



操作说明书 Instruction Manual

PS 8000 2U Laboratory Power Supply




本图片为标准2U版产品 / 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		



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严禁再版、复印或部分错误地使用该说明书，否则将承担该行为导致的法律后果。

 **有生命危险!**

危险电压

本产品输出电压可能上升至危险级别 ($>60V_{DC}$)!

产品上所有带电元件必须有外遮盖。输出端的所有操作必须在产品与主电源（电源开关关闭）断开时才能执行，且可只有受过训过电流危险知识的专业人员执行此类操作。负载与本产品间的任何连接必须有防碰擦装置。连到功率输出端的应用设备必须配置好，并且有保险丝熔断保护，这样可防止使用过程中由于过载或误操作损坏产品或更严重事情发生。

 **注意!**

产品或输出关闭后，直流输出端在一定时间内仍存在危险电压!

 **请谨记**

- 请仅在铭板标示电压下操作本产品。
- 请勿将任何机械零件，特别是金属件，插入通风孔内。
- 请不要在本产品周围使用任何液体物质，以免进入产品内。
- 请勿将高于电源供应器额定电压的电压源连接到产品上。
- 从后板插槽安装接口卡时，请遵循一般防静电规则。
- 只能在产品完全关闭（电源开关为关闭状态）后插入和取出接口卡。
- 产品老化以及超负荷使用都可能导致如按钮、旋钮类的产品控制件操作不稳定。
- 请勿将电压源反接到直流输出端！产品可能会被损坏。
- 请勿将那些可能会产生高于产品额定电压的电压源连到直流输出端！

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1. 介绍

实验室用PS 8000 2U系列电源供应器为19“外壳，适用于测试系统和工业控制设备。

除具备电源供应器的标准功能外，用户还可定义和恢复5组不同的预设值，或利用内置模拟接口的功能，该接口可在0...5V或0...10V普通电压范围下工作。从而可完全在遥控状态下轻易地监控本产品。

您还可选择各种数字接口卡通过电脑执行更宽范围的控制和监控功能。

1000W型号以上产品配有可调功率调整线路（有两个选择，见规格参数表），还有“System Bus”端子，通过它可实现主-从模式下的串联或共享总线模式下的并联。

通过接口卡可方便地将产品融入现有系统，且完全不需配置卡或仅做少数几个设定。

电源通过模拟接口可连接其它电源供应器，并藉由该接口来控制他们。或通过外部控制系统，如编程器，来控制 and 监控。

本产品由微处理器控制，使得产品能准确、快速地测量和显示出各实际值。

主功能一览：

- 设置0...100%范围的设定电压和电流
- 0...110% U_{Nom} 可调过压极限
- 可拔插式接口卡 (CAN, USB, RS232, IEEE/GPIB, Ethernet/LAN, Profibus)
- 外控用模拟接口，0...5V或0...10V（可选）对应0...100%数值
- 功率级别分别为640W, 1000W, 1500W 和 3000W
- 温控风扇
- 状态指示灯 (OT, OVP, CC, CV, CP)
- 5组可选内存集
- 串联（1kW型号起，720V产品除外）
- 共享总线操作（并联），（1kW以上型号）
- Vector™兼容的CAN系统
- 免费的Windows软件
- LabView™ VIs

2. 技术规格

2.1 控制面板和显示器

型号

显示： 202 x 32点阵显示
分为三个区域

旋钮： 2个旋钮，9+2个按钮

显示格式

额定值决定最大可调范围。

实际电压和电流同时显示，（1kW以上型号）过压极限设定值，电压、电流和功率限定值则分别显示。

电压值显示

分辨率： 4位
格式： 0.00V...99.99V
0.0V...999.9V

电流值显示

分辨率： 4位数
格式： 0.000A...9.999A
0.00A...99.9A
0.0A...999.9A

功率值显示 (1kW以上型号)

分辨率： 4位数
格式： 0.000kW...9.999kW

2.2 技术规格

	PS 8032-20 2U	PS 8065-10 2U	PS 8160-04 2U	PS 8080-40 2U
电源输入				
输入电压	90...264V AC	90...264V AC	90...264V AC	90...264V AC
输入电压功率降额	-	-	-	-
230V时输入电流	max. 3.2A	max. 3.4A	max. 3.2A	max. 4.8A
100V时输入电流	max. 7.5A	max. 7.5A	max. 7.5A	max. 11.4A
输入频率	45...65Hz	45...65Hz	45...65Hz	45...65Hz
输入保险丝	T 8A	T 8A	T 8A	T 16A
功率因数	> 0.99	> 0.99	> 0.99	> 0.99
输出 - 电压				
额定电压 U_{Nom}	32V	65V	160V	80V
可调范围	0V... U_{Nom}	0V... U_{Nom}	0V... U_{Nom}	0V... U_{Nom}
市电波动范围在 $\pm 10\%$ ΔU_{IN} 时的稳定度	< 0.02%	< 0.02%	< 0.02%	< 0.02%
满载10...90%时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%
纹波 @ BWL 20MHz	< 100mV _{PP} < 8mV _{RMS}	< 150mV _{PP} < 10mV _{RMS}	< 120mV _{PP} < 20mV _{RMS}	< 10mV _{PP} < 4mV _{RMS}
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	10mV	10mV	100mV	10mV
远程感测补偿	max. 2V	max. 2V	max. 2V	max. 2.5V
过压保护门限 (可调)	0...35.2V	0...71.5V	0...176V	0...88V
输出 - 电流				
额定电流 I_{Nom}	20A	10A	4A	40A
可调范围	0... I_{Nom}	0... I_{Nom}	0... I_{Nom}	0... I_{Nom}
市电波动范围在 $\pm 10\%$ ΔU_{IN} 时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%
满载0...100% ΔU_{OUT} 时的稳定度	< 0.15%	< 0.15%	< 0.15%	< 0.15%
纹波 @ BWL 20MHz	< 65mA _{PP} < 10mA _{RMS}	< 25mA _{PP} < 3mA _{RMS}	< 3mA _{PP} < 1mA _{RMS}	< 19mA _{PP} < 7mA _{RMS}
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	10mA	10mA	1mA	10mA
负载从10...90%瞬态恢复时间	< 2ms	< 2ms	< 2ms	< 2ms
输出 - 功率				
额定功率 P_{Nom}	640W	650W	640W	1000W
电压<150V U_{IN} 时的额定功率	-	-	-	-
精确度*	-	-	-	0... P_{Nom}
可调范围	-	-	-	≤ 1%
调节分辨率	-	-	-	1W
最大效率	90.5%	91.0%	92.0%	93.0%
其它				
环境温度	0...40°C	0...40°C	0...40°C	0...40°C
储存温度	-20...70°C	-20...70°C	-20...70°C	-20...70°C
相对湿度	< 80%	< 80%	< 80%	< 80%
标准型号的尺寸 (W×H×D)	19" 2U 380mm	19" 2U 380mm	19" 2U 380mm	19" 2U 460mm
带ZH选项功能的尺寸 (W×H×D)	-	-	-	19" 2U 460mm
标准型号的重量	9.5kg	9.5kg	9.5kg	11.5kg
带ZH选项功能的重量	-	-	-	13kg
输出正极对外壳的隔离电压	500V	500V	500V	500V
输出负极对外壳的隔离电压	300V DC			
输入<->输出的绝缘耐压	4200V			
制冷方式	风扇制冷, 入风孔在产品前板, 排风孔在后板			
安全标准	EN 60950, EN 61326, EN 55022 Class B			
过压等级	2			
保护等级	1			
污染等级	2			
工作高度	< 2000m			
串联				
串联允许最大电压	600V			
主-从联接	no			
并联				
并联允许最大电压	720V			
主-从联接	有, 经Share bus			
模拟编程				
输入电压范围	0...5V 或 0...10V, 可选			
精确度	≤ 0.2%			
产品编号	09230130	09230131	09230132	09230133

* 与额定值有关, 该精确度决定设定值与实际值间允许最大误差。

举例: 一台80V型号产品的电压精确度最少为0.2%, 即为160mV。当设定5V电压时, 且允许最大误差为160mV, 故得出实际值可能在4.84V和5.16V之间。

	PS 8040-60 2U	PS 8080-60 2U	PS 8360-15 2U	PS 8040-120 2U
电源输入				
输入电压	90...264V AC	90...264V AC	90...264V AC	180...264V AC
输入电压功率降额	90...150V AC	90...150V AC	90...150V AC	180...207V AC
230V时输入电流	max. 7.5A	max. 7.5A	max. 7.5A	max. 15A
100V时输入电流	max. 11.4A	max. 11.4A	max. 11.4A	-
输入频率	45...65Hz	45...65Hz	45...65Hz	45...65Hz
输入保险丝	T 16A	T 16A	T 16A	T 16A
功率因数	> 0.99	> 0.99	> 0.99	> 0.99
输出 - 电压				
额定电压 U_{Nom}	40V	80V	360V	40V
可调范围	0V... U_{Nom}	0V... U_{Nom}	0V... U_{Nom}	0V... U_{Nom}
市电波动范围在 $\pm 10\% \Delta U_{IN}$ 时的稳定度	< 0.02%	< 0.02%	< 0.02%	< 0.02%
带载10...90%时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%
纹波 @ BWL 20MHz	< 10mV _{pp} < 4mV _{RMS}	< 10mV _{pp} < 4mV _{RMS}	< 50mV _{pp} < 8mV _{RMS}	< 10mV _{pp} < 5mV _{RMS}
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	10mV	10mV	100mV	10mV
远程感测补偿	max. 2.5V	max. 2.5V	max. 8V	max. 2.5V
过压保护门限 (可调)	0...44V	0...88V	0...396V	0...44V
输出 - 电流				
额定电流 I_{Nom}	60A	60A	15A	120A
可调范围	0... I_{Nom}	0... I_{Nom}	0... I_{Nom}	0... I_{Nom}
市电波动范围在 $\pm 10\% \Delta U_{IN}$ 时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%
带载0...100% ΔU_{OUT} 时的稳定度	< 0.15%	< 0.15%	< 0.15%	< 0.15%
纹波 @ BWL 20MHz	< 19mA _{pp} < 7mA _{RMS}	< 19mA _{pp} < 7mA _{RMS}	< 1mA _{pp} < 0.45mA _{RMS}	< 25mA _{pp} < 9mA _{RMS}
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	10mA	10mA	10mA	100mA
负载从10...90%瞬态恢复时间	< 2ms	< 2ms	< 2ms	< 2ms
输出 - 功率				
额定功率 P_{Nom}	1500W	1500W	1500W	3000W
电压<150V U_{in} 时的额定功率	1000W	1000W	1000W	2500W
精确度*	0... P_{Nom}	0... P_{Nom}	0... P_{Nom}	0... P_{Nom}
可调范围	≤ 1%	≤ 1%	≤ 1%	≤ 1%
调节分辨率	1W	1W	1W	1W
最大效率	93.0%	93.0%	93.0%	93.0%
其它				
环境温度	0...40°C	0...40°C	0...40°C	0...40°C
储存温度	-20...70°C	-20...70°C	-20...70°C	-20...70°C
相对湿度	< 80%	< 80%	< 80%	< 80%
标准型号的尺寸 (W×H×D)	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm
带ZH选项功能的尺寸 (W×H×D)	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm	19" 4U 460mm
标准型号的重量	11.5kg	11.5kg	11.5kg	14.7kg
带ZH选项功能的重量	13kg	13kg	13kg	17kg
输出正极对外壳的隔离电压	500V	500V	500V	500V
输出负极对外壳的隔离电压	300V DC			
输入<->输出的绝缘耐压	4200V			
制冷方式	风扇制冷, 入风孔在产品前板, 排风孔在后板			
安全标准	EN 60950, EN 61326, EN 55022 Class B			
过压等级	2			
保护等级	1			
污染等级	2			
工作高度	< 2000m			
串联				
串联允许最大电压	600V			
主-从联接	no			
并联				
并联允许最大电压	720V			
主-从联接	有, 经Share bus			
模拟编程				
输入电压范围	0...5V 或 0...10V, 可选			
精确度	≤ 0.2%			
产品编号	09230144	09230134	09230137	09230145

* 与额定值有关, 该精确度决定设定值与实际值间允许最大误差。

举例: 一台80V型号产品的电压精确度最少为0.2%, 即为160mV。当设定5V电压时, 且允许最大误差为160mV, 故得出实际值可能在4.84V和5.16V之间。

	PS 8080-120 2U	PS 8160-60 2U	PS 8360-30 2U	PS 8720-15 2U
电源输入				
输入电压	180...264V AC	180...264V AC	180...264V AC	180...264V AC
输入电压功率降额	180...207V AC	180...207V AC	180...207V AC	180...207V AC
230V时输入电流	max. 15A	max. 15A	max. 15A	max. 15A
100V时输入电流	-	-	-	-
输入频率	45...65Hz	45...65Hz	45...65Hz	45...65Hz
输入保险丝	T 16A	T 16A	T 16A	T 16A
功率因数	> 0.99	> 0.99	> 0.99	> 0.99
输出 - 电压				
额定电压 U_{Nom}	80V	160V	360V	720V
可调范围	0V... U_{Nom}	0V... U_{Nom}	0V... U_{Nom}	0V... U_{Nom}
市电波动范围在 $\pm 10\%$ ΔU_{IN} 时的稳定度	< 0.02%	< 0.02%	< 0.02%	< 0.02%
带载10...90%时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%
纹波 @ BWL 20MHz	< 10mV _{PP} < 5mV _{RMS}	< 20mV _{PP} < 10mV _{RMS}	< 30mV _{PP} < 12mV _{RMS}	< 50mV _{PP} < 20mV _{RMS}
精确度*	$\leq 0.2\%$	$\leq 0.2\%$	$\leq 0.2\%$	$\leq 0.2\%$
显示器分辨率	10mV	100mV	100mV	100mV
远程感测补偿	max. 2.5V	max. 5V	max. 8V	max. 16V
过压保护门限 (可调)	0...88V	0...176V	0...396V	0...792V
输出 - 电流				
额定电流 I_{Nom}	120A	60A	30A	15A
可调范围	0... I_{Nom}	0... I_{Nom}	0... I_{Nom}	0... I_{Nom}
市电波动范围在 $\pm 10\%$ ΔU_{IN} 时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%
带载0...100% ΔU_{OUT} 时的稳定度	< 0.15%	< 0.15%	< 0.15%	< 0.15%
纹波 @ BWL 20MHz	< 25mA _{PP} < 9mA _{RMS}	< 18mA _{PP} < 6mA _{RMS}	< 60mA _{PP} < 21mA _{RMS}	< 2mA _{PP} < 1mA _{RMS}
精确度*	$\leq 0.2\%$	$\leq 0.2\%$	$\leq 0.2\%$	$\leq 0.2\%$
显示器分辨率	100mA	10mA	10mA	10mA
负载从10...90%瞬态恢复时间	< 2ms	< 2ms	< 2ms	< 2ms
输出 - 功率				
额定功率 P_{Nom}	3000W	3000W	3000W	3000W
电压<150V U_{IN} 时的额定功率	2500W	2500W	2500W	2500W
精确度*	0... P_{Nom}	0... P_{Nom}	0... P_{Nom}	0... P_{Nom}
可调范围	$\leq 1\%$	$\leq 1\%$	$\leq 1\%$	$\leq 1\%$
调节分辨率	1W	1W	1W	1W
最大效率	93.0%	93.0%	93.0%	93.0%
其它				
环境温度	0...40°C	0...40°C	0...40°C	0...40°C
储存温度	-20...70°C	-20...70°C	-20...70°C	-20...70°C
相对湿度	< 80%	< 80%	< 80%	< 80%
标准型号的尺寸 (W×H×D)	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm	19" 2U 460mm
带ZH选项功能的尺寸 (W×H×D)	19" 4U 460mm	19" 4U 460mm	19" 4U 460mm	-
标准型号的重量	14.7kg	14.7kg	14.7kg	14.7kg
带ZH选项功能的重量	17kg	17kg	17kg	-
输出正极对外壳的隔离电压	500V	500V	500V	1000V
输出负极对外壳的隔离电压	300V DC			
输入<->输出的绝缘耐压	4200V			
制冷方式	风扇制冷, 入风孔在产品前板, 排风孔在后板			
安全标准	EN 60950, EN 61326, EN 55022 Class B			
过压等级	2			
保护等级	1			
污染等级	2			
工作高度	< 2000m			
串联				
串联允许最大电压	600V			
主-从联接	no			
并联				
并联允许最大电压	720V			
主-从联接	有, 经Share bus			
模拟编程				
输入电压范围	0...5V 或 0...10V, 可选			
精确度	$\leq 0.2\%$			
产品编号	09230135	09230136	09230138	09230139

