift of the output poles when using series connection! Grounding is hereby only recommended at the pole with the lowest potential against ground.

5.5 "Sense" terminal (remote sense)

In order to compensate the voltage drop along the load leads (max. 1V per lead), the power supply can "sense" the voltage at the load instead at the output. It will regulate the output voltage so that the desired voltage is provided to the load.

The connection for remote sense is done at the terminal "**system bus**" on the rear side, pins 1 and 2. Also see section "3.1 Views".

ATTENTION!

(+) Sense must only be connected to (+) at the load application and (–) Sense must only be connected to (–)! Else both systems can take damage.

For additional information also refer to section "7.7 Remote sense operation".

5.6 Interface card slot

The unit can be equipped with an optional interface card. The slot to insert the card is located at the rear side. Further information about the interface cards can be found in section "9. Digital interface cards".

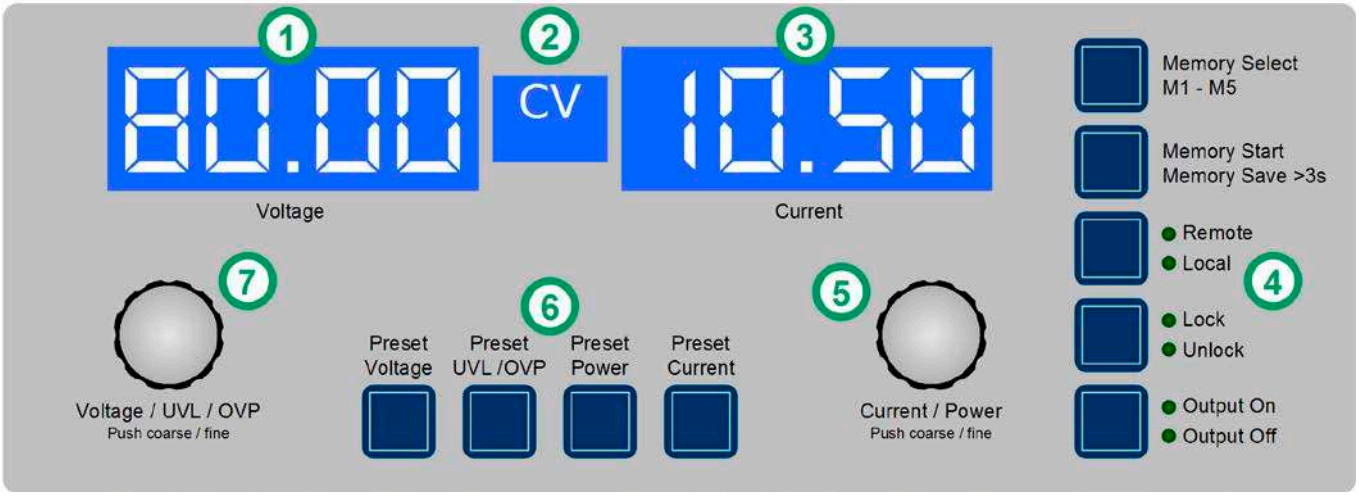


Figure 5. Control panel

6. Handling

6.1 The display

Figure 5 depicts an overview of the dot matrix display and the control panel. During normal operation, the display areas show the actual values of voltage (left side) and current (right side) and device status (middle). In preset mode, the left display area shows the set values of voltage (Preset Voltage), of the overvoltage protection threshold (Preset OVP) or the undervoltage limit (Preset UVL). The right display area shows the set values of current (Preset Current) or power (Preset Power, only models from 1kW). In the device setup the display is used to show adjustable parameters and settings.

The status area in the middle can show the following status: **CV**-

Constant voltage regulation (only when output is "on") **OT**-

Overtemperature error **original packaging**-Overvoltage error

CC-Constant current regulation (only when output is "on") **CP**-

Constant power regulation (only when output is "on") **Fine**-

Fine adjustment for both rotary knobs active **PF**-Power fail

(input voltage failure, from firmware 6)

Legend:

(1) - Left display area: Actual voltage or set value U, UVL, OVP

(2) - Status area: status display like CC, CV etc.

(3) - Right display area: Actual current or set value I, P

(4) - Control buttons: Setting the device condition etc.

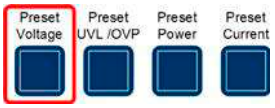
(5) - Rotary knob right: Set value adjustment of I and P, as well as settings in the device setup

(6) - Preset buttons: Switching to set value display

(7) - Rotary knob left: Set value adjustment of U, UVL, OVP, as well as parameters in the device setup

6.2 Push buttons on the control panel

6.2.1 Preset Voltage push button



During normal operation, this button is used to switch the display from actual to preset value of the output voltage (ie preset mode). The left display area will then show like this:

In preset mode, the left rotary knob (**Voltage / UVL / OVP**) is used to adjust the voltage set value the same way as during normal operation. The adjusted value is instantly transferred to the output.

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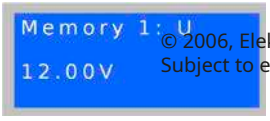
The set value adjustment can be limited by the undervoltage threshold UVL. So see 6.2.2.

A second push leaves the preset mode instantly or it will end automatically, if no preset button is pushed or any set value is altered within 5 seconds.

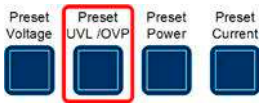
During remote control by analogue or digital interface, the preset mode can be used to check the voltage set value that is given from remote.

The button might be locked by the condition**LOCK.**See 6.2.8.

In memory selection mode the button is also used to switch to the voltage set value of the selected memory set, but in this mode the set value is not transferred to the output. The left display area will then show like this:



6.2.2 Pushbutton Preset UVL / OVP



During normal operation, this button is used to switch the display from actual voltage to the set value of the undervoltage limit (one push) or the overvoltage protection threshold (two pushes). The left display area will then show like this:

resp.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The undervoltage limit (UVL) is only an adjustment limit for the output voltage value. It means, if UVL is set to anything above 0, the voltage set value can only be adjusted down to the UVL value. In the same way, the UVL value can only be adjusted up to the voltage set value.

The left rotary knob (**Voltage / UVL / OVP**) is used to adjust the UVL value from 0...U_{set}.

A second push of the button changes to overvoltage protection threshold preset (OVP). This value can always be adjusted from 0...110% U_{noun}.

A third push leaves the preset mode instantly or it ends automatically, if no preset button is pushed or any set value is altered within 5 seconds.

During remote control by digital interface, the preset mode can be used to check the OVP set value that is given from remote.

The button might be locked by the condition**LOCK.**See 6.2.8.

In memory selection mode the button is also used to switch to the UVL or OVP value of the selected memory set, but in this mode the valuesare not active yet. The left display area will then show like this:

resp.


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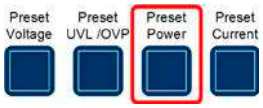
6.2.3 Preset Power push button



During normal operation, this button is used to switch the display from actual current to preset value of the output power (ie preset mode).

