Elektro-Automatik GmbH

高效电源供应器系列
High Efficiency Power Supply Series

PSI 8000 3U

3.3kW - 15kW
40V - 1500V
30A - 510A

PSI 8080-170 3U:	09 230 430	PSI 81500-30 3U:	09 230 439
PSI 8080-340 3U:	09 230 431	PSI 8200-70 3U:	09 230 440
PSI 8080-510 3U:	09 230 432	PSI 8200-140 3U:	09 230 441
PSI 8160-170 3U:	09 230 433	PSI 8200-210 3U:	09 230 442
PSI 8240-170 3U:	09 230 434	PSI 8400-70 3U:	09 230 443
PSI 8500-30 3U:	09 230 435	PSI 8600-70 3U:	09 230 444
PSI 8500-60 3U:	09 230 436	PSI 8040-170 3U:	09 230 445
PSI 8500-90 3U:	09 230 437	PSI 8040-340 3U:	09 230 446
PSI 81000-30 3U:	09 230 438	PSI 8040-510 3U:	09 230 447

安全须知

- 请仅在铭板标示电压下操作该仪器。
- 请勿将任何机械零件，特别是金属件，插入仪器通风孔内。
- 请避免在仪器周围使用液体物质，因有可能进入仪器内部并损坏它。
- 不要将可能产生高于产品额定输出电压的设备连接到本产品上。
- 在后板插槽上安装接口卡时，应遵循一般防静电规则。
- 接口卡只能在仪器完全关闭(电源开关关闭)后插入和取出。

重要说明

- 产品老化以及超负荷使用都可能导致如按钮、旋转编译器类的产品控制件操作不稳定。

1. 简介

PSI 8000 3U 系列高效电源供应器，装于19“拉拔式外壳内，是测试系统和工业控制设备的理想选择。

除具备电源供应器的标准功能外，用户还可定义和恢复设定值的预设值，用可定义极限监控设定值和实际值，或者用函数管理器为预设参数创建函数列。

还有各种数字接口卡可选，这些接口卡通过电脑可执行更宽范围的控制和监控功能。另外还有一种扩展卡，即隔离模拟接口卡-IF-A1，通过外部手段，如PLC-可编程控制器，可对产品进行控制。

通过接口卡的使用可轻易地将产品整合于现有系统内，且根本不需配置接口卡或仅需配置少数设定值。

本系列所有型号具有一共同特征：带可调功率调整电路，以及并联时实现电流对称分布的“Share Bus”端子。

主功能一览：

- 设定0...100%范围内的电压、电流和功率
- 设定0...100%范围内的功率
- 0...110% U_{Nom}可调过压阀值
- 可选插拔式接口卡（CAN，USB，RS232，IEEE/GPIB，模拟，Ethernet/LAN，Profibus）
- 可选外部控制和监测用模拟接口
- 功率级别：3.3kW, 5kW, 6.6kW, 10kW 或 15kW, 装柜后可扩至150kW
- 温控风扇
- 状态（OT，OVP，CC，CV）指示灯
- 4种可选内存集，监控函数
- 函数管理器
- 可调内阻（选项）
- 高速跃变（选项）
- 并联连接（共享总线下）

2. 技术规格

2.1 控制面板和显示器

型号

显示器：	128x64点阵图形显示器
操作控制件：	6个旋钮，2个旋转编译器

显示格式

额定值限定最大可调范围。

电压、电流和功率实际值与设定值同时显示，过压阀值设定值则分开显示。

电压的显示

分辨率：	4位数
格式：	0.00V…99.99V
	0.0…999.9V
	0V...9999V

电流的显示

分辨率：	4位数
格式：	0.00A...99.99A
	0.0A…999.9A

功率的显示

分辨率：	4位数
格式：	0.00kW...9.999kW
	0.0kW….99.99kW

阻值的显示

（仅当“内阻控制”解锁情况下）

分辨率：	4位数
格式：	0.00mΩ…99.99mΩ
	0.000Ω...9.999Ω
	00.00Ω…99.99Ω
	0.0Ω…999.9Ω
	0Ω…9999Ω