* 与额定值有关, 该精确度决定设定值与实际值间允许最大误差。

举例: 一台80V型号产品的电压精确度最少为0.2%, 即为160mV。当设定5V电压时, 且允许最大误差为160mV, 故得出实际值可能在4.84V和5.16V之间。

3. 产品描述

3.1 各面视图

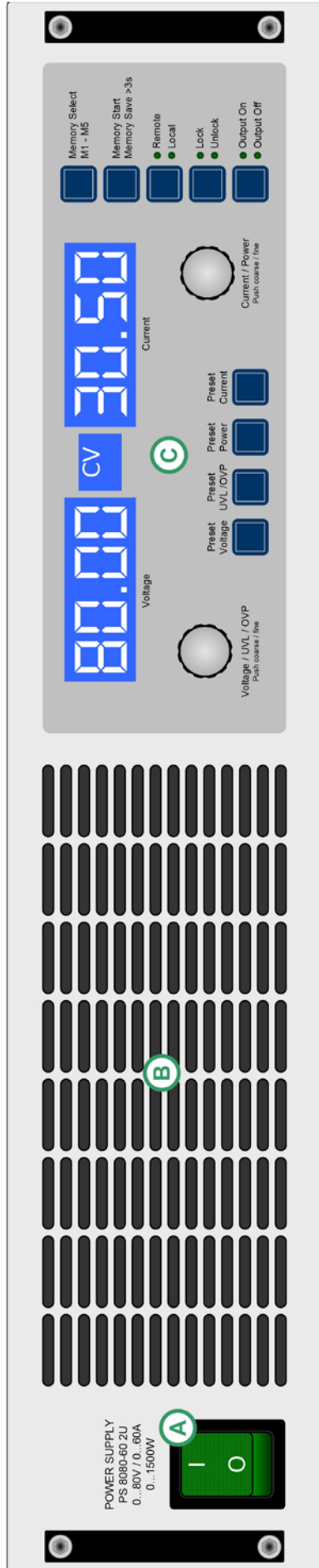


图 1. 标准2U型号的前视图，带ZH选项功能的则有不同

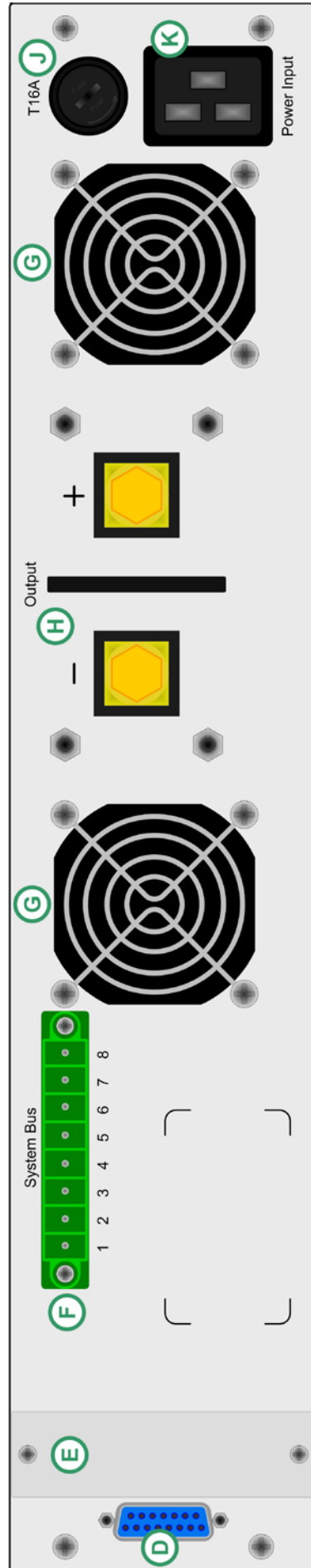


图 2. 标准2U型号的后视图

系统总线各引脚说明（请参阅11.1章节了解重要详情）：

- 1 - 感测 +
- 2 - 感测 -
- 3 - 主机输出电流
- 4 - 主机输出电压
- 5 - 从机输入电流
- 6 - 从机输入电压
- 7 - 共享总线
- 8 - 地

图解：

- A - 电源开关
- B - 通风槽
- C - 控制面板
- D - 模拟接口，15个引脚，母座
- E - 外接数字接口卡插槽
- F - 系统总线
- G - 风扇
- H - 电源输出端，M8螺旋式接线柱
- J - 输入保险丝（具体规格请参考“2. 技术规格”）
- K - 电源输入插座，3个引脚，IEC 60320

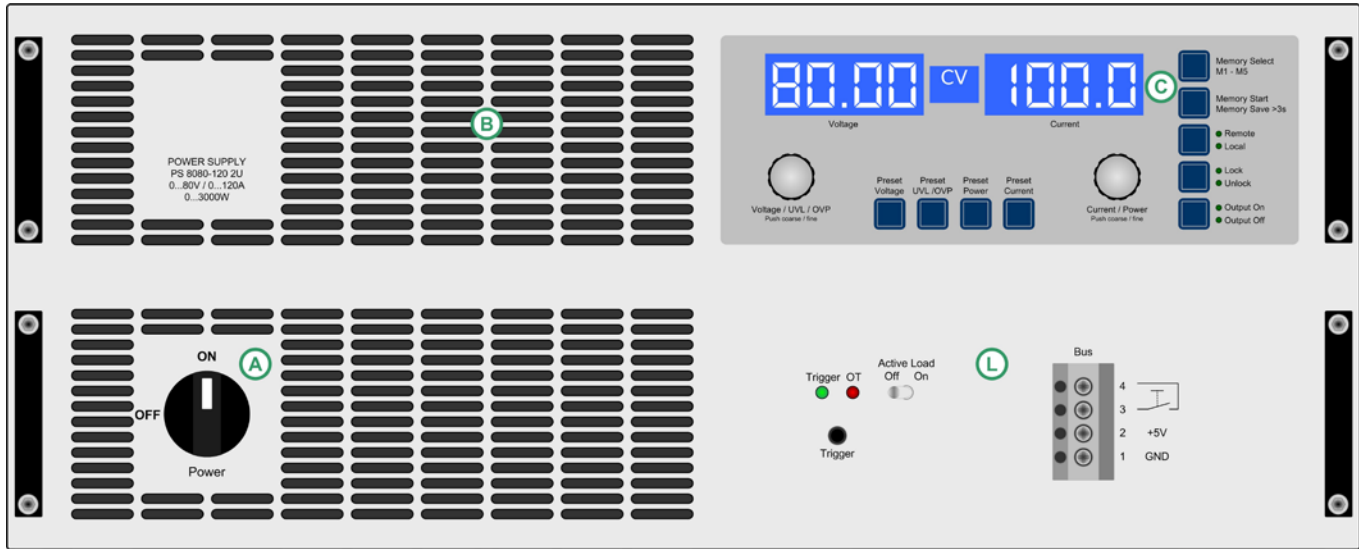


图 3. 带ZH选项功能的4U产品前视图

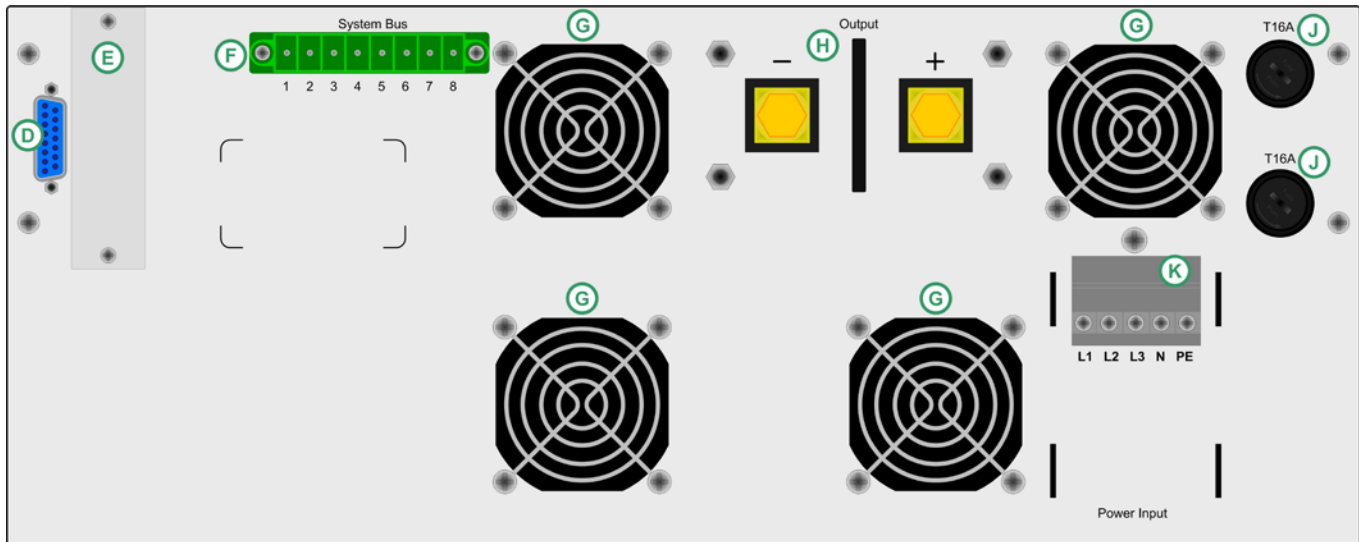


图 4. 4U产品后视图

图解:

- A- 电源开关
- B - 通风槽
- C - 控制面板
- D - 模拟接口, 15个引脚, 母座
- E - 外接数字接口卡插槽
- F- System Bus系统总线
- G - 风扇
- H - 电源输出端, M8螺旋式接线柱
- J- 输入保险丝 (具体规格请参考„2. 技术规格“)
- K - 电源输入插座 (见章节 5.3)
- L- 带ZH选项功能的控制面板

System Bus-系统总线各引脚说明 (请参阅11.1章节了解详情) :

- 1 - 感测 +
- 2 - 感测 -
- 3 - 主机输出电流
- 4 - 主机输出电压
- 5 - 从机输入电流
- 6 - 从机输入电压
- 7 - Share Bus-共享总线
- 8 - 地

3.2 供应清单

- 1 x 电源供应器
- 1 x 印刷版使用说明书
- 1 x 电源线 (仅2U型号产品有)
- 1 x 系统总线插头

4. 一般信息

4.1 序言/安全警告

本说明书和本设备专给对本电源有基本了解的人士使用。不应给无基本电器知识的人士操作，因本说明书未作此方面解释。操作不当和未遵守安全说明的操作可能导致仪器损坏或丧失保修的权利！

4.2 制冷

前板进风孔和后板排风孔必须保持干净，以保证良好的冷却效果。注意产品(后方)要与周围摆放的任何物体保持至少10cm距离，以保证空气通畅。

4.3 操作产品

打开该产品或用工具从内部取出零件时可能有高压触电的危险。必须将该产品与主电源断开后方可进行，否则用户自行承担风险。

只有受过电流危险知识训练的人员才可进行相关的维护或修理。

5. 安装

5.1 目检

收到产品后，请检查是否有外观受损痕迹。如发现，请不要操作该产品，应立即联系您的供应商。

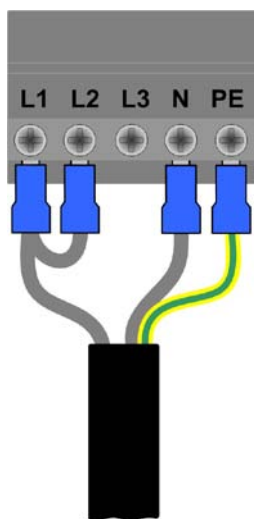
5.2 与市电的连接

本产品通过电源线接地。故要与带接地片的电源插座联合使用。且中间不可使用无地线的延伸线！

使用5x20mm的保险丝(具体规格请参考技术规格表)，从后面板可拆装更换。

5.3 4U型号的市电连接

尽管4U产品有一三相输入端，但却使用普通的230V供电电压(L+N+PE)。鉴于安全考虑不允许接三相输入电压。而连接L1和L2，加上N和PE。故输入端接线必须如下图所示：



5.4 直流输入端

电源输出端位于产品后面。

产品输入端并无容丝装置。为避免馈源损坏负载设备，应随时注意电子负载器的额定值。

负载线的直径由多个条件而定，如：输出电流，连线长度和环境温度。

我们建议使用1.5米以下长度的连线：

10A以下：	0,75mm ²	15A以下：	1,5mm ²
30A以下：	4mm ²	40A以下：	6mm ²
60A以下：	16mm ²	120A以下：	35mm ²

针对每根线(弹性线)。

输入“+”和“-”极未接地，若有需要，可将其中一极接地。

注意！

将其中一输出极接地时，请随时检查负载(如电子负载)的其中一极是否也已接地。否则将引起短路！

注意！

串联时注意输出极的电位转移！此时仅建议带最低电位的极点接地。

5.5 “感测”端(远程感测)

为补偿负载线(每根线最大1.1V)上的压降，电源可“感测”负载的电压，而不是其输出端的。然后调整输出电压，从而提供所需电压给负载。

感测线连接到后面“System Bus”端的1和2引脚上。见章节„3.1 各面视图“。

注意！

(+) 感测端只能与负载设备(+)端相连，(-)感测端与(-)端相连！否则会损坏两头的产品。

其它信息请见章节„7.7 远程感测被激活“。

5.6 接口卡插槽

本产品配有接口卡。接口卡插槽位于产品后面。关于接口卡的更多信息见章节„9. 数字接口卡“。

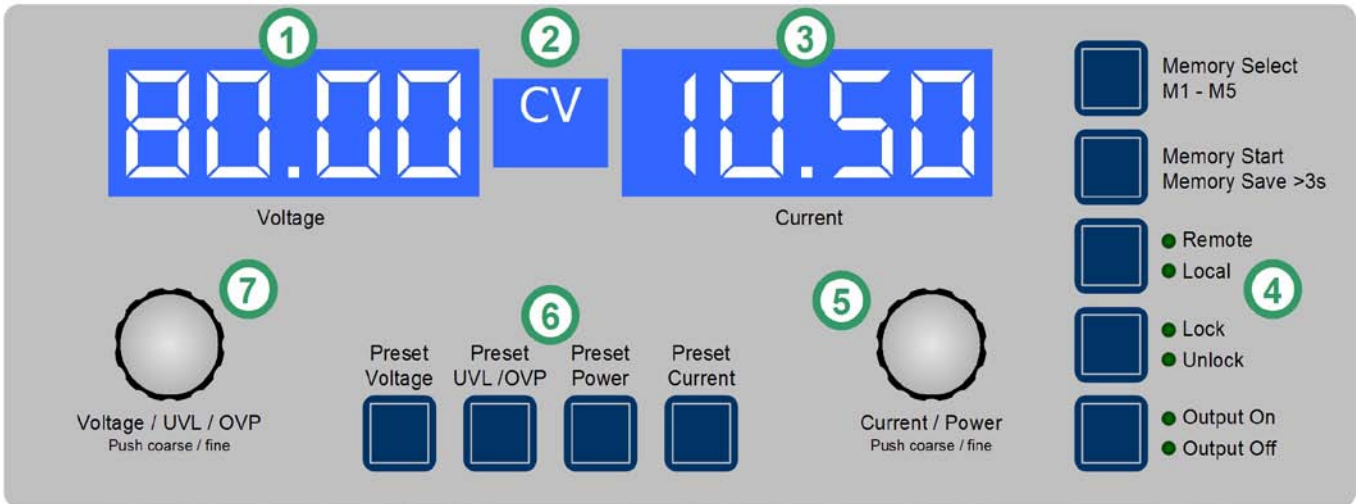


图 5. 控制面板

6. 操作

6.1 显示

图5描述了点阵显示和控制面板总图。正常操作期间，显示区域展示实际电压（右边）和电流值（左边），以及产品状态（中间）。在预设模式下，左显示区域显示电压设定值（预设电压），过压保护阈值（预设OVP）欠压极限设定值（预设UVL）。右显示区域显示电流设定值（预设电流）或功率设定值（预设功率，仅从1kW型号起）。在产品设置模式下显示可调参数和设定。