Only models from**1kW**feature an adjustable power regulation and will show like this on the right display area:

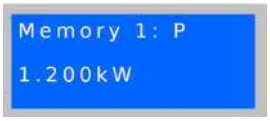
In preset mode, the right rotary knob (**Current / Power**) is used to adjust the power set value from 0...100% P_{noun}. The adjusted value is instantly transferred to the output.

A second push leaves the preset mode instantly or it ends automatically, if no preset button is pushed or any set value is altered within 5 seconds.

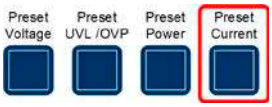
The button might be locked by the condition**LOCK.**See 6.2.8.

During remote control by analogue or digital interface, the preset mode can be used to check the power set value that is given from remote.

In memory selection mode the button is also used to switch to the power set value (only models from 1kW) of the selected memory set, but in this mode the set valueis not transferred to the output. The right display area will then show like this:



6.2.4 Preset Current push button



During normal operation, this button is used to switch the display from actual to preset value of the output current (ie preset mode).

The right display area will then show like this:

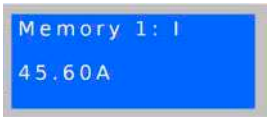
In preset mode, the right rotary knob (**Current / Power**) is used to adjust the set value of current from 0...100% $I_{noun}$the same way as in normal operation. The adjusted value is instantly transferred to the output.

A second push leaves the preset mode instantly or it ends automatically, if no preset button is pushed or any set value is altered within 5 seconds.

During remote control by analogue or digital interface, the preset mode can be used to check the current set value that is given from remote.

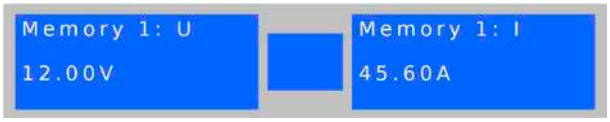
The button might be locked by the condition**LOCK.**See 6.2.8.

In memory selection mode the button is also used to switch to the current set value of the selected memory set, but in this mode the set valueis not transferred to the output. The right display area will then show like this:



6.2.5 Pushbutton Memory Select M1-M5

This button cycles through the 5 memory sets, each with set values for U, I and P, as well as UVL and OVP. From here, the selected memory set can be edited, stored or submitted. The button only works if the output is***off***. The memory mode and the selected memory set number are displayed like this:



Following options of use:

a) Adjust values

Output off, short push of the button, the display changes to the first memory set, as displayed above.

Now the set values of U (left) and I (right) of the selected memory set can be adjusted. The other adjustable values can be accessed by pushing the corresponding preset buttons.

Further pushes will cycle through the memory sets up to number 5 and then exit memory mode.

The adjusted values remain as long as the device is powered, but are not submitted to the output set values**and are not saved yet! For saving see section 6.2.6.**

The button might be locked by the condition**LOCK.**See 6.2.8.

6.2.6 Push button Memory Start / Memory Save >3s

This pushbutton is either used to submit the values of the selected memory set to the output or to save the memory set. The button only works if the output is***off***.

Following options of use:

b) Submit only

Output off, memory set is selected (1-5), button is pushed **shortly** -->the values of the memory set are submitted to the output and the memory mode exits. In order to use the new set values, the output is switched on as usual by button**Output On**or by remote control.

grade
Submitting the values does not save them!

c) Save only

Output off, select memory set(s), adjust the values as desired, then push the button**>3s**-->all memory sets are saved, but none is submitted to the output. The output remains off, the memory mode exits after saving.

The memory sets can also be defined by remote control and corresponding commands using a digital interface (except GPIB). They're stored immediately.

The button might be locked by the condition**LOCK.**See 6.2.8.

6.2.7 Local push button

This pushbutton activates or deactivates the LOCAL mode. In LOCAL mode, no remote control of the device is possible. LOCAL mode is indicated by LED "Local". As long as LOCAL is not active, the "Remote" LED indicates an active remote control by analogue or digital interface.

The button might be locked by the condition**LOCK.**See 6.2.8.

grade
Activation of LOCAL mode results in immediate return from remote control (analogue or digital) and locks the device against further attempts to control it remotely, until LOCAL is cleared again.

grade
LOCAL condition is only temporary and will not be stored when switching the device off.

6.2.8 Pushbutton Lock / Unlock

This pushbutton activates or deactivates the control panel lock. The LOCK mode locks all buttons, except the LOCK button itself, and the rotary knobs against unintended operation.

grade
Activation of the LOCK mode instantly exits any preset or memory mode, if currently active. The display will return to normal display of actual values.

grade
Since firmware 6.02, LOCK mode will be stored when the device is switched off and restored after power-on.

6.2.9 Push button Output On / Output Off

This pushbutton is used to manually switch the power output on or off, as long as the device is not in remote control mode. The output condition is always indicated by the LEDs "Output On" or "Output Off". If the output is switched on, the device indicates the currently active regulation mode CC, CV or CP (only models from 1kW) in the status area in the middle of the display.

The button migKSGee 6.2.8.

Switching the output on may be inhibited by pin 13 (REM-SB) of the analogue interface. See section "10. analog interface".

The button also acknowledges the errors. See sections 7.4 and 7.5 for more information.

6.3 Other control elements

6.3.1 Rotary knobs

Both of the rotary knobs have a push button function. Pushing any or both of these will effect the following:

a) Fine adjustment mode (Fine)

A short push of any of both buttons activates or deactivates the fine adjustment mode for manual operation. If "Fine" is active, all set values, thresholds and limits can be adjusted in the smallest possible steps, no matter what mode is currently active (preset, memory ect.). It is indicated by the status text "Fine" in the status area. Also see section "6.4 Adjusting set values" below.

b) Device setup

pushing**both**buttons together for >3s while the output is**off** changes to device setup. It is left the same way.

6.4 Adjusting set values

1. In manual operation

During manual operation, both rotary knobs are used to continuously adjust the set values of voltage and current from 0% to 100% nominal value in predefined steps (see table). In order to set the values for OVP and UVL the button**Preset UVL/ OVP**has to pushed once or twice. In order to set the power set value (models from 1kW only) the button**preset power** has to be pushed.

grade

The OVP value can be lower than the voltage set value and will cause an OV error as soon as the output is switched on and the actual voltage reaches the OVP threshold!

Setting values manually can be done in fine or coarse steps, whereas coarse is default.**Fine**is required to be activated by the one of rotary knob pushbuttons and has a step width of 1.

for**coarse**adjustment, following step widths apply in dependency of the nominal values (also refer to technical specs):

Voltage / OVP / UVL			Current		
Nom.val.	**coarse**	**Fine**	**Nom.val.**	**coarse**	**Fine**
32V	0.2V	0.01V	4A	0.05A	0.001A
40V	0.25V	0.01V	10A	0.1A	0.01A
65V	0.5V	0.01V	15A	0.1A	0.01A
80V	0.5V	0.01V	20A	0.2A	0.01A
160V	1V	0.1V	30A	0.2A	0.01A
360V	2V	0.1V	40A	0.5A	0.01A
720V	5V	0.1V	60A	0.5A	0.01A
			120A	1A	0.1A

power		
nominal value	**coarse**	**Fine**
1000W	0.01kW	0.001kW
1500W	0.01kW	0.001kW
3000W	0.02kW	0.001kW

grade

The resolution of the set value adjustment in some cases is, depending on the nominal values, higher than the one of the output voltage. Thus it can happen that the output voltage only changes every 2 or 3 steps.