时间的显示

时间以4种自动转换的范围显示。

分辨率：

范围1：	2ms to 9.999 s
范围2：	10ms to 59.99s
范围3：	1:00m to 59:59min
范围4：	1:00h to 99:59h

精确度：

范围1：	2ms
范围2：	10ms
范围3：	1s
范围4：	1 min

2.2 各型号详细规格

	PSI 8040-170 3U	PSI 8080-170 3U	PSI 8200-70 3U	PSI 8500-30 3U	PSI 8040-340 3U
电源输入					
输入电压范围	340…460V AC	340…460V AC	340…460V AC	340…460V AC	340…460V AC
可选输入电压范围	-	-	-	-	-
要求相数	L1, L2, PE	L1, L2, PE	L1, L2, PE	L1, L2, PE	L1, L2, L3, PE
输入频率	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz
输入保险丝	2x T16A	2x T16A	2x T16A	2x T16A	4x T16A
输入电流	最大11A	最大16A	最大16A	最大16A	最大29A
功率因数值	> 0.99	> 0.99	> 0.99	> 0.99	> 0.99
输出 - 电压					
额定电压U_{Nom}	40V	80V	200V	500V	40V
可调范围	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}
市电波动范围在±10% ΔU_{IN}时的稳定度	< 0.02%	< 0.02%	< 0.02%	< 0.02%	< 0.02%
带载0…100%时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
带载100%时电压从R10%至90%的上升时间	最大30ms	最大30ms	最大30ms	最大30ms	最大30ms
纹波 @ BWL 20MHz	< 100mVpp < 10mVrms	< 100mVpp < 10mVrms	< 200mVpp < 25mVrms	< 250mVpp < 70mVrms	< 150mVpp < 10mVrms
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	10mV	10mV	100mV	100mV	10mV
远程感测补偿电压	最大2.5V	最大2.5V	最大6V	最大10V	最大2.5V
过压保护阀值 (可调)	0…44V	0…88V	0…220V	0….550V	0…44V
输出 - 电流					
额定电流I_{Nom}	170A	170A	70A	30A	340A
可调范围	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}
市电波动范围在±10% ΔU_{IN}时的稳定度	< 0.05%	< 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%	< 0.15%
纹波 @ BWL 20MHz	< 528mApp < 106mArms	< 300mApp < 40mArms	< 44mApp < 11mArms	< 14mApp < 8mArms	< 600mApp < 80mArms
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	100mA	100mA	10mA	10mA	100mA
负载从10…90%瞬态恢复时间	< 2ms	< 2ms	< 2ms	< 2ms	< 2ms
输出 - 功率					
额定功率P_{Nom}	3300W	5000W	5000W	5000W	6600W
功率降额时的额定功率	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	0.001kW	0.001kW	0.001kW	0.001kW	0.001kW
效率	93%	93%	95.20%	95.50%	93%
其它					
环境温度	0….50°C	0….50°C	0….50°C	0….50°C	0….50°C
储存温度	-20….70°C	-20….70°C	-20….70°C	-20….70°C	-20….70°C
相对湿度	< 80%	< 80%	< 80%	< 80%	< 80%
尺寸 (WxHxD)**	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm
重量	19.8kg	19.8kg	19.8kg	19.8kg	25.5kg
冗餘操作	无	无	无	无	有
Isolation +output to enclosure	500V DC	500V DC	500V DC	1000V DC	500V DC
Isolation -output to enclosure	300V DC				
绝缘耐压输入对输出	4200V DC				
制冷	风扇制冷，前板为入风口，后板为排风口				
安全标准	EN 60950				
EMC标准	EN 61326, EN 55022 等级 B				
过压等级	2				
保护等级	1				
污染程度	2				
工作高度	<2000m				
串联操作					
最大串联电压	600V				
主-从操作	无				
并联操作					
最大并联电压	1500V				
主-从操作	有，经共享总线连接器				
模拟编程					
输入范围	0…5V 或 0…10V，可选				
精确度*	≤ 0.2%				
输入阻抗	53kOhm				