中间区域显示的状态如下：

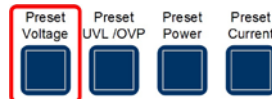
- CV** - 恒压调整（仅当输出为“on”时）
- OT** - 过温错误
- OVP** - 过压错误
- CC** - 恒流调整（仅当输出为“on”时）
- CP** - 恒功率调整（仅当输出为“on”时）
- Fine** - 两旋钮启用时作精调
- PF** - 电源故障（输入电压故障，自6.0固件版本后方显示）

图解：

- (1) - 左显示区域：实际电压或V, UVL, OVP的设定值。
- (2) - 状态区域：显示状态，如CC, CV等。
- (3) - 右显示区域：实际电流或I, P的设定值。
- (4) - 控制按钮：设定产品条件等。
- (5) - 右旋钮：调节I和P设定值，以及在产品设定模式下的各项设定。
- (6) - 预设按钮：转为显示设定值。
- (7) - 左旋钮：调节V、UVL和OVP设定值，以及产品设定模式下的各项参数。

6.2 控制面板各按钮

6.2.1 Preset Voltage按钮



正常操作模式下，该按钮可将实际输出电压值的显示转为预设输出电压值的显示（即：预设模式）。左显示区域将显示如下：



预设模式下，左旋钮(**Voltage / UVL / OVP**)用来调节设定电压，其操作与在正常操作方式下的一样。调节值会立即传输到输出端！

! 提示

设定值的调节由欠压阈值UVL限制。见章节6.2.2。

按两下该按钮立即退出预设模式，或者，如果没按预设按钮或有任一设定值被更改，则5s后自动退出。

由模拟或数字接口控制的远程控制模式下，可用预设模式检测远程输入的电压设定值。

用**LOCK**键可锁定该按钮。见章节6.2.8详述。

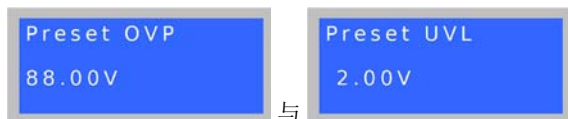
内存集选择模式下，利用该按钮可转为显示所选内存集的电压设定值，但是不会传输到输出端。左显示区域将显示如下：



6.2.2 Preset UVL / OVP按钮



正常操作模式下，利用该按钮可将欠压极限（按一下）或过压保护阈值（按两下）实际值的显示转为其设定值的显示（预设模式）。左显示区域将显示如下：



欠压极限(UVL)仅仅是输出电压的调节极限。意思是，如果UVL设为0以外的任何值，则只能将电压设定值下调，最低至UVL值。同样，UVL值只能往上调，最高至电压设定值。

左旋钮(Voltage / UVL / OVP)用来调节0... U_{Set} 范围内的UVL值。

按两下按钮，转为显示过压保护阈值预设值(OVP)。这个数值始终在0...110% U_{Nom} 范围内。

按三下按钮立即退出预设模式，或者，如果没按预设按钮或有任一设定值被更改，则5s后自动退出。

由数字接口控制的远程控制模式下，可用预设模式检测远程输入的OVP设定值。

用LOCK键可锁定该按钮。见章节6.2.8详述。

在内存集选择模式下，利用该按钮可转为显示所选内存集的UVL值或OVP值，但是不会立即生效。左显示区域将显示如下：



6.2.3 Preset Power按钮



正常操作模式下，该按钮可将实际电流值的显示转为输出功率预设值（预设模式）。

只有1kW以上型号才有可调功率调整功能，右显示区域将显示如下：



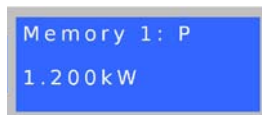
预设模式下，右旋钮(Current / Power)用来调节0...100% P_{Nom} 范围内的功率设定值。调节值会立即传输到输出端！

按两下该按钮立即退出预设模式，或者，如果没按预设按钮或有任一设定值被更改，则5s后自动退出。

用LOCK键可锁定该按钮。见章节6.2.8详述。

由模拟或数字接口控制的远程控制模式下，可用预设模式检测远程输入的功率设定值。

内存选择模式下，用该按钮可转为显示所选内存集的功率设定值（仅针对1kW以上型号），但是不会传输到输出端。右显示区域将显示如下：



6.2.4 Preset Current按钮



正常操作模式下，该按钮可将实际输出电流值的显示转为预设输出电流值（预设模式）。以上多数型号都有可调功率调整。

右显示区域将显示如下：



预设模式下，右旋钮(Current / Power)可在正常操作模式下一样，调节0...100% I_{Nom} 范围内的电流设定值。调节值会立即传输到输出端！

按两下该按钮立即退出预设模式，或者，如果没按预设按钮或有任一设定值被更改，则5s后自动退出。

由模拟或数字接口控制的远程控制模式下，可用预设模式检测远程输入的电流设定值。

用LOCK键可锁定该按钮。见章节6.2.8详述。

内存选择模式下，用该按钮可转为显示所选内存集的电流设定值，但是不会传输到输出端。右显示区域将显示如下：



6.2.5 Memory Select M1-M5按钮



该按钮在5个内存集之间循环，每个内存集都含有U、I、P、以及UVL和OVP的设定值。在这儿可编辑、存储或提交所选内存集。该按钮只有在输出为off时才工作。内存模式和所选内存集编号显示如下：



用该按钮用户可执行下列操作：

a) 调节数值

输出关闭，短按按钮，显示器变为第一个内存集，如上所示。

现在可调节所选内存集的U(左)和I(右)设定值。推动相应预设按钮可访问其它可调值。

再按按钮，会循环显示至内存集编号5，然后退出内存模式。

调节后数值一直保留，只要产品为关闭状态，但是不会提交给输出设定值，也不保存！保存它们请见章节6.2.6。

用LOCK键可锁定该按钮。见章节6.2.8详述。

6.2.6 Memory Start / Memory Save >3s按钮



Memory Start
Memory Save >3s

该按钮用来将选好的内存集值提交给输出端，或将内存保存于内置集内。该按钮只有当输出为**off**时才工作。

该按钮还有下列选项功能：

b) 仅提交

输出关闭，选择内存集(1-5)，短按按钮 --> 内存集值提交给输出端，然后退出内存模式。要使用新的设定值，先用**Output On**按钮或远程控制打开输出。



提示

提交设定值不会保存它们！

c) 仅存储

输出关闭，选择一个或多个内存集，按需要调节数值，按住该按钮超过**3s**以上 --> 所有内存集被保存，但不会提交给输出。输出仍为关闭状态，保存内存集后退出内存模式。

也可利用数字接口（除GPIB外）通过远程控制和相应指令来定义内存集，并被即时存储。

用**LOCK**键可锁定该按钮。见章节6.2.8详述。

6.2.7 Local按钮



Remote
Local

本按钮激活或终止LOCAL模式。在LOCAL模式下不可进入远程控制模式。LOCAL模式由“Local”灯指示。只要LOCAL未激活，“Remote”灯就显示产品通过模拟或数字接口处于远程控制模式。

用**LOCK**键可锁定该按钮。见章节6.2.8详述。



提示

激活LOCAL模式将会即刻从远程控制模式退出（模拟或数字控制），并锁定产品，不再允许继续远程控制产品，直到再次退出LOCAL模式。



提示

LOCAL模式只是暂时的，关闭产品后不会保存。

6.2.8 Lock / Unlock按钮



Lock
Unlock

本按钮激活/终止控制面板锁定。LOCK模式下锁定所有的按钮，除LOCK按钮外。锁定控制面板可防止无意使用按钮和旋钮。



提示

激活LOCK模式会即刻退出任何预设或记忆模式，如果有任何此类模式被激活。显示器会返回实际值的正常显示。



提示

自6.02版固件版本的产品，当产品关闭时LOCK模式会被保存，重启后则恢复。

6.2.9 Output On / Output Off按钮



Output On
Output Off

只要产品未处于远程控制模式，可用此按钮手动打开或关闭电源输出。输出状态通过按钮上面的“Output On”或“Output Off”LED灯指示出来。输出打开时，在显示器中间的状态区域显示当前工作中的调整模式CC、CV或CP(仅针对1kW以上型号)。

用**LOCK**键可锁定该按钮。见章节6.2.8详述。

输出的打开可通过模拟接口的13脚(REM-SB)来阻止。见章节„10. 模拟接口“。

此按钮还可用来确认错误消息。详情请见7.4和7.5章节。

6.3 其它控制键

6.3.1 旋钮



这两个旋钮有推动按钮功能。推动任何一个或两个会有下列作用：

a) 细调模式 (Fine)

短按任一按钮可起用或停用细调模式。如果激活“Fine”，所有设定值、阈值和极限值都按最小的幅度调节，不管当前为何种模式（预设，内存等）。在状态显示区域以“Fine”文字显示出来。也可参考下面章节，6.4 调节设定值“。

b) 产品设置

当输出为off时，同时按住两个按钮，时间>3s，可将产品改至产品设置。按相同方式可退出。

6.4 调节设定值

1. 手工操作

在手工操作下，两旋钮可按预定幅度（见下表）在0%至100%的额定电压和电流设定值间连续调节。若想设置OVP和UVL，需按一下或两下Preset UVL/OVP按钮。若想设置功率设定值（1kW以上型号），需按Preset Power按钮。

! 提示

OVP值低于电压设定值，只要一打开输出，实际电压达到OVP门限，就会出现OV错误！

可通过细调或粗调手动完成设定值的设置，默认为粗调。需Fine-细调时按任意一个旋钮来激活，幅度为1。

coarse-粗调则按额定值的下列步宽来进行（也可参考技术规格）：

电压 / OVP / UVL			电流		
额定值	粗调	细调	额定值	粗调	细调
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

功率		
额定值	粗调	细调
1000W	0.01kW	0.001kW
1500W	0.01kW	0.001kW
3000W	0.02kW	0.001kW

! 提示

可调设定值的分辨率在某些型号上要高于输出电压分辨率。故有可能发生执行2或3个步宽后才能改变输出电压。

2. 通过模拟接口远程控制

详情请参考章节，10. 模拟接口“。

3. 通过数字接口卡远程控制

请参考章节，9. 数字接口卡“。

7. 产品特性

7.1 用电源开关打开

电源开关位于产品前端。打开产品后，显示器将显示一些信息：生产商名称，地址和标识，产品类型和固件版本。在设置模式下（见“8. 产品设置”）出现“AutoPwOn”（自动打开电源）选项，它决定产品打开时的输出状态。默认状态下为“on”，意思是可恢复产品最后关闭时U、I、P的设定值，OVP和UVL值，以及输出条件。如果该选项为“off”，U和I设定值设为0，P的设定值为100%，OVP设为最大值，UVL为最小值，输出在每一次开启后打开。

7.2 用电源开关关闭

用电源开关关闭产品如电源断电一样。它会保存最后的设定值和输出条件。短时间过后，功率输出和风扇关闭，几秒钟后，产品完全关闭。

7.3 转至远程控制模式

a) **模拟接口**: 如果产品没被LOCAL模式限制，或早已经数字接口激活远程模式，“Remote”引脚可将产品转换到远程控制模式。于是VSEL (1), CSEL (2), 以及REM-SB(13)引脚的设定值可被使用。传输给这些引脚的输出状态和设定值即刻被设置。从远程控制返回后，输出关闭。

b) **数字接口**: 如果产品没被LOCAL模式限制，或早已经模拟接口激活远程控制，通过相关指令（此处为：对象）转为数字远程控制，并保留输出状态和设定值，直至被更改。退出远程控制，会自动关闭输出。

7.4 过压报警

过压报警可以因内部缺陷（输出电压上升且不可控）或外部电压太高而引起。过压保护(OVP)将关闭输出，并在显示器上以“OV”文字和AI上的“OVP”引脚指示此报警信息。

如果清除过压原因，输出会再次打开，但需先确认此报警信息。在手工操作模式下，以按下Output On/Off按钮为确认方式，在模拟遥控模式下是“REM-SB”引脚，而在数字遥控模式下为相关指令。会出现“OV”状态文本和OVP信号。只要报警仍然存在，则不打开输出。

OV报警会被记录到内部警报缓冲区内。通过数字接口可读取该缓冲区内信息（除用SCPI语言编程的外）。读取缓冲区信息也表示确认报警信息。

! 提示

OV报警状态优先于OT报警状态，当两个错误同时出现时会覆盖“OT”状态文字，但不确认该报警信息。

7.5 过温报警

一旦因内部过热而出现过温(OT)错误，则关断输出，且出现“OT”状态文字。“Output On”灯会闪烁，指示出产品一旦冷却后即自动重启。如果不想这样，可手工关闭输出。LED灯停止闪烁，输出就不会自动启动。

OT报警要被确认。如果输出已关闭，产品已冷却下了，可用Output On/Off按钮，或通过REM-SB“引脚，亦或相关指令再次打开输出。如果输出为打开状态，可按一下Output On/Off按钮，或给“REM-SB”引脚一由高至底的触发，或使用相关指令先确认该报警信息，然后关闭输出。

，如果产品在冷却后还是关闭的，可使用Output on按钮或“REM-SB”引脚或相关指令来打开

OT报警会被记入内部报警缓冲区。通过数字接口可读取该缓冲区内信息（除用SCPI语言编程的外）。读取缓冲区信息也表示确认报警信息。

! 提示

OT报警状态对于OV错误报警而言，优先级较低一些。当两个报警同时出现时，“OV”会覆盖“OT”状态文字，但不确认该报警信息。

7.6 调整电压、电流或功率

电源的输出电压和负载的阻值决定输出电流。只要输出电流低于设定电流极限值，产品以恒压(CV)模式操作，且以“CV”状态文字指示出来。

如果输出电流受限于电流设定值或额定电流，产品会转为恒流模式(CC)，并以“CC”状态文字指示出来。

输出功率在1kW以上的多数型号有一额外特征，即具有0...P_{Nom}的可调功率极限。如果产品实际电流和电压超过可调功率极限，即激活该功能，并覆盖恒压或恒流调整模式。功率极限最初影响输出电压。因为电压、电流和功率极限相互影响，有可能出现像下面这样的不同状况：

例1：产品进入恒压模式，然后限制了功率，因此，输出电压减少。较低的输出电压导致输出电流减小。如果负载阻值减小，输出电流会再次上升，输出电压进一步下降。

例2：产品进入恒流模式，输出电压有负载阻值决定。于是限制了功率，根据 $P = U \cdot I$ 公式，输出电压和电流减少。如果电流设定值减少，输出电流和电压也会减少。产品的两个值，实际功率将低到之前设定的功率极限以下，产品由恒功率调整(CP)转为恒流调整(CC)。

7.7 远程感测被激活

远程感测操作用来补偿电源和负载间连线的压降。因为这受限于一定水平，建议按照输出电流选择适当直径的连线，以将压降减小到最小。

感测输入端位于产品后板，**System Bus**端子上。按正确极性连线到此。电源会自动检测外部感测端，并通过负载的实际电压而非输出电压，来补偿输出电压，从而按照电源与负载间的压降值提升输出电压。最大补偿值请见规格参数表。也可参考下图5。

7.8 市电出现欠压或过压

本产品的特征为采用主动式功率因素和宽范围的输入。意为，可在90V...264V，输入电压下操作。超出该范围的输入电压被认为是断电，或完全关闭产品，它会保存产品最后条件，关断功率输出。