2. In remote control via analogue interface

See section "10. analog interface".

3. In remote control via digital interface card

See section “9. Digital interface cards”.

7. Device characteristics

7.1 Switching on by power switch

The power switch is located at the front. After switching on, the device will show some information in the display: manufacturer's name, address and logo, device type and firmware version. In the device setup (see section "8. Device setup") there is an option "AutoPwrOn" (auto power-on) that determines the output condition after the device is switched on. Default is "on" and means that the set values of U, I, P, the values of OVP and UVL and the output condition are restored to what was present when the device was switched off the last time. In case the option is set to "off", the set values of U and I are set to 0, the set value of P to 100%, OVP to max., UVL to min. and the output is switched on after every start .

7.2 Switch off by power switch

Switching the device off by power switch is handled as mains blackout. The device will save the last set values and output condition. After a short time, power output and fans will be switched off and after a few seconds more, the device will be completely off.

7.3 Switching to remote control

a)*analog interface* : Pin "Remote" switches the device to remote control, if not inhibited by LOCAL mode or remote control by digital interface already being active. The set values pins VSEL, CSEL and PSEL (only required with models from 1kW), as well as REM-SB are then in command. The output condition and the set values which are put into the pins are immediately set. After return from remote control, the output will be switched off.

b)*Digital interface* : Switching to remote control is done by the corresponding command (here: object), if not inhibited by LOCAL mode or remote control via analogue interface already being active. I, keeps output state and set values until altered. Leaving remote control automatically switches the output off.

7.4 Overvoltage alarms

An overvoltage alarm can occur due to an internal defect (output voltage rises uncontrolledly) or by a too high voltage from external. The overvoltage protection (OVP) will switch off the output and indicate the alarm on the display by the status text "OV" and on the pin "OVP" of the analogue interface.

If the cause of the overvoltage is removed, the alarm has to be acknowledged first. In manual operation, it is done by pushing button**Output On/Off**, in analogue remote control with pin "REM-SB" and in digital remote control by the corresponding command. Then status text "OV" and OVP signal will disappear. If the alarm is still present, the output will not be switched on.

OV alarms are recorded into the internal alarm buffer. This buffer can be read out via a digital interface, except those using SCPI language. Reading the buffer will also acknowledge.

grade

The status of an OV alarm has priority over the status of an OT alarm and will overwrite the status text "OT" in case both alarms occur the same time and are not yet acknowledged.

7.5 Over temperature alarms

As soon as an overtemperature (OT) alarm occurs due to internal overheating, the output is switched off and the status text "OT" is indicated. Simultaneously, the LED “Output On"will flash, indicating that the output will automatically switch on again as soon as the device has cooled down. In case this is not wanted, the output can be switched off manually. Then the LED stops flashing and the output won't switch on automatically.

If the output is off after the device has cooled down, it can be switched on again by using button**Output On/Off**or pin "REM-SB" or the corresponding command. If the output is on, pushing button**Output On/Off**once or giving pin "REM-SB" a high-to-low toggle or using the corresponding command first acknowledges the alarm and then switches the output off.

OT alarms are recorded into the internal alarm buffer. This buffer can be read out via a digital interface (except those using SCPI language). Reading the buffer will also acknowledge.

grade

The status of an OT alarm has lower priority than an OV alarm and the status text "OT" will be overwritten by "OV" in case both alarms occur the same time and are not yet acknowledged.

7.6 Voltage, current and power regulation

The output voltage of the power supply and the resistance of the load determine the output current. If this current is lower than the current limitation set by the current set value, then the device is working in constant voltage (CV) regulation, indicated by the status text "CV".

If the output current is limited by the current set value or by the nominal current, the device will change to constant current (CC) regulation mode, indicated by the status text "CC".

Models from 1kW output power also feature an adjustable power limitation for 0...P_{noun}. It becomes active and overrides constant voltage or constant current regulation mode, if the product of actual current and actual voltage exceeds the adjusted power limitation or nominal power of the device. The power limitation primarily affects the output voltage. Because voltage, current and power limitation affect each other, various situations like these may occur:

Example 1: the device is in constant voltage regulation, then the power is limited down. As a result, the output voltage is decreased. A lower output voltage results in a lower output current. In case the resistance of the load is then decreased, the output current will rise again and the output voltage will sink further.

Example 2: the device is in constant current regulation, the output voltage is defined by the resistance of the load. Then the power is limited down. Output voltage and current are decreasing to values according to the formula P = U * I. If the current set value is then decreased, the output current would also decrease and thus the output voltage. The product of both values, the actual power, would sink below the previously set power limit and the device would change from constant power regulation (CP) to constant current regulation (CC).

7.7 Remote sense operation

Remote sense operation is used to compensate voltage drops along the leads between power supply and load. Because this compensation is limited to a certain level, it is recommended to match the cross section of the load leads to the output current and thus minimize the voltage drop.

The sense input is located on the rear, at the terminal**system bus** , where the sense leads are connected to the load with correct polarity. The power supply will detect the external sense automatically and compensate the output voltage by the actual voltage at the load instead of the output. The output voltage will be raised by the value of the voltage drop between power supply and load. For maximum compensation see technical specifications. Also see figure 6 below.

7.8 Mains undervoltage or overvoltage

The device features a rectification with active PFC and a wide range input. This means, it can be operated at input voltages of approx. 90V...264V. Input voltages outside this range are considered as blackout, respectively as complete switch-off and will store the last condition, as well as switch off the power output.

ATTENTION!

Permanent input undervoltage or overvoltage must be avoided!

grade

Models with 1500W nominal power will derate the output power down to 1000W at input voltages below approx.150V.

7.9 Connecting different types of loads

Different types of loads, such as ohmic loads (lamp, resistor), electronic loads or inductive loads (motor) behave differently and can retroact to the power supply. For example, motors can induce a countervoltage which may cause the overvoltage protection of the power supply to shut off the output.

Electronic loads have regulator circuits for voltage, current and power that can counteract to the ones of the power supply and may result in increased output ripple or other, unwanted side effects. Ohmic loads are almost 100% neutral. It is recommended to consider the load situation when planning applications.

8. Device setup

The device setup is intended to adjust certain operation parameters. It can only be accessed while the output is off. Push both pushbuttons of the rotary knobs (also see section 6.3) simultaneously for longer than 2s. Leaving the setup and storage of the settings is done the same way. Three elementary settings are always available, see below. Other settings are only available if a digital interface card is equipped.

Elementary settings:

parameter:AutoPwrOn	Default:on
Settings:on, off	

Meaning: "on" --> device restores the last output state and set values of last time the device was switched off or a blackout occurred. The purpose is to make the unit automatically continue operation after a blackout.