* 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。

** 此仅为外壳尺寸，非产品整体外形尺寸

	PSI 8040-510 3U	PSI 8080-340 3U	PSI 8160-170 3U	PSI 8200-140 3U	PSI 8400-70 3U
电源输入					
输入电压	340…460V AC	340…460V AC	340…460V AC	340…460V AC	340…460V AC
可选输入电压范围	-	-	-	-	-
要求相数	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE
输入频率	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz
输入保险丝	6x T16A	4x T16A	4x T16A	4x T16A	4x T16A
输入电流	最大28A	最大28A	最大28A	最大28A	最大28A
功率因数值	> 0.99	> 0.99	> 0.99	> 0.99	> 0.99
输出 - 电压					
额定电压U_{Nom}	40V	80V	160V	200V	400V
可调范围	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}
市电波动范围在±10% ΔU_{IN}时的稳定度	< 0.02%	< 0.02%	< 0.02%	< 0.02%	< 0.02%
带载0…100%时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
带载100%时电压从R10至90%的上升时间	最大30ms	最大30ms	最大30ms	最大30ms	最大30ms
纹波 @ BWL 20MHz	< 150mVpp < 10mVrms	< 150mVpp < 10mVrms	< 300mVpp < 30mVrms	< 200mVpp < 25mVrms	< 300mVpp < 40mVrms
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	10mV	10mV	100mV	100mV	100mV
远程感测补偿	最大2.5V	最大2.5V	最大5V	最大6V	最大12V
过压保护门限 (可调)	0…44V	0….88V	0….176V	0…220V	0…440V
输出 - 电流					
额定电流I_{Nom}	510A	340A	170A	140A	70A
可调范围	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}
市电波动范围在±10% ΔU_{IN}时的稳定度	< 0.05%	< 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%	< 0.15%
纹波 @ BWL 20MHz	< 900mApp < 120mArms	< 600mApp < 80mArms	< 300mApp < 60mArms	< 89mApp < 22mArms	< 33mApp < 9mArms
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	100mA	100mA	10mA	100mA	10mA
负载从10…90%瞬态恢复时间	< 2ms	< 2ms	< 2ms	< 2ms	< 2ms
输出 - 功率					
额定功率P_{Nom}	10000W	10000W	10000W	10000W	10000W
电压<150V U_{in}时的额定功率	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	0.01kW	0.01kW	0.01kW	0.01kW	0.01kW
效率	93%	93%	93%	95.20%	95.20%
其它					
环境温度	0….50°C	0….50°C	0….50°C	0….50°C	0….50°C
储存温度	-20….70°C	-20….70°C	-20….70°C	-20….70°C	-20….70°C
相对湿度	< 80%	< 80%	< 80%	< 80%	< 80%
尺寸 (WxHxD)**	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm
重量	33kg	25.5kg	25.5kg	25.5kg	25.5kg
冗餘操作	有	有	无	有	无
Isolation +output to enclosure	500V DC	500V DC	500V DC	500V DC	900V DC
Isolation -output to enclosure	300V DC				
绝缘耐压输入对输出	4200V DC				
制冷	风扇制冷，前板为入风口，后板为排风口				
安全标准	EN 60950				
EMC标准	EN 61326, EN 55022 等级 A				
过压等级	2				
保护等级	1				
污染程度	2				
工作高度	<2000m				
串联操作					
最大串联电压	600V				
主-从操作	无				
并联操作					
最大并联电压	1500V				
主-从操作	有，经共享总线连接器				
模拟编程					
输入范围	0…5V 或 0…10V，可选				
精确度*	≤ 0.2%				
输入阻抗	52kOhm				