⚠ 注意！

应避免输入端长期欠压或过压！

💡 提示

1500W功率的产品在输入电压低于约150V时降额至1000W。

7.9 连接不同类型的负载

不同类型的负载，如阻性负载（台灯，电阻），电子负载或感性负载（马达），性能不同，它们会对电源起反作用。例如，马达会产生一反电压，导致电源因过压保护而关断输出。

电子负载有电压、电流和功率调整线路，它们与电源的相互作用，可能会提高输出纹波或其它多余的副作用。电阻负载几乎100%中性。故建议在安排应用时要考虑负载的特性。

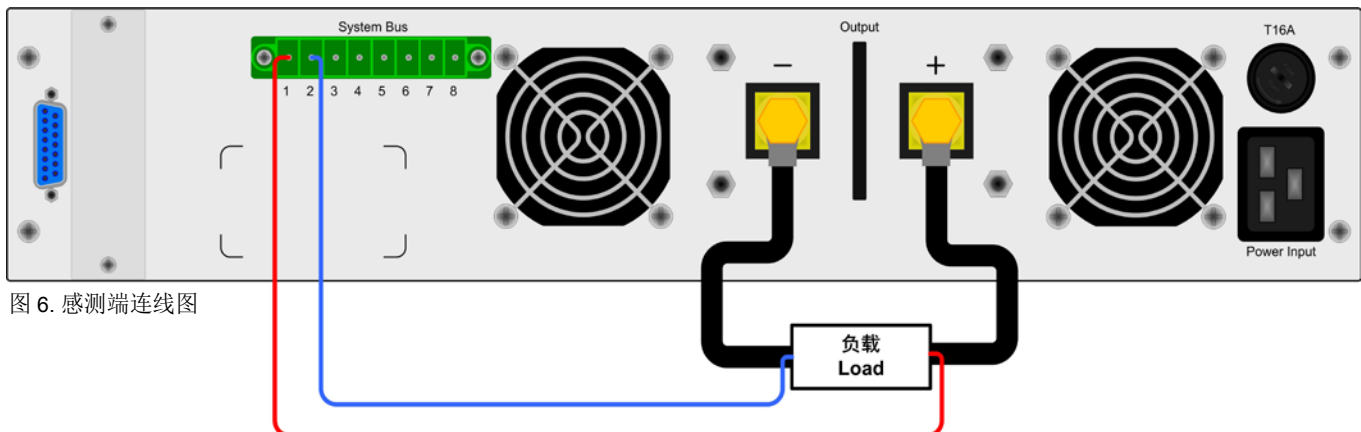


图 6. 感测端连线图

8. 产品设置

产品设置目的在于调节某些操作参数。当输出关闭后方可访问。长按旋钮上的两个按钮（见章节6.3）超过2s即可。退出设置并存储设定的操作方式与之相同。通常有三个基本设置，见下面。其它设定仅在配上数字接口卡时才出现。

基本设置：

参数: **AutoPwrOn** 默认值: **on**

可设置值: **on, off**

解释: “on” --> 在产品被关闭或停电前, 最后输出状态和设定值被保存下来。这可保证产品在恢复电源后可继续按最后的设定自动运作。

“off” --> 每次产品打开后, 输出也被打开, U, UVL和的设定值被设为0%, P为100%, 而OVP为110%。

参数: **AI range** 默认值: **0-10**

可设置值: **0-5, 0-10**

解释: 通过模拟接口选择使用的电压范围。

参数: **Contrast** 默认值: **70**

可设置值: **50...100**

解释: 调整LCD显示器的对比度。

下列设置适用于**所有**接口卡:

参数: **Device node** 默认值: **1**

可设置值: **1...30**

解释: 选择产品位址(产品节点, 来自CAN专业术语)。当将产品应用于总线系统(CAN或GPIB)时, 每台产品必须有一独特的地址!

利用**CAN**接口卡-**IF-C1**才可进行下列设置:

参数: **Baud** 默认值: **100k**

设置值: **10k, 25k, 50k, 100k, 125k, 250k, 500k, 1M**

解释: 选择CAN传输波特率。

参数: **Base ID** 默认值: **0x000**

设置值: **0x000...0x7FC (0...2044)**

解释: 通过三个IDs (Vector兼容, DBC文件) 来定义CAN ID系统的基本ID (BAID)。根据调整后的基本ID, 这三个IDs预留给一台产品。因此只有在第四步时才能调节这些参数。推动任一旋钮可将显示器从十进制值转为十六进制值显示。

只有当**ID Sys = Vector** 被选定后方出现这个参数, 见下面参数**ID Sys**。

参数: **Broad ID** 默认值: **0x7FF**

设置值: **0x000...0x7FF (0...2047)**

解释: 通过三个IDs (Vector兼容, DBC文件) 来调节CAN ID系统的广播ID (BCID)。这个ID是产品用来给同一总线上的多台产品广播信息的第四个ID。仅以十六进制值显示。目的在于所有产品的这个ID调节成相同值, 从而可通过设定值或产品状态同时控制这些产品。

只有当**ID Sys = Vector** 被选定后方出现这个参数, 见下面参数**ID Sys**。

参数: **RID** 默认值: **0**

可设置值: **0...31**

解释: 选择重定位识别段(RID)。可参考CAN专业术语或IF-C1 CAN接口卡的说明书, 查阅更多信息。

参数: **Bus term** 默认值: **yes**

可设置值: **yes, no**

解释: 启用/停用CAN接口卡的总线终止电阻。仅在产品位于总线终端时需要。

参数: **ID Sys** 默认值: **Vector**

可设置值: **Vector, normal**

解释: 选择CAN ID系统(IDSY)。用“Normal”设定, 针对旧CAN ID系统, 每台产品使用两个CAN IDs。这两个ID由“Device node” (如上) 与“RID” (如上) 创建而成。也可参考接口卡的使用说明书, CAN ID计算方法的描述。

其它ID系统就选择“Vector”, 每台产品使用三个CAN ID, 因此才能使用所谓的DBC文档, 将产品应用到公司的Vector软件中。选择这个ID系统时, 与设定相关的两个ID (如上) 被激活, 用户可调节用来定义三个ID的基本ID, 以及一个广播ID (如有使用)。

利用**RS232**接口卡-**IF-R1**才可进行下列设置:

参数: **Baud** 默认值: **57600**

可设置值: **9600, 19200, 38400, 57600**

解释: 选择以波特率为单位的串行传输速率。利用RS232不可配置其它参数, 但可这样定义:

奇偶性 = 奇数

停止位 = 1

数据位 = 8

必须在电脑上设置相同的配置。

利用**Profibus**接口卡-**IF-PB1**才可进行下列设置:

参数: **Profibus** 默认值: **1**

可设置值: **1-125**

解释: 定义产品的Profibus地址。该地址与产品节点分开使用, 以在现场总线系统上进入产品内部。

9. 数字接口卡

本产品支持下列插拔式接口卡：

IF-U1 (USB)

IF-R1 (RS232)

IF-C1 (CAN)

IF-G1 (GPIB/IEEE)

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

IF-PB1 (Profibus + USB)

这些卡插入产品后仅需进行少数设置或无需任何设置。即使替换成另外一不同类型卡，仍能保留前一张卡的具体设置。因此不用每次插入一张卡就设置一次。

关于接口卡的详细技术规格和操作，以及将产品应用于总线系统的说明，或用电脑(LabView等)控制产品，都可在IF卡用户操作说明书中找到。

注意！

仅在产品被完全关闭（用电源开关）后才可插入或取出接口卡！

关于插拔式接口卡的配置请看章节„8. 产品设置“。

数字接口允许电脑设置电压，电流和功率，以及OVP阈值与欠压极限值UVL。当转为远程控制模式时，产品保留最后的设定值，直至被更改。因此可传送任意的设定值仅用来控制电压，而电流值保持不变。

数字接口（除GPIB外）传输的设定值永远为百分数，对应100% (hex: 0x6400)的额定值，或110% (hex: 0x6E00)的OVP阈值。使用GPIB卡时，任何值都按实际十进制值输入。

另外，数字接口卡允许查询和设定大量其它功能和数值。更多详情请参考接口卡的使用说明书。

10. 模拟接口

10.1 一般信息

内置、非隔离15脚模拟接口(AI)位于产品后端，提供下列功能：

- 远程控制输出电流和电压
- 远程控制输出功率 (仅针对1kW以上型号)
- 远程控制输出电压
- 远程监控(OT, OVP, CC, CV)状态
- 远程监控实际数值
- 远程打开/关闭输出

模拟接口(简称: AI)通常能结合起来远程控制电源产品的电流，电压和功率（针对1kW以上型号）。即，用AI来调节电压的同时，不可用前板旋钮调节电流，反之亦然。1kW以下型号的输出功率不需功率设定值PSEL，因此不需输入。

由于不可用AI调节OVP阈值，故需在远程控制模式前以手动设定。用设定按钮转为预设模式，显示转化后的设定值，传输给AI设定值引脚，作为它的电压。为了设置合适的设定值，用户可借助外电压，或3脚的参考输出电压。

AI能通过普通的0...5V或0...10V范围工作，它们对应0...100%的额定值。产品设置模式（见章节„8. 产品设置“）下可选择所需电压范围。输出引脚3的参考电压与选择的设定范围有关，要么为5V，或者为10V。

以下适用：

0-5V: 参考电压= 5V，0...5V设定电压相当于0...100%的额定电压，在实际输出端，则相当于0...100%的实际数值。

0-10V: 参考电压 = 10V，0...10V设定电压相当于0...100%的额定电压，在实际输出端则对应0...100%的实际数值。

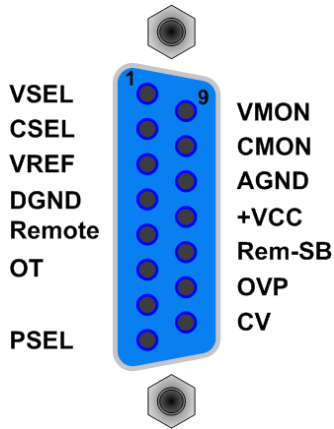
若输入超过极限的设定值，如>5V，当已选择0...5V电压范围，则将有关设定值减至100%而限制。

请注意：

- 用模拟电压来控制产品需用“REMOTE” (5)引脚转为远程控制模式。
- 连接控制电源的应用设备前，要保证所有连线正确，并检查应用设备不会输入高于指定电压的电压（最大12V）。
- REM-SB (程待机，13引脚)引脚要优先于Output On按钮。意思是，如果该引脚定义输出状态为“off”，除非已激活LOCAL模式。该模式会锁定所有接口，阻止其访问产品。也可见“6.2.7 Local按钮”。
- 模拟接口的地与输出负极相连。

10.2 应用举例

引脚总图



注意!

请勿将模拟接口的地接到外控设备（比如：**PLC**）的负输出端，如果连上，就表示控制设备连到了电源输出负极（形成接地回路），负载电流流经控制线，从而损坏设备！

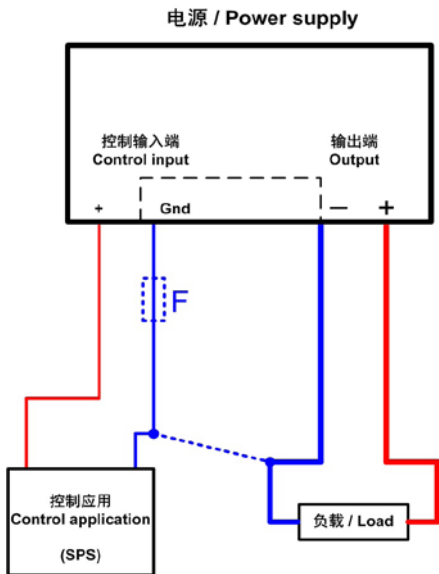


图 7

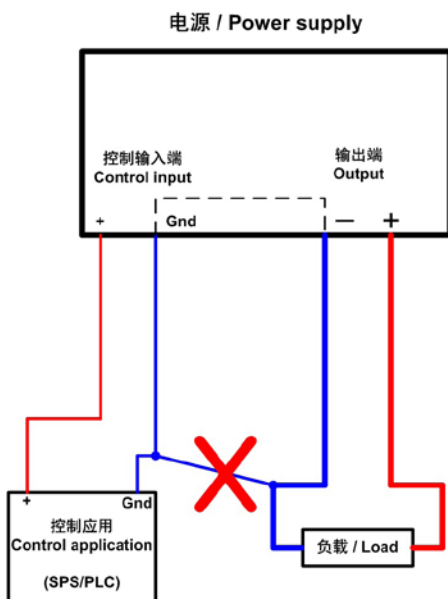


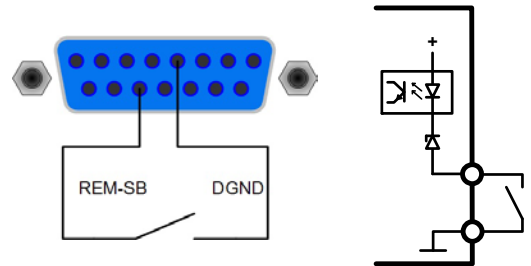
图 8

输出输出关闭

“REM-SB” 引脚一直都为工作状态，因此它不依靠远程模式。在无外部手段的条件下可用来关闭输出。具体操作是，利用一低阻连接件，如开关、开集三极管或继电器，将该引脚接到地（DGND），这样就关闭输出。

注意

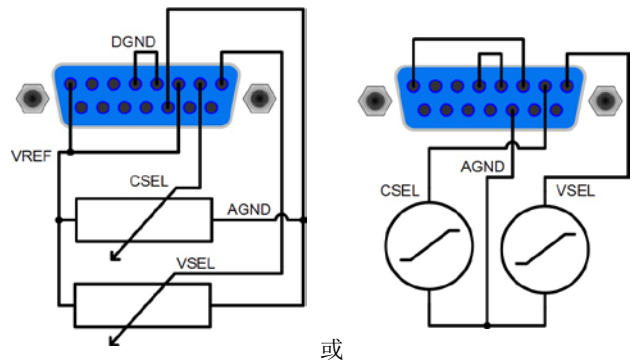
例如PLC的数字输出脚可能无法正确操作，因其阻抗可能不够低。故需随时检查您外部控制设备的技术规格。



远程控制电流和电压

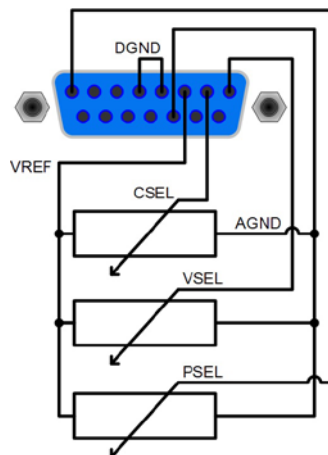
VREF和接地脚之间有两电位器，VSEL和CSEL输入端上有一滑动器。利用前板上的旋钮可控制电源，将它当作电流源或电压源用。如果VREF输出脚的电流最大为3mA，则需使用至少为10kOhm的电位器。