"off" --> the output is switched on and the set values of U, UVL and I are set to 0%, P to 100% and OVP to 110%, everytime the unit is powered.

parameter:Al range	Default:0-10
Settings:0-5, 0-10	

Meaning: selects the control voltage range to use with the analogue interface. Further details in section 10.

parameter:contrast	Default:70
Settings:50...100	

Adjusts the contrast of the LCD display.

for**Alles** interface cards this setting applies:

parameter:Device node	Default:1
Settings:1...30	

Meaning: Selects the device's address (ie device node, term taken from the CAN terminology). When using the device on a bus system (CAN or GPIB), every device must have a unique address!

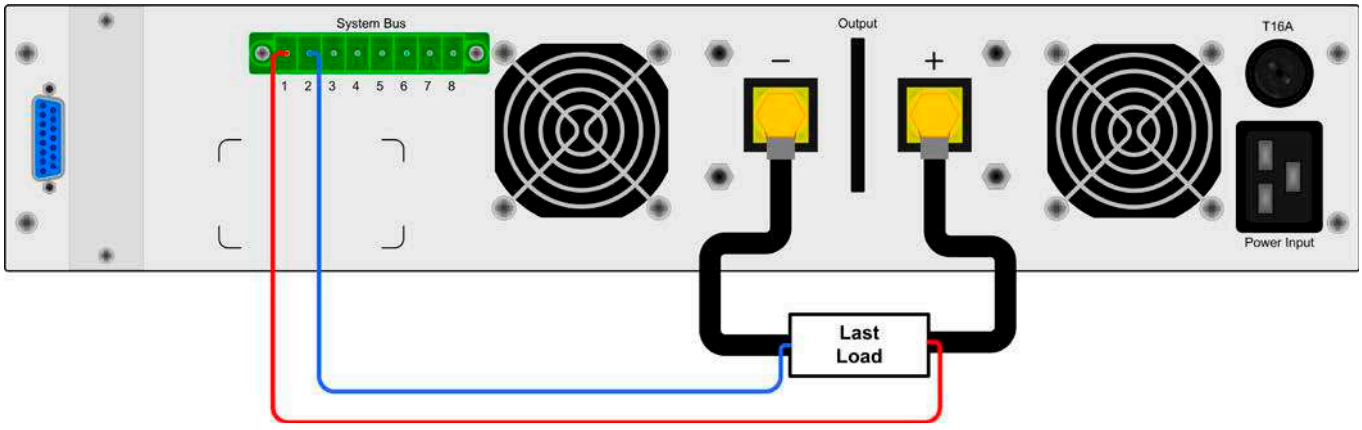


Figure 6. Wiring the sense

Following settings only with**CAN interface IF-C1:**

parameter:baud	Default:100k
Settings:10k,25k,50k,100k,125k,250k,500k,1M	

Meaning: Selects the CAN transmission baud rate.

parameter:BaseID	Default:0x000
Settings:0x000...0x7FC (0...2044)	

Meaning: Defines the base ID (BAID) for the CAN ID system with three IDs (Vector compatible, dbc files). Three IDs are reserved for a device, based upon the adjusted base ID. Thus this value is only adjustable in steps of four. Display can be switched from decimal to hexadecimal by pushing any of the rotary knobs.

Only available, ifID Sys=Vectorhas been selected. See below at parametersID Sys.

parameter:BroadID	Default:0x7FF
Settings:0x000...0x7FF (0...2047)	

Meaning: Adjusts the broadcast ID (BCID) for the CAN ID system with three IDs (Vector compatible, dbc files). This extra ID is a fourth ID for the device which can be used for broadcast messages to multiple units on a bus. Purpose if this ID is to adjust it to the same value on all units that are targeted to be controlled simultaneously by set values or device conditions. Display can be switched from decimal to hexadecimal by pushing any of the rotary knobs.

Only available, ifID Sys=Vectorhas been selected. See below at parametersID Sys.

parameter:RID	Default:0
Settings:0...31	

Meaning: Selects the relocatable identifier segment (RID). Refer to CAN terminology or instruction manual of the IF-C1 CAN interface card for further information.

parameter:Bus term	Default:yes
Settings:yes, no	

Meaning: activates/deactivates the bus termination resistor of the CAN interface card. This is required if the device is at the end of the bus.

parameter:ID Sys	Default:Vector
Settings:vector, normal	

Meaning: Selects the CAN ID systems (IDSY). With "Normal", the former, old CAN ID system with two CAN IDs per unit is used, where the IDs are built from "Device node" (see above) and "RID " (see above) . Also see the external user manual for the interface cards regarding the calculation scheme of the CAN IDs.

The other ID system, selected with "Vector", uses three CAN IDs per unit and it thus enables the use of so-called DBC files to implement the device into Vector company software. By selecting this ID system, two ID related settings (see above) become active, where the user adjusts a base ID that defines the three CAN IDs, plus a broadcast ID (if used).

Following settings only with**RS232 interface IF-R1**:

parameter:baud	Default:57600
Settings:9600, 19200, 38400, 57600	

Meaning: Selects the serial transmission baud rate (in baud). Further parameters for the RS232 are not configurable, but defined as follows:

Parity = odd
Stop bits = 1
Data bits = 8
and have to be set to the same configuration at the PC.

Following settings only with**Profibus interface IF-PB1**:

parameter:Profibus	Default:1
Settings:1-125	

Meaning: Defines the Profibus address of the device. This address is used apart from the device node to implement and access the unit on a field bus system.

9. Digital interface cards

The device supports the following pluggable interface cards: **IF-U1 (USB)**

IF-R1 (RS232)

IF-C1 (CAN)

IF-G1 (GPIB/IEEE)

IF-E1 / IF-E1B (Ethernet/LAN + USB)

IF-PB1 (Profibus + USB)

The cards require only a little or no setup after insertion. The card specific settings are stored and kept, even if the card is replaced by one of different type. Thereby it is not necessary to configure the card settings everytime a card is inserted.

Details about the technical specs of the interface cards and the handling, as well as instructions to implement the device into a bus system or to control the device by means of a PC (LabView etc.) can be found in the user manual for the IF cards.

ATTENTION!

Insertion or removal only if the device is completely switched off (power switch)!

About configuration of the interfaces see section “8. Device setup".

The digital interface cards allow to set voltage, current and power, as well as the OVP threshold and undervoltage limit UVL by means of a PC. When changing to remote control mode, the device keeps the last set values until they're altered. Hence it would be possible to control only voltage by sending arbitrary set values and the current set value would remain unaltered.

Set values given by the digital interface (except GPIB) are always percentag©e2a0n0d6,cE olrerketsrop-oAnudtoamta nlo% ik0Gm(bhHex&Cc 40 0x0KG0), resp. at 110% (hex: 0 mi Irxrt6üE0e0)unfodrÄtnhdeer etc Penthvroersbheo holds, etno the nominal values of the device. Using GPIB, any value is given as real decimal value.

Furthermore, the digital interfaces allow to query and set a lot of other features and values. For details refer to the user manual of the interface cards.