* 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。

** 此仅为外壳尺寸，非产品整体外形尺寸

	PSI 8500-60 3U	PSI 81000-30 3U	PSI 8080-510 3U	PSI 8200-210 3U	PSI 8240-170 3U
电源输入					
输入电压	340…460V AC	340…460V AC	340…460V AC	340…460V AC	340…460V AC
可选输入电压范围	-	-	588…796V AC +MP	588…796V AC +MP	588…796V AC +MP
要求相数	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE
输入频率	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz
输入保险丝	4x T16A	4x T16A	6x T16A	6x T16A	6x T16A
输入电流	最大28A	最大28A	最大28A	最大28A	最大28A
功率因数值	> 0.99	> 0.99	> 0.99	> 0.99	> 0.99
输出 - 电压					
额定电压U_{Nom}	500V	1000V	80V	200V	240V
可调范围	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}
市电波动范围在±10% ΔU_{IN}时的稳定度	< 0.02%	< 0.02%	< 0.02%	< 0.02%	< 0.02%
带载0…100%时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
带载100%时电压从R10至90%的上升时间	最大30ms	最大30ms	最大30ms	最大30ms	最大30ms
纹波 @ BWL 20MHz	< 300mVpp < 70mVrms	< 800mVpp < 200mVrms	< 150mVpp < 10mVrms	< 250mVpp < 25mVrms	< 500mVpp < 20mVrms
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	100mV	1V	10mV	100mV	100mV
远程感测补偿	最大10V	最大20V	最大2.5V	最大6V	最大7.5V
过压保护门限 (可调)	0…550V	0…1100V	0…88V	0…220V	0…264V
输出 - 电流					
额定电流I_{Nom}	60A	30A	510A	210A	170A
可调范围	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}
市电波动范围在±10% ΔU_{IN}时的稳定度	< 0.05%	< 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%	< 0.15%
纹波 @ BWL 20MHz	< 33mApp < 16mArms	< 22mApp < 11mArms	< 900mApp < 120mArms	< 167mApp < 33mArms	< 333mApp < 27mArms
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	10mA	10mA	100mA	100mA	100mA
负载从10…90%瞬态恢复时间	< 2ms	< 2ms	< 2ms	< 2ms	< 2ms
输出 - 功率					
额定功率P_{Nom}	10000W	10000W	15000W	15000W	15000W
电压<150V U_{in}时的额定功率	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	0.01kW	0.01kW	0.01kW	0.01kW	0.01kW
效率	95.50%	95.50%	93%	95.20%	93%
其它					
环境温度	0….50°C	0….50°C	0….50°C	0….50°C	0….50°C
储存温度	-20….70°C	-20….70°C	-20….70°C	-20….70°C	-20….70°C
相对湿度	< 80%	< 80%	< 80%	< 80%	< 80%
尺寸 (WxHxD)**	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm
重量	25.5kg	25.5kg	33kg	33kg	33kg
冗餘操作	有	无	有	有	无
Isolation +output to enclosure	1000V DC	1500V DC	500V DC	500V DC	500V DC
Isolation -output to enclosure	300V DC				
绝缘耐压输入对输出	4200V DC				
制冷	风扇制冷，前板为入风口，后板为排风口				
安全标准	EN 60950				
EMC标准	EN 61326, EN 55022 等级 A				
过压等级	2				
保护等级	1				
污染程度	2				
工作高度	<2000m				
串联操作					
最大串联电压	600V				
主-从操作	无				
并联操作					
最大并联电压	1500V				
主-从操作	有，经共享总线连接器				
模拟编程					
输入范围	0…5V 或 0…10V，可选				
精确度*	≤ 0.2%				
输入阻抗	52kOhm				