这儿显示的是带功率调整特点的产品型号，功率设定值束缚于VREF，因此为100%。



远程控制功率

与上述例子相似，但是用可调功率极限来完成。（仅适用于具有功率调节功能的产品型号）



10.3 模拟接口各引脚分布说明

引脚	名称	类型 ⁽¹⁾	描述	水平	电气参数
1	VSEL	AI	设定值: 电压	0...10V 或 0...5V 对应 U_{Nom} 的 0..100%	精确度 < 0,2%
2	CSEL	AI	设定值: 电流	0...10V 或 0...5V 对应 I_{Nom} 的 0..100%	阻值 $R_i > 100K$
3	VREF	AO	参考电压	10V或5V	$I_{max} = +5mA$ 时, 精确度 < 0.2% 短路保护对AGND
4	DGND	POT	数字控制信号参考电位		For +Vcc, 控制和状态信号
5	REMOTE	DI	在内控和外控间切换	外控 = LOW, $U_{Low} < 1V$ 内控 = HIGH, $U_{High} > 4V$ 内控 = open	电压范围 = 0 ... 30V $I_{max} = +1mA$ at 5V 发送: 开集电极对DGND
6	OT/PF	DO	过温错误 电源故障 ⁽⁴⁾	OT = HIGH, $U_{High} > 4V$ 无OT = LOW, $U_{Low} < 1V$	准开集电极上拉至Vcc ⁽²⁾ 输出5V时, 电流最大+1mA $U_{CE} = 0.3V$ 时, $I_{max} = -10mA$, $U_{max} = 0...30V$ 短路保护对DGND
7	N.C.				不连
8	PSEL ⁽³⁾	AI	设定值: 功率	0...10V 或 0...5V 对应 P_{Nom} 的 0..100%	精确度 < 0.5% 阻值 $R_i > 100K$
9	VMON	AO	实际值: 电压	0...10V 或 0...5V 对应 U_{Nom} 的 0..100%	$I_{max} = +2mA$ 时, 精确度Accuracy < 0.2% 短路保护对AGND
10	CMON	AO	实际值: 电流	0...10V 或 0...5V 对应 I_{Nom} 的 0..100%	
11	AGND	POT	模拟信号参考电位		For -SEL, -MON, VREF信号
12	+Vcc	AO	辅助电压输出 (Ref: DGND)	11...13V	$I_{max} = 20mA$ 短路保护对DGND
13	REM-SB	DI	输出关闭	关 = LOW, $U_{Low} < 1V$ 开 = HIGH, $U_{High} > 4V$ 开 = OPEN	U range = 0...30V $I_{max} = +1mA$ at 5V 发送: 开集电极对DGND
14	OVP	DO	过压错误	OVP = HIGH, $U_{High} > 4V$ 无OVP = LOW, $U_{Low} < 1V$	准开集电极上拉至Vcc ⁽²⁾ 输出5V时, 电流最大+1mA $U_{ce} = 0.3V$ 时, $I_{max} = -10mA$ at
15	CV	DO	指示电压调整启用	CV = LOW, $U_{Low} < 1V$ CC = HIGH, $U_{High} > 4V$	$U_{max} = 0...30V$ 短路保护对DGND

⁽¹⁾ AI = 模拟输入, AO = 模拟输出, DI = 数字输入, DO = 数字输出, POT = 电位

⁽²⁾ 内控 Vcc 约为14.3V

⁽³⁾ 仅针对1kW以上型号

⁽⁴⁾ Power fail-电源故障 = PFC或输入端出现故障 (仅自6.01固件版本后的才会报告)

11. 其它应用

11.1 终端系统总线的功能

8脚System Bus端子位于产品后端，用来连接远程感测线或串联或并联多台产品。

各引脚分布说明：

- 1：感测 +
- 2：感测 -
- 3：主机输出电流
- 4：主机输出电压
- 5：辅机输入电流
- 6：辅机输入电压
- 7：共享总线
- 8：地

⚠ 注意！

3-8引脚的功能仅对输出功率为1000W以上的产品才有用，但是720V产品除外，因为考虑到产品安全，该型号也配有。

11.1.1 主-从模式下的串联

串联时，建议只针对具有相同输出电流的产品，否则额定输出电流最低的产品将定义为系统的最大电流。

一台设备总是下一台的主机，然后这个下一台成为辅机和再下一台的主机，如此类推。连接两台以上产品时，建议将某一台作为主机，其它为辅机。辅机由主机通过System Bus端子的辅机输入引脚3和4来控制。可同时控制其电压和电流，也可分开控制。

图9为连线举例。由主机提供电压和电流。如果只控制电压或电流其中一个，那另外一个的设定值应设为100%。

要远程控制整个系统，经模拟或数字接口控制主机即可。读出实际值时，电流监控值会代表整个系统的电流，但是电压监控值仅代表主机的输出电压。若想获得实际读数，可将串联（只有当所有产品为同型号时适用）在一起的多台产品的实际电压相乘，或者分开读出它们。

⚠ 注意！

主机必须总是那台最低电压的产品！

⚠ 注意！

若需将其中一个直流输出端接地，鉴于安全考虑，建议将输出端接到最低电压上，即：主机的负极(-)输出端。

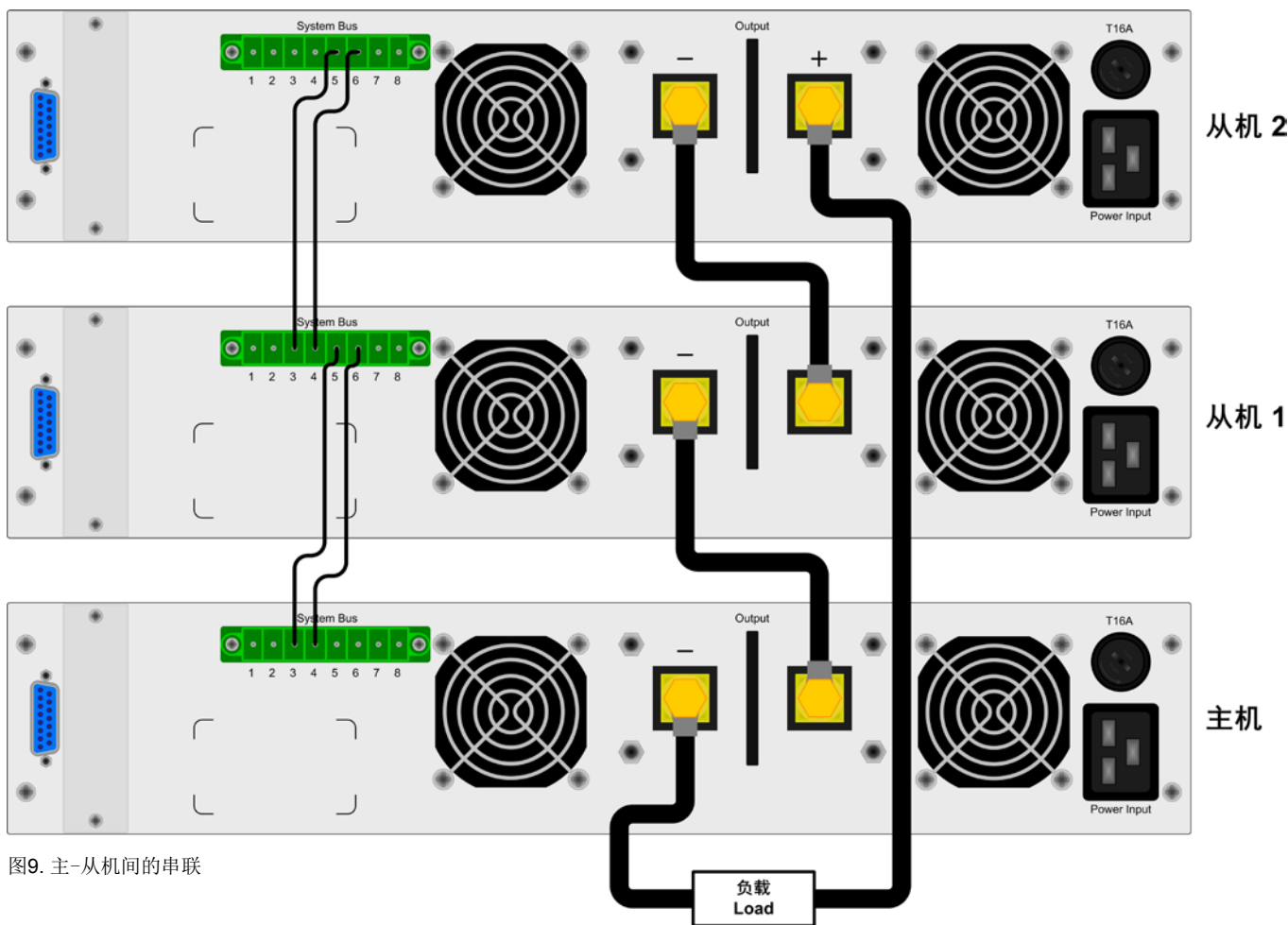
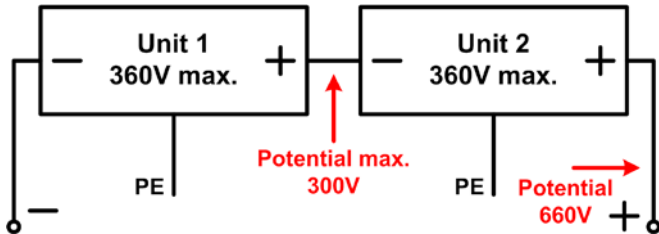


图9. 主-从机间的串联

鉴于安全和隔离的原因，需考虑下面一些限制和规则：

- 串联时任何一台产品的负直流输出端对地(PE)的电压不可上升到 >300V的电位！
- 共享总线端不可连线！
- 串联中各产品模拟接口的地(AGND, DGND)不可相互连接！
- 远程感测端不可连线！

举例：额定电压为360V的两台同型号产品，比如：PS 8360-15 2U。按计算，它们串联后的总电压可能高达720V。鉴于产品负输出端的电位，第二台产品的负直流端电压可能会上升到360V。这是绝对不允许的！所以必须将较低电位的产品限制到某一最大值。下图阐述了最后形成的总电压将为660V。



11.1.2 共享总线模式下的并联

注意：额定功率1kW以上的产品方具有该功能。

⚠ 注意！

只有相同型号（输出电压和电流相同）的产品才可执行操作模式。

若想增加输出电流，可通过共享总线的连接，并联两台或更多同型号的产品。

需要进行下列连接：将所有产品的(+)直流输出极相互连接。所有产品System Bus端子的7（共享总线）和8（地）引脚并联连接。如果还需远程感测，则将所有感测+和感测-的输入脚并联后与负载连接。

重点：在此连接下，最小输出电压的产品决定整个系统的输出电压。意思是，每一台机根据其调整数值，都可控。故建议选择一台机来控制整个系统，并将其它产品的设定值调到最大。

💡 提示

若有一台产品因过热(OT)或过压(OVP)而出现故障或不工作，整个系统都不会提供功率输出，直至故障被清除才回复。

要远程控制整个系统，经模拟或数字接口控制主机即可。读出实际值时，电压监控值会代表整个系统的电压，但是电流监控值仅代表主机的输出电流。若想获得实际读数，可将并联（只有具有相同输出电流的产品适用）在一起的多台产品的实际电流相乘，或者分开读出它们。

图10为连线举例。

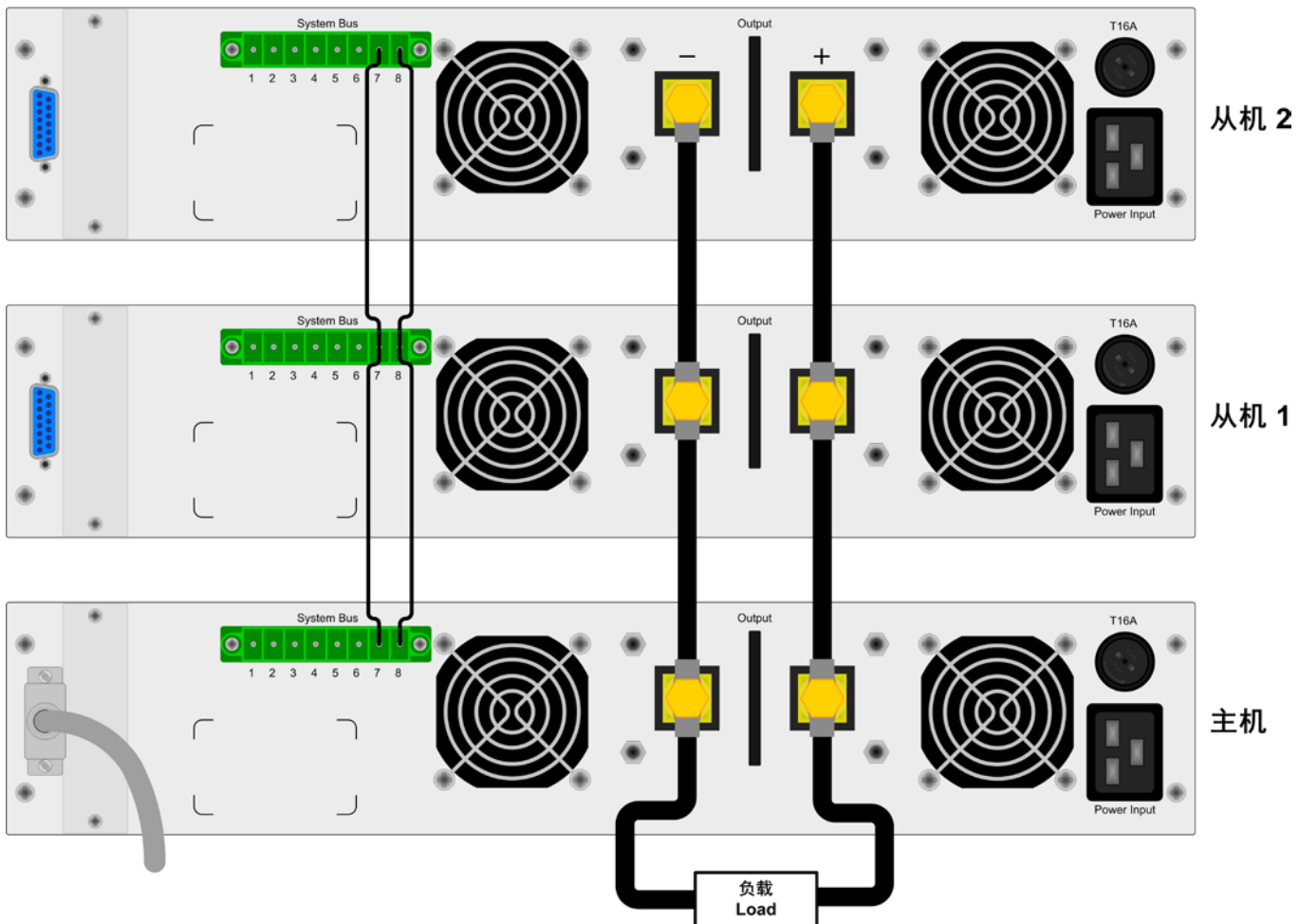


图10. 在共享总线上的并联

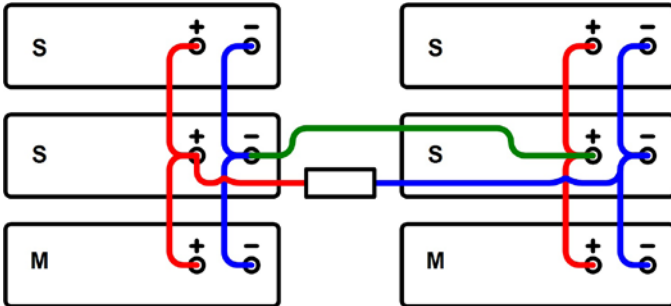
11.1.3 混合连接

本产品允许一个系统内并联与串联的混合连接。虽然具有这功能，仍建议按下列步骤进行：

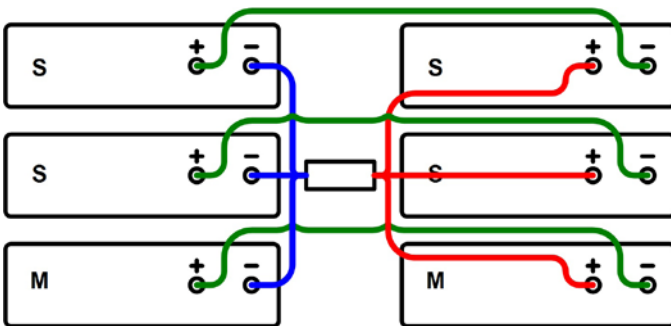
先执行并联，如：3台65V/10A的先并联，然后再将它们串联（相同的三台设备），以获得130V/30A的系统。