10. Analog interface

10.1 General

The integrated, non-isolated, 15 pole analogue interface (AI) is located on the rear and offers the following main features:

- Remote control of output current and voltage
- Remote control of output power (only models from 1kW)
- Remote monitoring of status (OT, OVP, CC, CV)
- Remote monitoring of actual values
- Remotely switching the output on/off

The analogue interface (short: AI) allows to remotely control current, voltage and power (models from 1kW) of the power supply, but always in combination. It means that it's not possible to adjust the voltage via the AI and the current with the rotary knob on the front at the same time, or vice versa. Models below 1kW output power don't require the power set value PSEL and thus it must not be given.

The OVP threshold cannot be adjusted via the AI, so it's required to set it manually on the device before using the remote control. Switching to preset mode with the preset buttons shows the translated set values, that are put into the set value pins of the AI as voltages. In order to put in appropriate set values, the user can either use an external voltage source or the reference output voltage on pin 3.

The AI can be operated with the common 0...5V or 0...10V ranges, each corresponding to 0...100% nominal values. The desired control voltage range is selected in the device setup (see section "8. Device setup"). The reference voltage at output pin 3 is related to the chosen setting and will be either 5V or 10V.

The following applies:

0-5V: Reference voltage = 5V, 0...5V set value voltage correspond to 0...100% nominal value, 0...100% actual value correspond to 0...5V at the actual value outputs (CMON, VMON) .

0-10V: Reference voltage = 10V, 0...10V set value voltage correspond to 0...100% nominal value, 0...100% actual value correspond to 0...10V at the actual value outputs (CMON, VMON) .

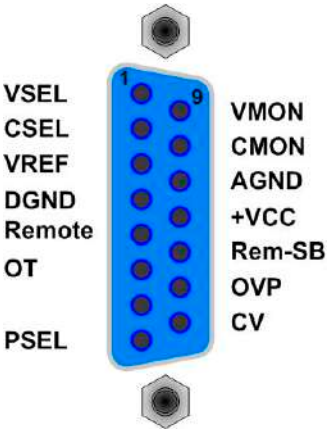
Putting in set values that exceed the limit, for example >5V while the 0...5V range is selected, is intercepted by clipping the corresponding set value to 100%.

Usage instructions:

- Controlling the device with analogue voltages requires to switch it to remote control with pin "REMOTE" (5).
- Before connecting the application that is used to control the power supply, make sure to wire all leads correctly and check if the application is unable to put in voltages higher than specified (max. 12V).
- The input REM-SB (remote standby, pin 13) overrides the pushbutton**Output On**. It means, the output can not be switched on by the button if the pin defines the output state as "off" , except LOCAL mode is active. This mode locks all interface from access to the device. Also see "6.2.7 Pushbutton Local".
- **The grounds of the analogue interface are related to minus output**.

10.2 Application examples

Pin overview



ATTENTION!

Never connect grounds of the analogue interface to minus (negative) output of an external control application (PLC, for example), if that control application is otherwise connected to the negative power supply output (ground loop). Load current may flow over the control leads and damage the device!

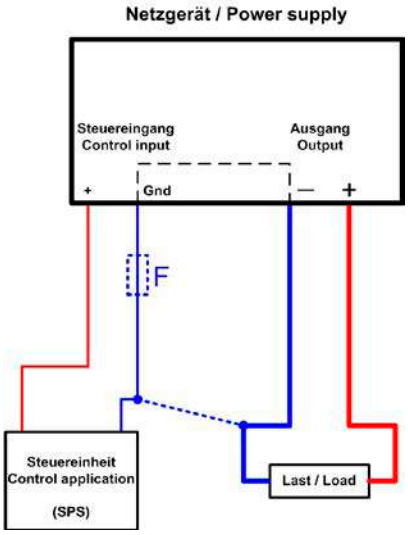


Figure 7

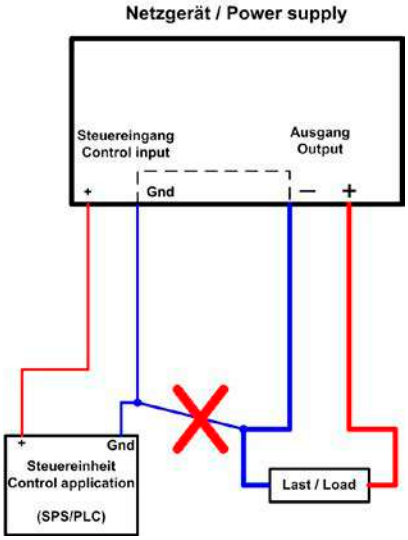


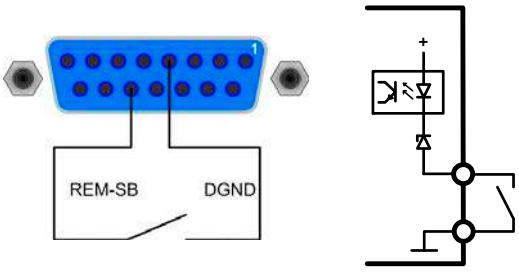
figure 8

output off

Pin "REM-SB" is always operative and does not depend on the remote control mode. It can be used to switch off the output without extra means, except in LOCAL mode which only allows manual control for the device. Switching the output off is done by connecting the pin to ground (DGND) via a low-resistive contact like a switch, open collector transistor or relay.

grade

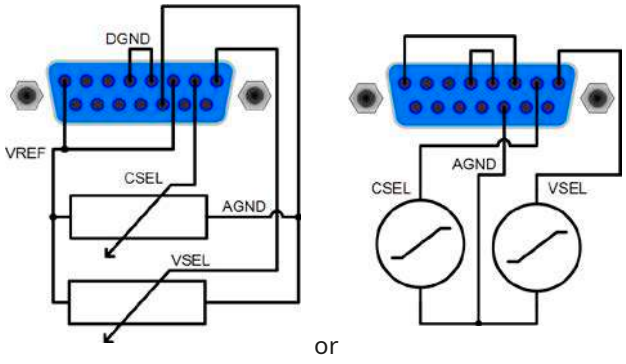
A digital output of, for example, a PLC may not be able to do this correctly, because it might not be low-resistive enough. Always check the technical specifications of your external control application.



Remote control of current and voltage

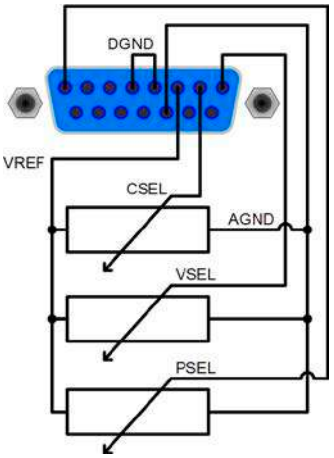
Two potentiometers between VREF and ground, sliders at the inputs VSEL and CSEL. The power supply can be controlled as with the rotary knobs on the front and can either operate as current or voltage source. In compliance with the max. 3mA for the VREF output, potentiometers with at least 10kOhm have to be used.

The power set value is here, for models with power regulation feature, tied to VREF and thus 100%.



Remote control with power

Similar to the example above, but with adjustable power limit (only applicable for models with power adjustment).



10.3 pin specification

Pin code	Surname	Type(1	Description	levels	Electrical specification
1	VSEL	AI	Set value: voltage	0...10V or 0...5V correspond to 0..100% of U_{noun}	Accuracy < 0.2% Impedance R_i>100k
2	CSEL	AI	Set value: current	0...10V or 0...5V correspond to 0..100% of I_{noun}	
3	VREF	oh	Reference voltage	10V or 5V	Accuracy < 0.2% at I_{Max}= +5mA short-circuit-proof against AGND
4	DGND	POT	Reference potential for digital control signals		For +Vcc, control and status signals
5	REMOTE	TUE	Toggle between internal or external control	External = LOW, U_{Low}<1 V Internal = HIGH, U_{High}> 4 V Internal = open	U range = 0 ...30V I $_{Max}$= +1mA at 5V Sender: Open collector against DGND
6	OT/PF	DO	Overtemperature error / Power fail error(4	Error = HIGH, U_{High}> 4V No error = LOW, U_{Low}<1V	Quasi open collector with pull-up to Vcc(2 With 5V at the pin there will be max.+1mA I $_{Max}$ = -10mA at U_{CE}= 0.3V = u_{Max}0...30V Short circuit proof against DGND
7	NC				Not connected
8th	PSEL(3	AI	Set value: power	0...10V or 0...5V correspond to 0..100% of P_{noun}	Accuracy < 0.5% Impedance R_i>100k
9	VMON	oh	Actual value: voltage	0...10V or 0...5V correspond to 0..100% of U_{noun}	Accuracy < 0.2% at I_{Max}= +2mA short-circuit-proof against AGND
10	CMON	oh	Actual voltage: current	0...10V or 0...5V correspond to 0..100% of I_{noun}	
11	AGND	POT	Reference potential for analogue signals		For -SEL, -MON, VREF signals
12	+ Vcc	oh	Auxiliary voltage output (Ref: DGND)	11...13V	I_{Max} = 20mA Short circuit proof against DGND
13	REM SB	TUE	output off	off = LOW, U_{Low}<1V on = HIGH, U_{High}> 4V on = OPEN	U range = 0...30V I_{Max}= +1mA at 5V Sender: Open Collector against DGND
14	original packaging	DO	Overvoltage error	OVP = HIGH, U_{High}> no4V OVP = LOW, U_{Low}<1V	Quasi open collector with pull-up to Vcc(2 With 5V at the pin there will be max.+1mA I_{Max}= -10mA at U_{CE}= 0.3VU_{Max}= 0...30V Short circuit proof against DGND
15	CV	DO	Indication of voltage regulation active	CV = LOW, U_{Low}<1V CC = HIGH, U_{High}>4V	

(1AI = analog input, AO = analog output, DI = digital input, DO = digital output, POT = potential

(2Internal Vcc, approx. 14.3V

(3Only with models from 1kW

(4Power fail = input failure or PFC (reported only since firmware 6.01)

11.Other applications

11.1 Functions of Terminal System Bus

The 8 pole terminal**system bus**is located on the rear and is used to connect leads for remote sense or to wire multiple devices for series or parallel connection.

Pin assignment:

1 : Scythe +

2 : Scythe -

3 : Master output Current

4 : Master output Voltage

5 : Slave input Current 6 :

Slave input Voltage 7 :

Share Bus

8 : Ground

ATTENTION!

The functions of pins 3-8 are only available with models from 1000W output power, except the 720V model where these are available because of safety reasons.

11.1.1 Series connection in master-slave mode

For a series connection, it is recommended to use only devices with identical output current, else the unit with the lowest nominal output current will define the maximum current of the system.

One unit is always the master of the next unit, which becomes slave and master for next one etc. When connecting more than two units, it is recommended to pick one certain unit as master and any other as slave. The slave(s) are controlled by the master via the slave input pins 3 and 4 of the terminal**system bus**. Voltage and current can be controlled simultaneously, but also separately.

For an example wiring see figure 9. Voltage and current are here given by the master. In case only one of both, voltage or current, is going to be controlled, the other set value should be set to 100%.

In order to control the whole system remotely, it is sufficient to control the master via its analogue or digital interface. When reading actual values, the current monitor value will represent the overall system current, but the voltage monitor only the output voltage of the master. In order to get accurate readings, either the actual voltage is multiplied by the number of unit in the series connection (only applicable if all are same type) or all units will have to be read separately.

ATTENTION!

The master unit must always be the one with the lowest potential!

ATTENTION!

In case one of the DC outputs shall be grounded it is advised, for safety reasons, to ground the outputs with the lowest potential, ie the negative (-) output of the master.

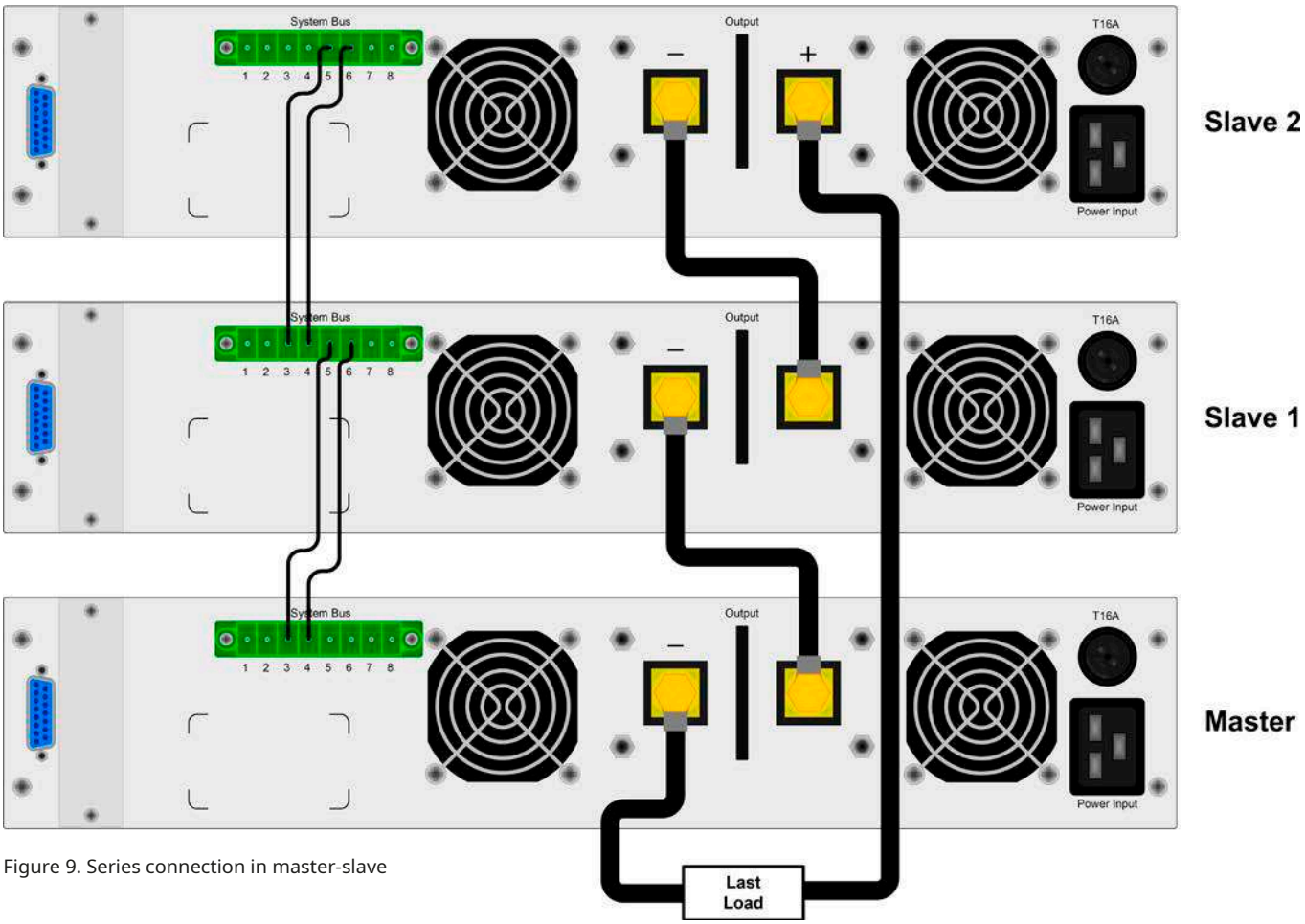
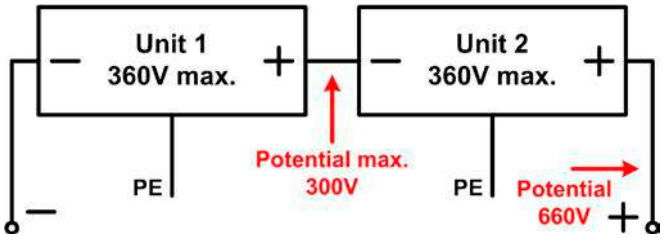