如需大电流，而且设备台数为奇数时，建议将负载放在并联产品的中间。

建议连接方式



不建议连接方式



11.2 连网

下图描述了多台产品在数控状态下以星形（USB，RS232，Ethernet）或车形（CAN，GPIB）配置的连网举例。

适用总线系统和接口的限制和技术规格。

通过**USB**，一台电脑可控制多达30台产品，需使用带特制电源的USB集线器。这也基本适用于RS232。区别在于操作和线长。

通过**CAN**，每个地址段上的多达30台电源，可容入新的或现有的CAN总线系统。它们由产品节点和RID组成。

通过**GPIB**，每一条总线限制最多为15台，由一台GPIB主机控制。一台电脑上可安装多台主机，这样可增加可编址单元数。

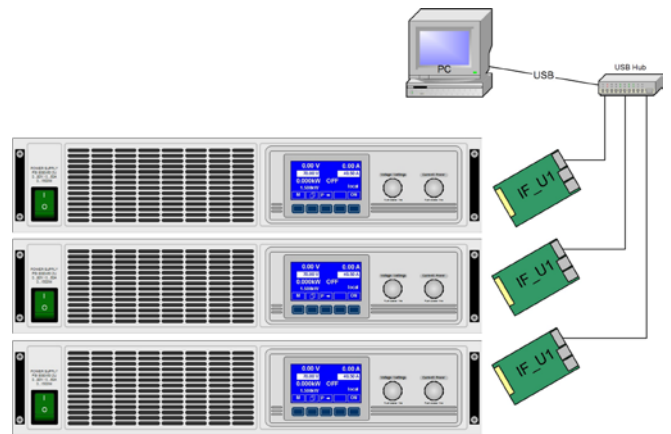


图 11. 用USB或RS232联网

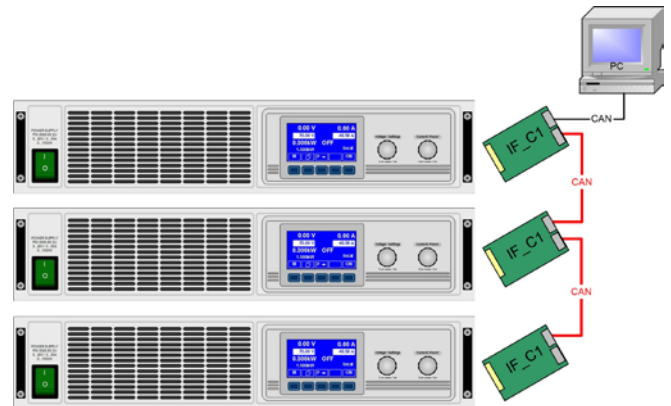


图 12 用CAN卡联网举例，也适用于GPIB卡

12. 其他

12.1 其它附件和选项功能

可供下列附件：

a) USB-至-模拟接口转换器 UTA12

经USB(电脑面)和产品内置模拟接口可远程控制。

b) 数字接口卡

还配USB, RS232, CAN, GPIB/IEEE (仅SCPI) 或以太网/LAN (仅SCPI)或Profibus用可插拔式数字接口卡。接口卡详情请看接口卡说明书。

可供下列选项：

a) HS选项功能：高速跃变(1kW以上型号)

通过减少输出电容容量来增加输出电压的动态。必须指出的是其它相关输出值也会增加，如纹波！这是个永久性更改，不可更改回来。

b) ZH选项功能：带汽车点火序列的内置有源负载

这个内部模块也被称为两象限模块，供应高达100W的连续功率和约2400W的峰值功率。主要目的是给产品的输出电容快速放电，比平常要快。从而增加输出电压的动态动作，但不影响其它输出值的。第二个功能是模拟内置汽车点火序列，从而可通过一按钮或远程信号触发它。该功能最初用在汽车行业，可用一开关停止该模块的功能。

1000W以上额定功率，400V以下输出电压的型号才可配该选项。

12.2 固件更新

只有当产品出现错误行为或者应用新功能时才需进行产品固件更新。

要更新一台产品固件，需要用到某一数字接口卡，新的固件文档，称作“更新工具”的Windows软件。

下列这些接口卡才能用于固件更新：

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

如果手上没有一张上述接口卡，则不可更新。请立即联系您的产品销售方寻求解决方案。

产品对应的更新工具和固件文档可从产品制造商网站获取，或者发邮件索取。更新工具将会指导用户整个半自动更新过程。

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Danger to life!

Hazardous voltage

The output voltage of some models can rise up 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.

Caution!

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 heavy use may result in unpredictable behaviour 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!

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1. Introduction

The laboratory power supplies of the series PS 8000 2U 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 also 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_{Nom}
- 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 under-voltage limit, voltage, current and power (models from 1kW) are displayed 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...99.9A
 0.0A...999.9A

Display of power values (models from 1kW)

Resolution: 4 digits
 Formats: 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...264V AC	90...264V AC	90...264V AC	90...264V AC
- with derating	-	-	-	-
Input current at 230V	max. 3.2A	max. 3.4A	max. 3.2A	max. 4.8A
Input current at 100V	max. 7.5A	max. 7.5A	max. 7.5A	max. 11.4A
Input frequency	45...65Hz	45...65Hz	45...65Hz	45...65Hz
Input fuse	T 8A	T 8A	T 8A	T 16A
Power factor	> 0.99	> 0.99	> 0.99	> 0.99
Output - Voltage				
Nominal voltage U_{Nom}	32V	65V	160V	80V
Adjustable range	0V... U_{Nom}	0V... U_{Nom}	0V... U_{Nom}	0V... U_{Nom}
Stability at mains fluctuation $\pm 10\% \Delta U_{IN}$	< 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	max. 2V	max. 2V	max. 2V	max. 2.5V
Overvoltage protection threshold (adjustable)	0...35.2V	0...71.5V	0...176V	0...88V
Output - Current				
Nominal current I_{Nom}	20A	10A	4A	40A
Adjustable range	0... I_{Nom}	0... I_{Nom}	0... I_{Nom}	0... I_{Nom}
Stability at mains fluctuation $\pm 10\% \Delta U_{IN}$	< 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} < 10mA _{RMS}	< 25mA _{pp} < 3mA _{RMS}	< 3mA _{pp} < 1mA _{RMS}	< 19mA _{pp} < 7mA _{RMS}
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	10mA	10mA	1mA	10mA
Transient recovery time 10...90% load	< 2ms	< 2ms	< 2ms	< 2ms
Output - Power				
Nominal power P_{Nom}	640W	650W	640W	1000W
Nominal power at derating	-	-	-	-
Accuracy*	-	-	-	0... P_{Nom}
Adjustable range	-	-	-	≤ 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
Weight normal	9.5kg	9.5kg	9.5kg	11.5kg
Weight with option ZH	-	-	-	13kg
Isolation +output<->enclosure	500V	500V	500V	500V
Isolation -output<->enclosure	300V DC			
Isolation input<->output	4200V			
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				
max. series connection voltage	600V			
Master-Slave	no			
Parallel connection				
max. parallel connection voltage	720V			
Master-Slave	yes, via Share bus			
Analogue 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 min. 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...264V AC	90...264V AC	90...264V AC	180...264V AC
- with derating	90...150V AC	90...150V AC	90...150V AC	180...207V AC
Input current at 230V	max. 7.5A	max. 7.5A	max. 7.5A	max. 15A
Input current at 100V	max. 11.4A	max. 11.4A	max. 11.4A	-
Input frequency	45...65Hz	45...65Hz	45...65Hz	45...65Hz
Input fuse	T 16A	T 16A	T 16A	T 16A
Power factor	> 0.99	> 0.99	> 0.99	> 0.99
Output - Voltage				
Nominal voltage U_{Nom}	40V	80V	360V	40V
Adjustable range	0V... U_{Nom}	0V... U_{Nom}	0V... U_{Nom}	0V... U_{Nom}
Stability at mains fluctuation $\pm 10\% \Delta U_{IN}$	< 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*	$\leq 0.2\%$	$\leq 0.2\%$	$\leq 0.2\%$	$\leq 0.2\%$
Resolution of display	10mV	10mV	100mV	10mV
Remote sense compensation	max. 2.5V	max. 2.5V	max. 8V	max. 2.5V
Overvoltage protection threshold (adjustable)	0...44V	0...88V	0...396V	0...44V
Output - Current				
Nominal current I_{Nom}	60A	60A	15A	120A
Adjustable range	0... I_{Nom}	0... I_{Nom}	0... I_{Nom}	0... I_{Nom}
Stability at mains fluctuation $\pm 10\% \Delta U_{IN}$	< 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} < 7mA _{RMS}	< 19mA _{pp} < 7mA _{RMS}	< 1mA _{pp} < 0.45mA _{RMS}	< 25mA _{pp} < 9mA _{RMS}
Accuracy*	$\leq 0.2\%$	$\leq 0.2\%$	$\leq 0.2\%$	$\leq 0.2\%$
Resolution of display	10mA	10mA	10mA	100mA
Transient recovery time 10...90% load	< 2ms	< 2ms	< 2ms	< 2ms
Output - Power				
Nominal power P_{Nom}	1500W	1500W	1500W	3000W
Nominal power at derating	1000W	1000W	1000W	2500W
Accuracy*	0... P_{Nom}	0... P_{Nom}	0... P_{Nom}	0... P_{Nom}
Adjustable range	$\leq 1\%$	$\leq 1\%$	$\leq 1\%$	$\leq 1\%$
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
Weight normal	11.5kg	11.5kg	11.5kg	14.7kg
Weight with option ZH	13kg	13kg	13kg	17kg
Isolation +output<->enclosure	500V	500V	500V	500V
Isolation -output<->enclosure	300V DC			
Isolation input<->output	4200V			
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				
max. series connection voltage	600V			
Master-Slave	no			
Parallel connection				
max. parallel connection voltage	720V			
Master-Slave	yes, via Share bus			
Analogue programming				
Input range	0...5V or 0...10V, selectable			
Accuracy	$\leq 0.2\%$			
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 min. 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...264V AC	180...264V AC	180...264V AC	180...264V AC
- with derating	180...207V AC	180...207V AC	180...207V AC	180...207V AC
Input current at 230V	max. 15A	max. 15A	max. 15A	max. 15A
Input current at 100V	-	-	-	-
Input frequency	45...65Hz	45...65Hz	45...65Hz	45...65Hz
Input fuse	T 16A	T 16A	T 16A	T 16A
Power factor	> 0.99	> 0.99	> 0.99	> 0.99
Output - Voltage				
Nominal voltage U_{Nom}	80V	160V	360V	720V
Adjustable range	0V... U_{Nom}	0V... U_{Nom}	0V... U_{Nom}	0V... U_{Nom}
Stability at mains fluctuation $\pm 10\% \Delta U_{IN}$	< 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*	$\leq 0.2\%$	$\leq 0.2\%$	$\leq 0.2\%$	$\leq 0.2\%$
Resolution of display	10mV	100mV	100mV	100mV
Remote sense compensation	max. 2.5V	max. 5V	max. 8V	max. 16V
Overvoltage protection threshold (adjustable)	0...88V	0...176V	0...396V	0...792V
Output - Current				
Nominal current I_{Nom}	120A	60A	30A	15A
Adjustable range	0... I_{Nom}	0... I_{Nom}	0... I_{Nom}	0... I_{Nom}
Stability at mains fluctuation $\pm 10\% \Delta U_{IN}$	< 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} < 9mA _{RMS}	< 18mA _{pp} < 6mA _{RMS}	< 60mA _{pp} < 21mA _{RMS}	< 2mA _{pp} < 1mA _{RMS}
Accuracy*	$\leq 0.2\%$	$\leq 0.2\%$	$\leq 0.2\%$	$\leq 0.2\%$
Resolution of display	100mA	10mA	10mA	10mA
Transient recovery time 10...90% load	< 2ms	< 2ms	< 2ms	< 2ms
Output - Power				
Nominal power P_{Nom}	3000W	3000W	3000W	3000W
Nominal power at derating	2500W	2500W	2500W	2500W
Accuracy*	0... P_{Nom}	0... P_{Nom}	0... P_{Nom}	0... P_{Nom}
Adjustable range	$\leq 1\%$	$\leq 1\%$	$\leq 1\%$	$\leq 1\%$
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	-
Weight normal	14.7kg	14.7kg	14.7kg	14.7kg
Weight with option ZH	17kg	17kg	17kg	-
Isolation +output<->enclosure	500V	500V	500V	1000V
Isolation -output<->enclosure	300V DC			
Isolation input<->output	4200V			
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				
max. series connection voltage	600V			
Master-Slave	no			
Parallel connection				
max. parallel connection voltage	720V			
Master-Slave	yes, via Share bus			
Analogue programming				
Input range	0...5V or 0...10V, selectable			
Accuracy	$\leq 0.2\%$			
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 min. 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

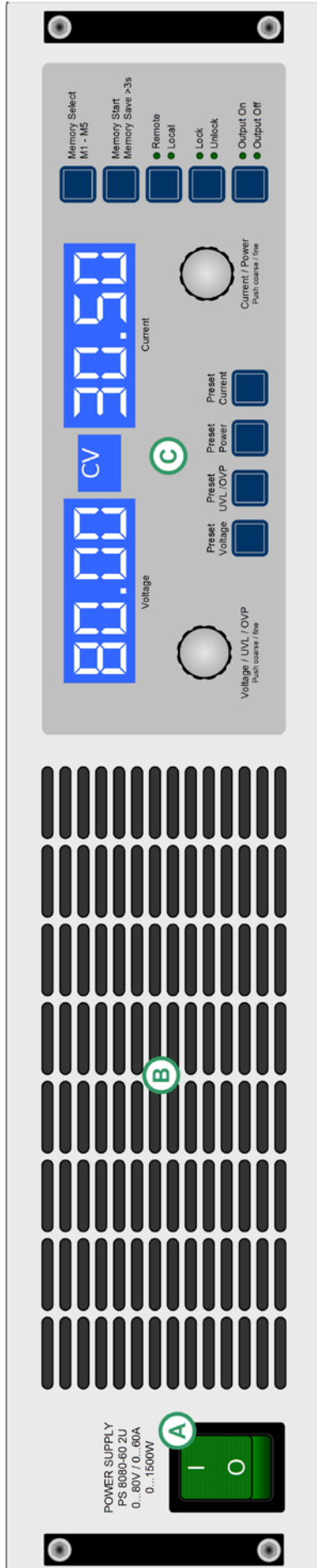


Figure 1. Front view of standard 2U model, models with ZH option can differ

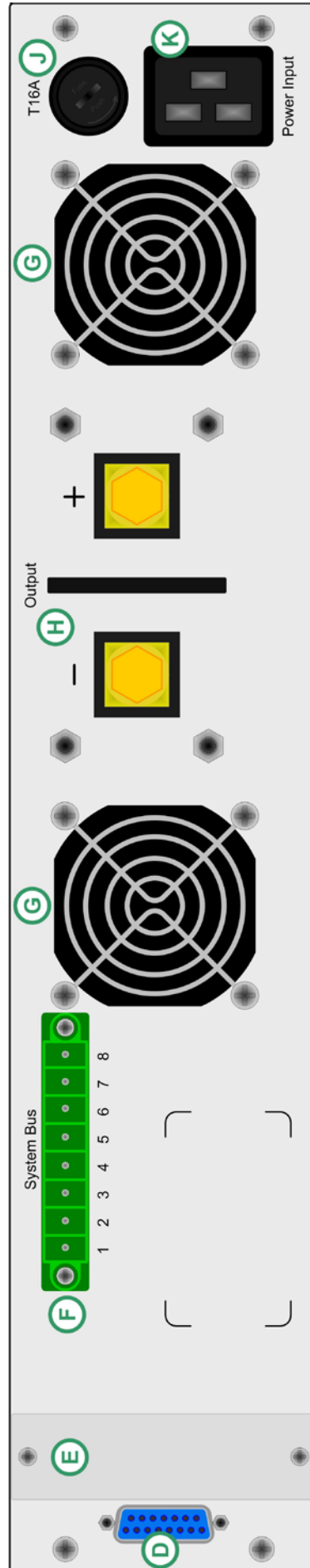


Figure 2. Rear view 2U model

Legend:

- A - Power switch
- B - Air ventilation slots
- C - Control panel
- D - Analogue interface, 15pole, 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, 3pole, IEC 60320

Pin assignment of System Bus (See section 11.1 for important details):

- 1 - Sense +
- 2 - Sense -
- 3 - Master output Current
- 4 - Master output Voltage
- 5 - Slave input Current
- 6 - Slave input Voltage
- 7 - Share Bus
- 8 - Ground