Figure 9. Series connection in master-slave

There are some restrictions and rules to consider because of safety and isolation reasons:

- **The negative DC output pole of no unit in the series connection may be raised to a potential >300V against ground (PE)!**
- **The share bus must not be wired!**
- **The grounds (AGND, DGND) of the analogue interfaces of the units must not be wired to each other!**
- **Remote sense must not be wired!**

Example: Two identical units with 360V nominal voltage, for example PS 8360-15 2U, shall be connected in series. When calculating, the total voltage of that series connection could go up to 720V. Looking at the resulting potentials on the negative outputs of the units, the 2nd unit's negative DC pole could be raised to 360V. This is not permitted! So the lower unit has to be limited to a certain maximum. The figure below clarifies that the resulting total voltage would be 660V:



11.1.2 Parallel connection (Share Bus)

Note: only available with devices from 1kW nominal power!

ATTENTION!

Only units of the same type (voltage and current) must be used for this operation mode.

In order to increase the output current, two or more units of the same type can be connected in parallel, using the Share bus connection.

Following connections are required: connect all (+) DC outputs of the units to each other and all (–) DC outputs to each other. Pin 7 (Share Bus) and pin 8 (Ground) of terminal**system bus** of all units are also connected in parallel. In case remote sense is also required, all Sense+ and all Sense - inputs are connected in parallel and also with the load. Also see the example wiring in figure 9.l

Important: in this connection the unit with the lowest output voltage determines the output voltage of the system. It means that every unit can be in control, depending on the adjusted values. It is thus recommended to select a unit that shall control the system and adjust the set of the other units to maximum.

grade

In case a unit malfunctions or fails due to overheating (OT) or overvoltage (OVP), the whole system can't provide power anymore until the failure is removed.

In order to control the whole system remotely, it is sufficient to control the master via its analogue or digital interface. When reading actual values, the voltage monitor value will represent the overall system voltage, but the current monitor only the output current of the master. In order to get accurate readings, either the actual current is multiplied by the number of units in the parallel connection (only applicable if all have the same nominal output current) or all units will have to be read separately.

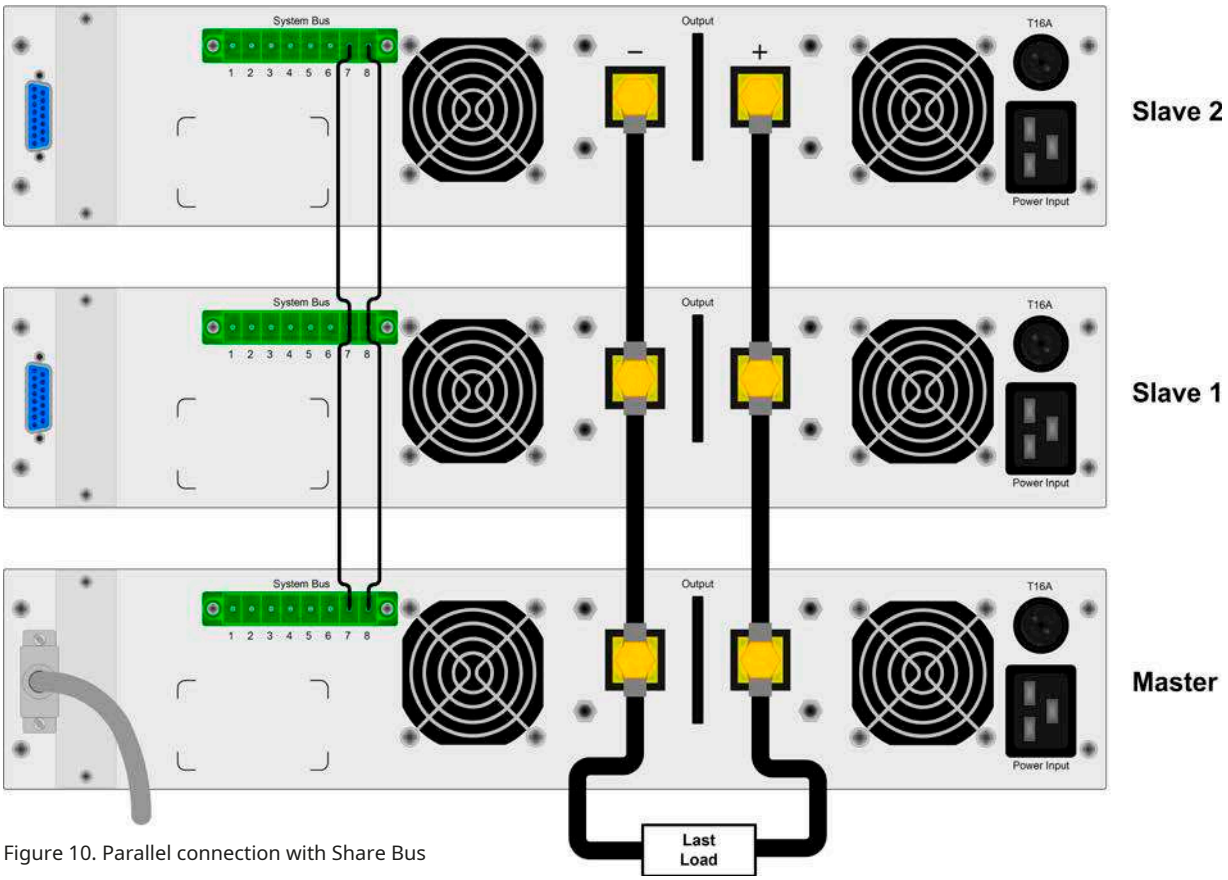


Figure 10. Parallel connection with Share Bus

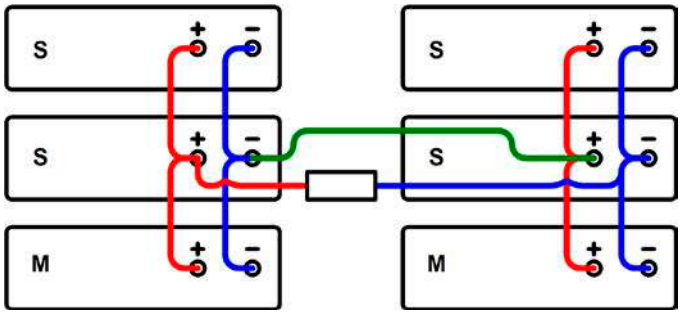
11.1.3 Mixed connections

Mixed connections are parallel and series connections within one system. It is possible to do so, but we advise as follows:

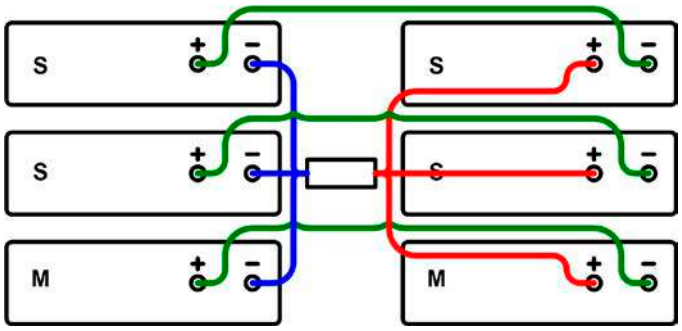
First do the parallel connections, for example 3 units with 65V and 10A each. Then do the series connection (same three units again) in order to gain, for example, a 130V and 30A system.

If running high currents, it is advised to put the load in the middle of parallely connected units, if an odd number.

Recommended



Not recommended



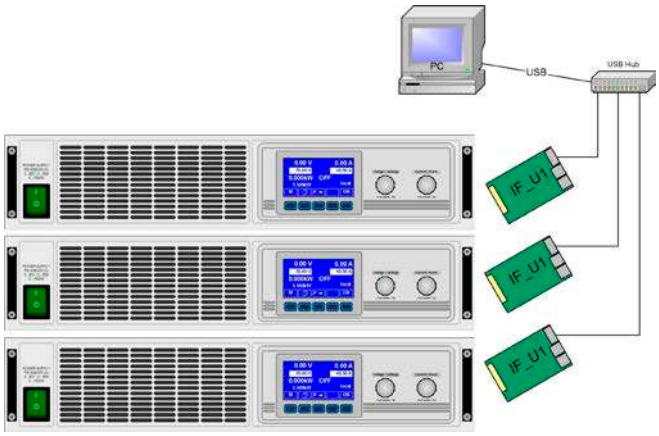


Figure 11. USB or RS232 networking

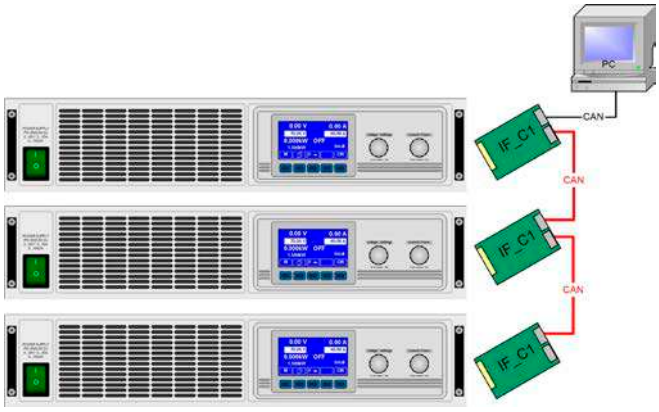


Figure 12. CAN networking example, also applies to GPIB

11.2 Networking

The figures below depict networking examples for the digital control of multiple devices in star-shaped (USB, RS232) or bus-like (CAN, GPIB) configuration.

Limitations and technical specifications of the bus systems and the interfaces apply.

With**USB**up to 30 units can be controlled with one PC, appropriate USB hubs with custom power supply assumed.This basically applies to RS232, too. Differences lie in the handling and the cable lengths.

With**CAN**up to 30 power supplies per address segment can be integrated into a new or existing CAN bus system. They are addressed by the device node and the RID.

With**GPIB**there is a limitation of max. 15 units on one bus, controlled by a GPIB master. Multiple GPIB masters can be installed in a PC in order to increase the number of addressable units.

12. Miscellaneous

12.1 Accessories and options

Note: Details about options and accessories are available in separate user instruction manuals.

The following accessories are optionally available:

a) USB-to-Analogue interface UTA12

Galvanically isolated remote control via USB (on PC side) and the device internal analogue interface.

b) digital interface cards

Pluggable and retrofittable, digital interface cards for USB, RS232, CAN, GPIB/IEEE (SCPI only), Profibus or Ethernet/ LAN (SCPI only) are available. Details about the interfaces can be found in the interface cards user manual.

The following options are available:

a) High-speed ramping

Increased dynamics of the output voltage by reduced output capacity. It must be pointed out, that other output related values also increase! This is a permanent modification which is not switchable.

b) Internal, active load with car ignition sequence

This internal module, also called two-quadrants module, offers a power sink up to 150W continuous or approx. 2400W pulse peak. The main purpose is to discharge the device's output capacities faster than usual and thus to increase the dynamic behavior of the output voltage, without worsen other output values. A second feature is the built-in car ignition sequence emulation which can be triggered by a button or remote signal. This is primarily used in the automotive industry. The module can be deactivated by a switch.

This option is available for models from 1000W nominal power and up to 400V nominal voltage.

12.2 Firmware updates

A firmware update of the device should only be done if the device shows erroneous behavior or if new features have been implemented.

In order to update a device, it requires a certain digital interface card, a new firmware file and a Windows software called "Update tool".

These interfaces are qualified to be used for a firmware update:

- IF-U1 (USB)
- IF-R1 (RS232)
- IF-E1 (Ethernet/USB)
- IF-PB1 (Profibus/USB)

In case none of the above interface types is at hand, the device cannot be updated. Please contact your dealer for a solution.

The update tool and the particular firmware file for your device are obtainable from the website of the device manufacturer, or are mailed upod request. The update too will guide the user through the semi-automatic update process.

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