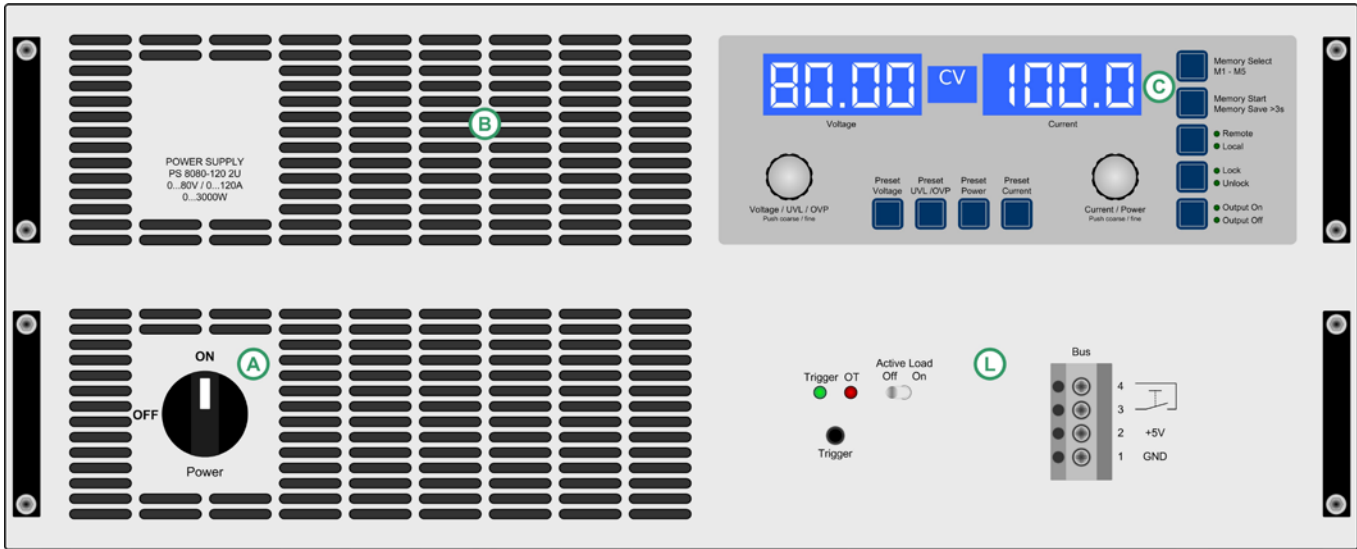


Figure 3. Front view 4U version with ZH option

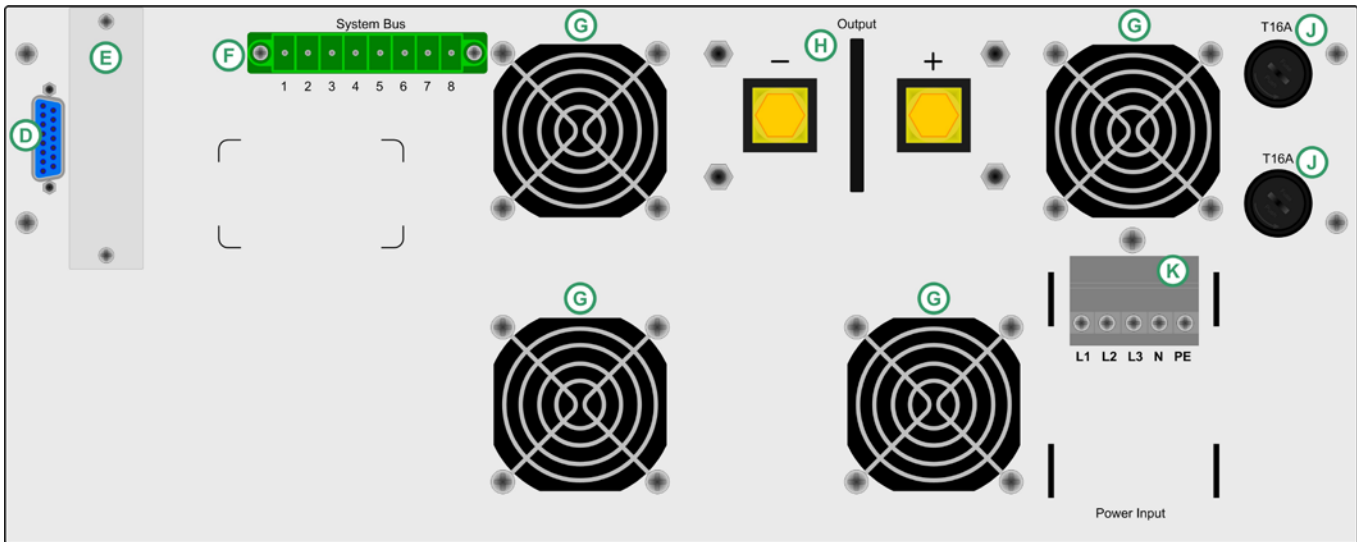


Figure 4. Rear view 4U version

Legend:

- A- Power switch
- B - Air ventilation slots
- C - Control panel
- D - Analogue interface, 15pole, 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 assigment of System Bus (see section 11.1 for details):

- 1 - Sense +
- 2 - Sense -
- 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)
- 1 x Plug for System Bus

4. General

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 / repair

When opening the unit or removing parts from the inside with tools there is risk of electric shock by 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.

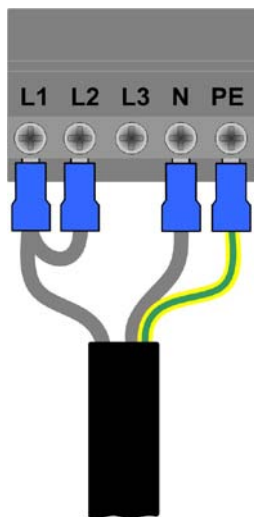
5.2 Mains connection 2U models

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 fuseholder 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:	0,75mm ²	up to 15A:	1,5mm ²
up to 30A:	4mm ²	up to 40A:	6mm ²
up to 60A:	16mm ²	up to 120A:	35mm ²

per 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 (eg. 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 Terminal „Sense“ (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“.

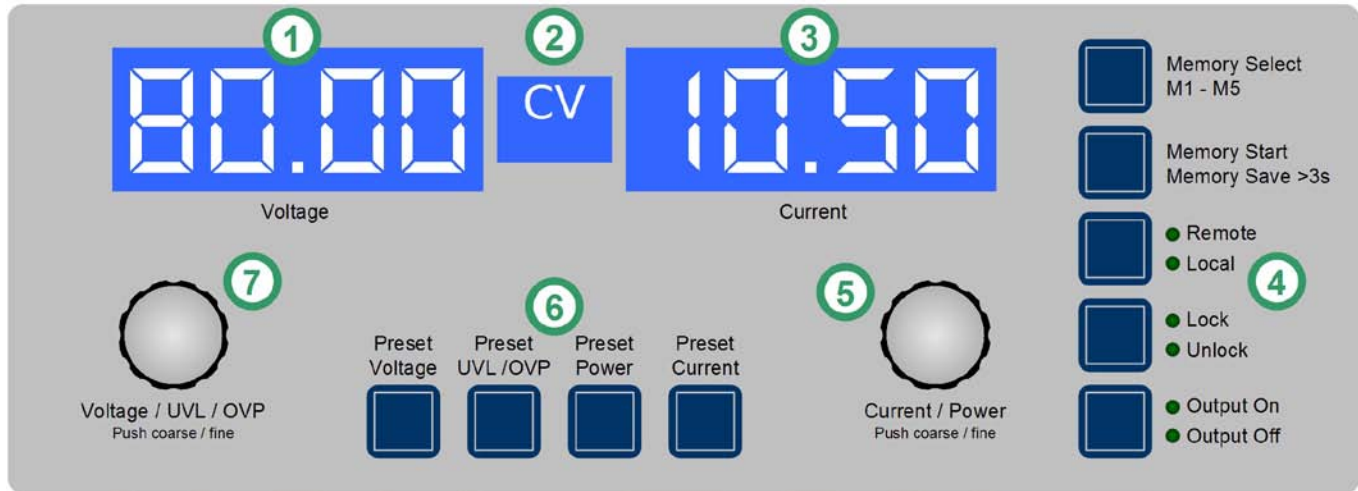


Figure 5. Control panel

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 following status:

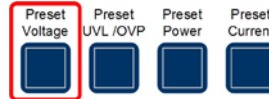
- CV** - Constant voltage regulation (only when output is „on“)
- OT** - Overtemperature error
- OVP** - Overvoltage error
- CC** - Constant current regulation (only when output is „on“)
- CP** - Constant power regulation (only when output is „on“)
- Fine** - Fine adjustment for both rotary knobs active
- 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 Pushbuttons on the control panel

6.2.1 Pushbutton Preset Voltage



During normal operation, this button is used to switch the display from actual to preset value of the output voltage (i.e. 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.

Note
The set value adjustment can be limited by the undervoltage threshold UVL. Also 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.

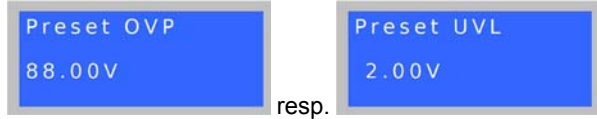
In memory selection mode the button is also used to switch to the voltage set value of the selected memory set, but in this mode the set value is not transferred to the output. The left display area will then show like this:



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:



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} .

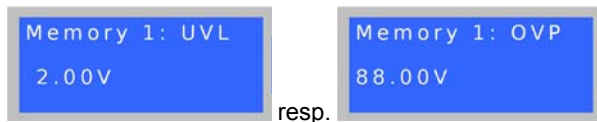
A second push of the button changes to overvoltage protection threshold preset (OVP). This value can always be adjusted from 0...110% U_{Nom} .

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 values are not active yet. The left display area will then show like this:



6.2.3 Pushbutton Preset Power



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

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



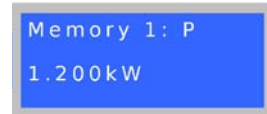
In preset mode, the right rotary knob (**Current / Power**) is used to adjust the power set value from 0...100% P_{Nom} . The adjusted value is instantly transferred to the output.

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 value is not transferred to the output. The right display area will then show like this:



6.2.4 Pushbutton Preset Current



During normal operation, this button is used to switch the display from actual to preset value of the output current (i.e. 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_{Nom} 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 value is 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.

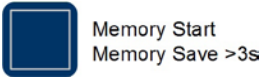
Now the set values of U (left) and I (right) of the selected memory set can be adjusted. The other adjustable values can be accessed by pushing the corresponding preset buttons.

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

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

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

6.2.6 Pushbutton 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.

Note
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 Pushbutton Local



This pushbutton activates or deactivate 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 LED „Remote“ indicates an active remote control by analogue or digital interface.

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

Note
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.

Note
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.

Note
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.

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

6.2.9 Pushbutton 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 might be locked by the condition **LOCK**. See 6.2.8.

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

The button also acknowledges the errors. See sections 7.4 and 7.5 fore 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 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 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.

Note

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	0.05mA	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

Note

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. Analogue 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 Switching 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) **Analogue 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.

Note

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 Overtemperature alarms

As soon as an overtemperature (OT) alarm occurs by 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.

Note

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 additionally feature an adjustable power limitation for $0 \dots P_{Nom}$. 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 $P = U \cdot I$. 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 minimise the voltage drop.

The sense input is located on the rear, at terminal **System Bus**, where the sense leads are connected to the load with correct polarity. The power supply will detect the external sense voltage 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 an 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!

! Note

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: AI 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 all interface cards this setting applies:

Parameter: Device node **Default:** 1

Settings: 1...30

Meaning: Selects the device's address (i.e. 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!

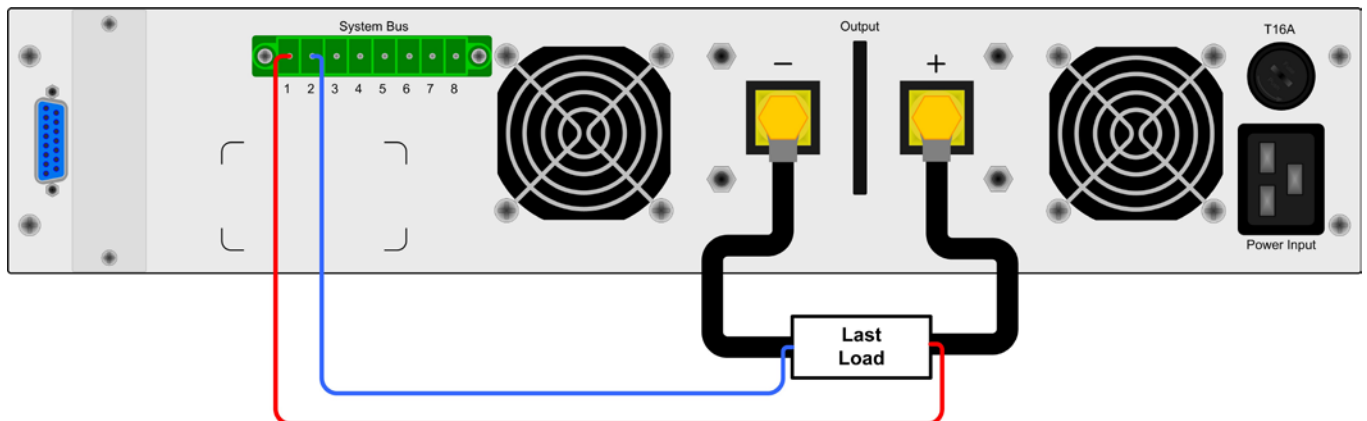


Figure 6. Wiring the sense

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: Base ID 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, if **ID Sys = Vector** has been selected. See below at parameter **ID Sys**.

Parameter: Broad ID 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, if **ID Sys = Vector** has been selected. See below at parameter **ID 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 baudrate (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 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 percentage and correspond at 100% (hex: 0x6400), resp. at 110% (hex: 0x6E00) for the OVP threshold, to 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. Analogue interface

10.1 General

The integrated, non-isolated, 15 pole analogue interface (AI) is located on the rear and offers 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 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 can not 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.

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).

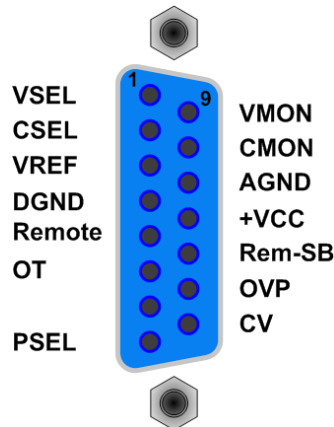
Putting in set values that exceed the limit, for example >5V while the 0...5V range is selected, is intercepted by clipping the corresponding set value to 100%.

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 neative power supply output (ground loop). Load current may flow over the control leads and damage the device!

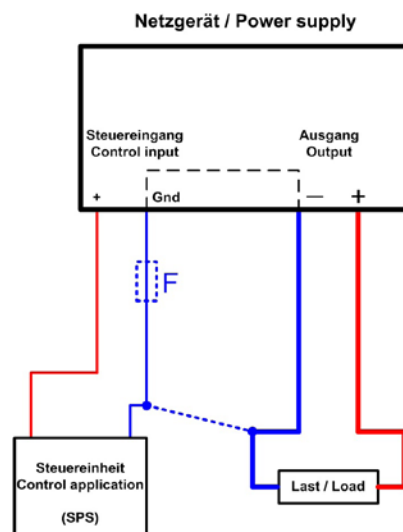


Figure 7

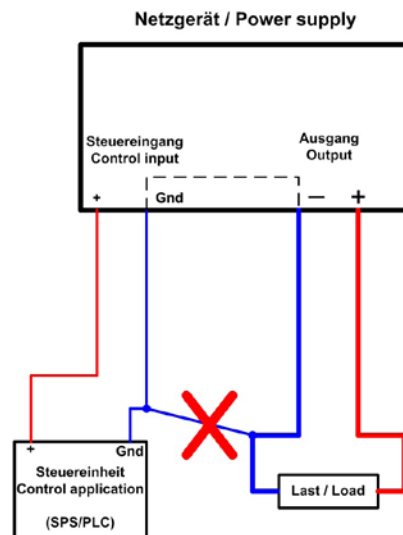
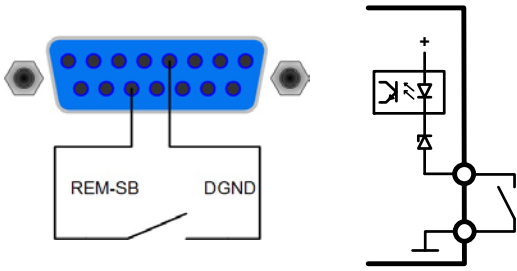


Figure 8

Output off

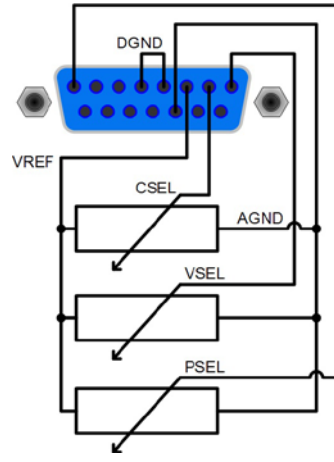
Pin „REM-SB“ is always operative and does not depend on the remote control mode. It can be used to switch off the output without extra means, except in LOCAL mode which only allows manual control for the device. Switching the output off is done by connecting the pin to ground (DGND) via a low-resistive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

! Note
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 with power

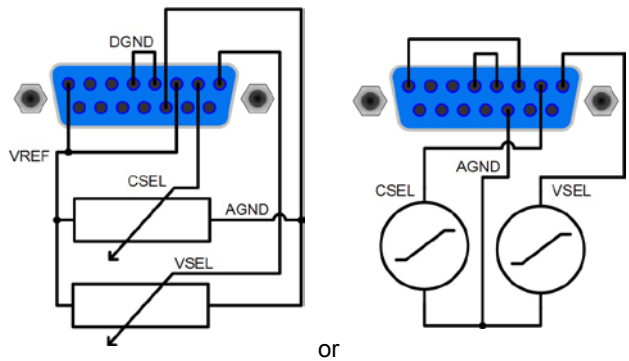
Similar to the example above, but with adjustable power limit (only applicable for models with power adjustment).



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%.



10.3 Pin specification

Pin	Name	Type ⁽¹⁾	Description	Level	Electrical specification
1	VSEL	AI	Set value: voltage	0...10V or 0...5V correspond to 0..100% of U_{Nom}	Accuracy < 0,2% Impedance $R_i > 100k$
2	CSEL	AI	Set value: current	0...10V or 0...5V correspond to 0..100% of I_{Nom}	
3	VREF	AO	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	DI	Toggle between internal or external control	External = LOW, $U_{Low} < 1V$ Internal = HIGH, $U_{High} > 4V$ 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 $V_{cc}^{(2)}$ At 5V at the output there will be max.+1mA $I_{Max} = -10mA$ at $U_{CE} = 0.3V$ $U_{Max} = 0...30V$ Short-circuit-proof against DGND
7	N.C.				Not connected
8	PSEL ⁽³⁾	AI	Set value: power	0...10V or 0...5V correspond to 0..100% of P_{Nom}	Accuracy < 0.5% Impedance $R_i > 100k$
9	VMON	AO	Actual value: voltage	0...10V or 0...5V correspond to 0..100% of U_{Nom}	Accuracy < 0.2% at $I_{Max} = +2mA$ Short-circuit-proof against AGND
10	CMON	AO	Actual voltage: current	0...10V or 0...5V correspond to 0..100% of I_{Nom}	
11	AGND	POT	Reference potential for analogue signals		For -SEL, -MON, VREF signals
12	+Vcc	AO	Auxiliary voltage output (Ref: DGND)	11...13V	$I_{Max} = 20mA$ Short-circuit-proof against DGND
13	REM-SB	DI	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	OVP	DO	Overvoltage error	OVP = HIGH, $U_{High} > 4V$ no OVP = LOW, $U_{Low} < 1V$	Quasi open collector with pull-up to $V_{cc}^{(2)}$ At 5V at the output there will be max.+1mA $I_{Max} = -10mA$ at $U_{CE} = 0.3V$
15	CV	DO	Indication of voltage regulation active	CV = LOW, $U_{Low} < 1V$ CC = HIGH, $U_{High} > 4V$	$U_{Max} = 0...30V$ Short-circuit-proof against DGND

⁽¹⁾ AI = Analogue input, AO = Analogue output, DI = Digital input, DO = Digital output, POT = Potential

⁽²⁾ Internal Vcc, approx. 14.3V

⁽³⁾ Only with models from 1kW

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

11. Other applications

11.1 Functions of terminal System Bus

The 8pole 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 : Sense +
- 2 : Sense -
- 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.

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, i.e. the negative (-) output of the master.

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.

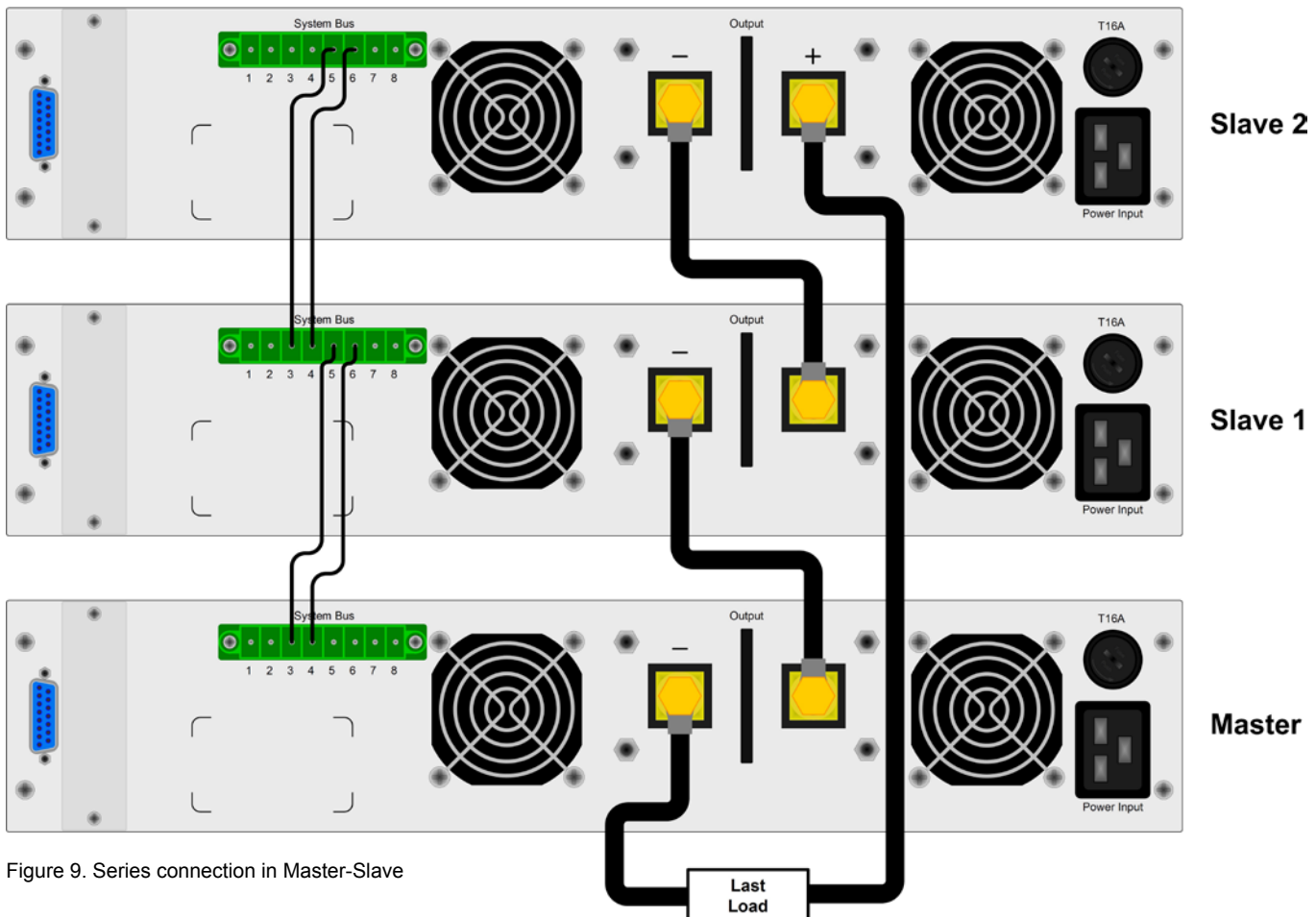
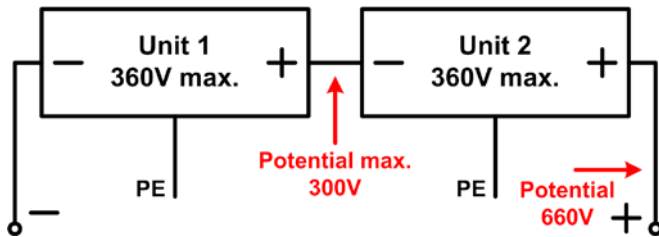


Figure 9. Series connection in Master-Slave

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.

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.

Note
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.

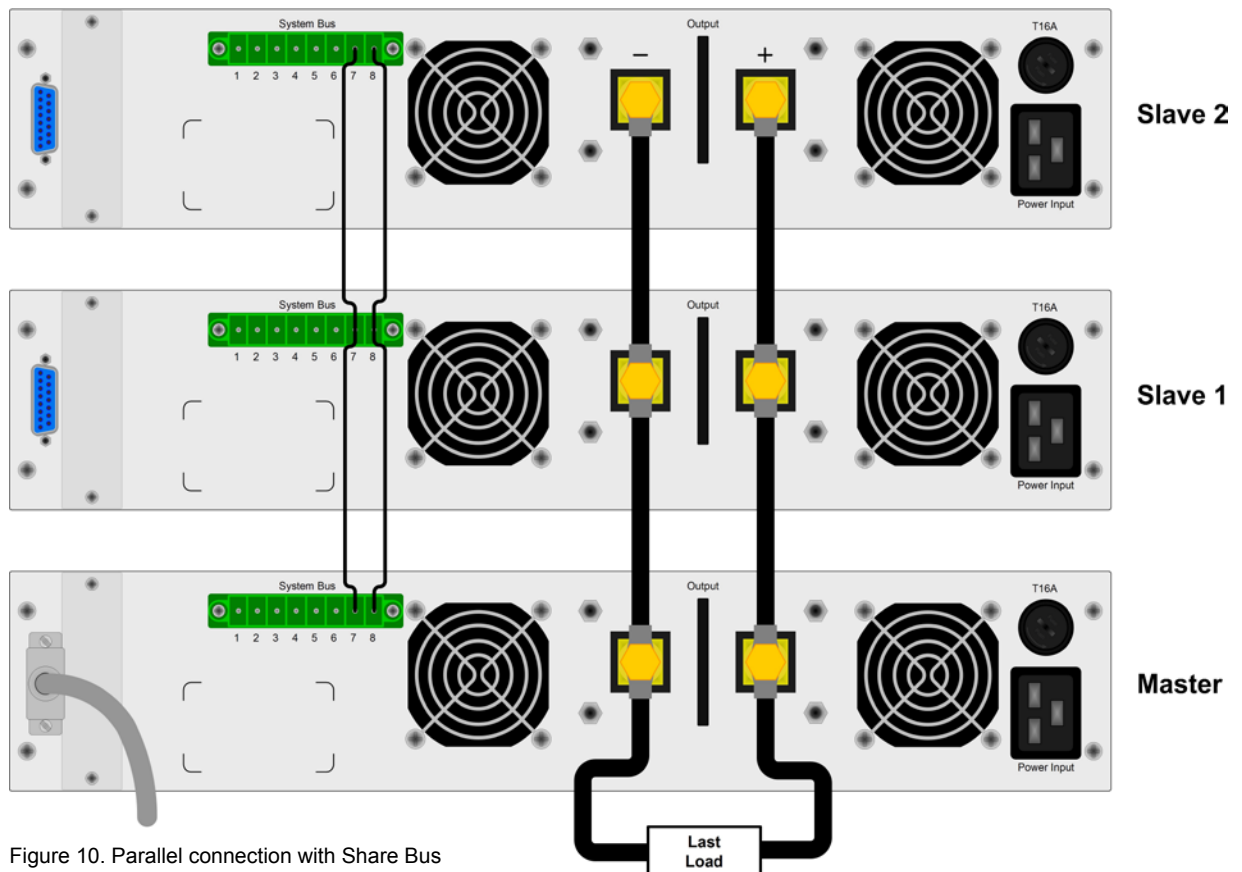


Figure 10. Parallel connection with Share Bus

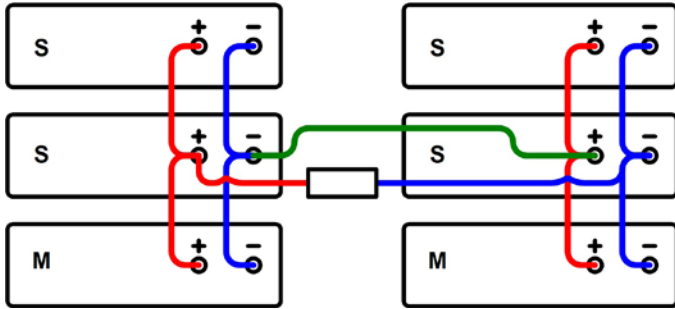
11.1.3 Mixed connections

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

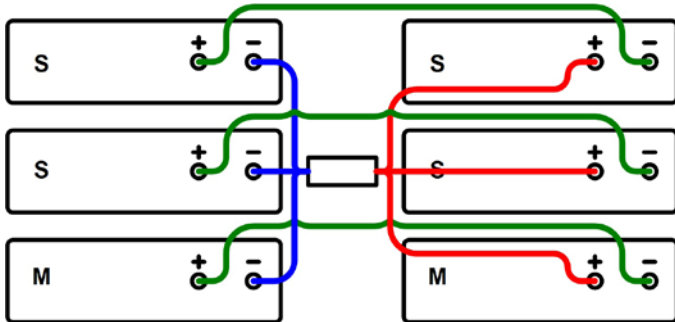
First do the parallel connections, for example 3 units with 65V and 10A each. Then do the series connection (same three units again) in order to gain, for example, a 130V and 30A system.

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

Recommended



Not recommended



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.

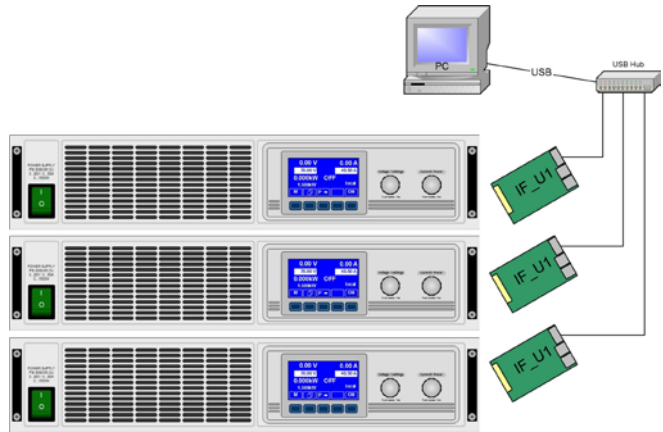


Figure 11. USB or RS232 networking

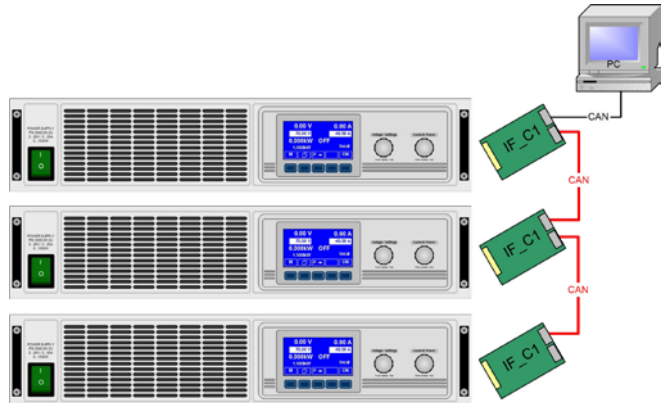


Figure 12. CAN networking example, also applies to GPIB

12. Miscellaneous

12.1 Accessories and options

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

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.

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 behaviour 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 update

A firmware update of the device should only be done if the device shows erroneous behaviour 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 can not 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 upon request. The update tool will guide the user through the semi-automatic update process.