* 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。

** 此仅为外壳尺寸，非产品整体外形尺寸

	PSI 8500-90 3U	PSI 8600-70 3U	PSI 81500-30 3U
电源输入			
输入电压	340…460V AC	340…460V AC	340…460V AC
可选输入电压范围	588…796V AC +MP	588…796V AC +MP	588…796V AC +MP
要求相数	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE
输入频率	50/60Hz	50/60Hz	50/60Hz
输入保险丝	6x T16A	6x T16A	6x T16A
输入电流	最大28A	最大28A	最大28A
功率因数值	> 0.99	> 0.99	> 0.99
输出 - 电压			
额定电压U_{Nom}	500V	600V	1500V
可调范围	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}
市电波动范围在±10% ΔU_{IN}时的稳定度	< 0.02%	< 0.02%	< 0.02%
带载0…100%时的稳定度	< 0.05%	< 0.05%	< 0.05%
带载100%时电压从R10至90%的上升时间	最大30ms	最大30ms	最大30ms
纹波 @ BWL 20MHz	< 300mVpp < 70mVrms	< 400mVpp < 80mVrms	< 1000mVpp < 350mVrms
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	100mV	100mV	1V
远程感测补偿	最大10V	最大18V	最大30V
过压保护门限 (可调)	0…550V	0…660V	0…1650V
输出 - 电流			
额定电流I_{Nom}	90A	70A	30A
可调范围	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}
市电波动范围在±10% ΔU_{IN}时的稳定度	< 0.05%	< 0.05%	< 0.05%
带载0…100% ΔU_{OUT}时的稳定度	< 0.15%	< 0.15%	< 0.15%
纹波 @ BWL 20MHz	< 50mApp < 23mArms	< 30mApp < 12mArms	< 19mApp < 13mArms
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	10mA	10mA	10mA
负载从10…90%瞬态恢复时间	< 2ms	< 2ms	< 2ms
输出 - 功率			
额定功率P_{Nom}	15000W	15000W	15000W
电压<150V U_{in}时的额定功率	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	0.01kW	0.01kW	0.01kW
效率	95.50%	95.20%	95.50%
其它			
环境温度	0….50°C	0….50°C	0….50°C
储存温度	-20….70°C	-20….70°C	-20….70°C
相对湿度	< 80%	< 80%	< 80%
尺寸 (WxHxD)**	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm
重量	33kg	33kg	33kg
冗餘操作	有	无	无
Isolation +output to enclosure	1000V DC	1000V DC	2000V DC
Isolation -output to enclosure	300V DC		
绝缘耐压输入对输出	4200V DC		
制冷	风扇制冷，前板为入风口，后板为排风口		
安全标准	EN 60950		
EMC标准	EN 61326, EN 55022 等级 A		
过压等级	2		
保护等级	1		
污染程度	2		
工作高度	<2000m		
串联操作			
最大串联电压	600V		
主-从操作	无		
并联操作			
最大并联电压	1500V		
主-从操作	有，经共享总线连接器		
模拟编程			
输入范围	0…5V 或 0…10V，可选		
精确度*	≤ 0.2%		
输入阻抗	52kOhm		

* 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。

** 此仅为外壳尺寸，非产品整体外形尺寸

3. 产品描述

3.1 各面视图

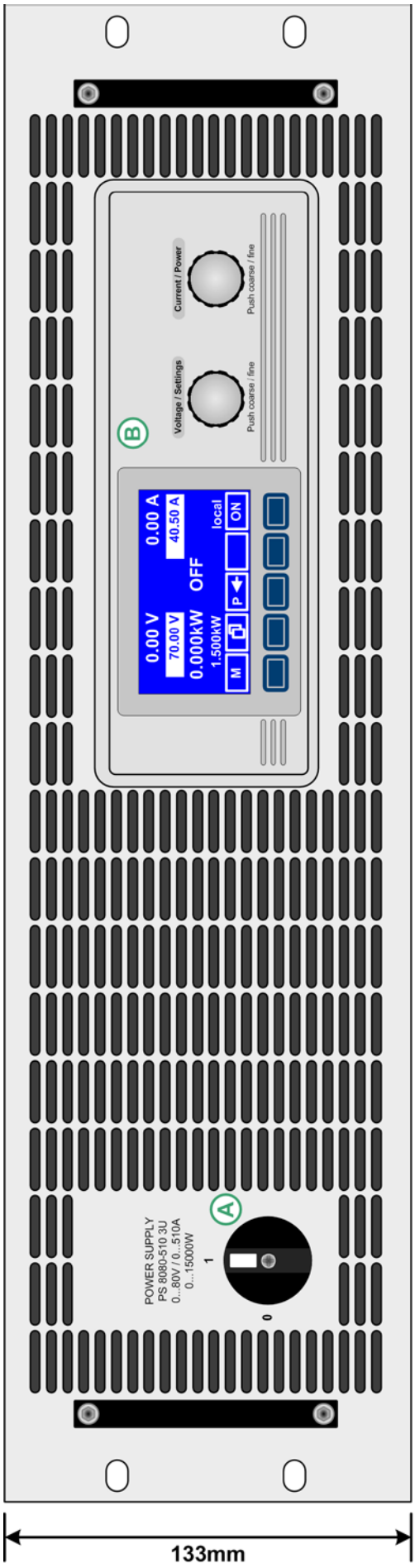


图 1

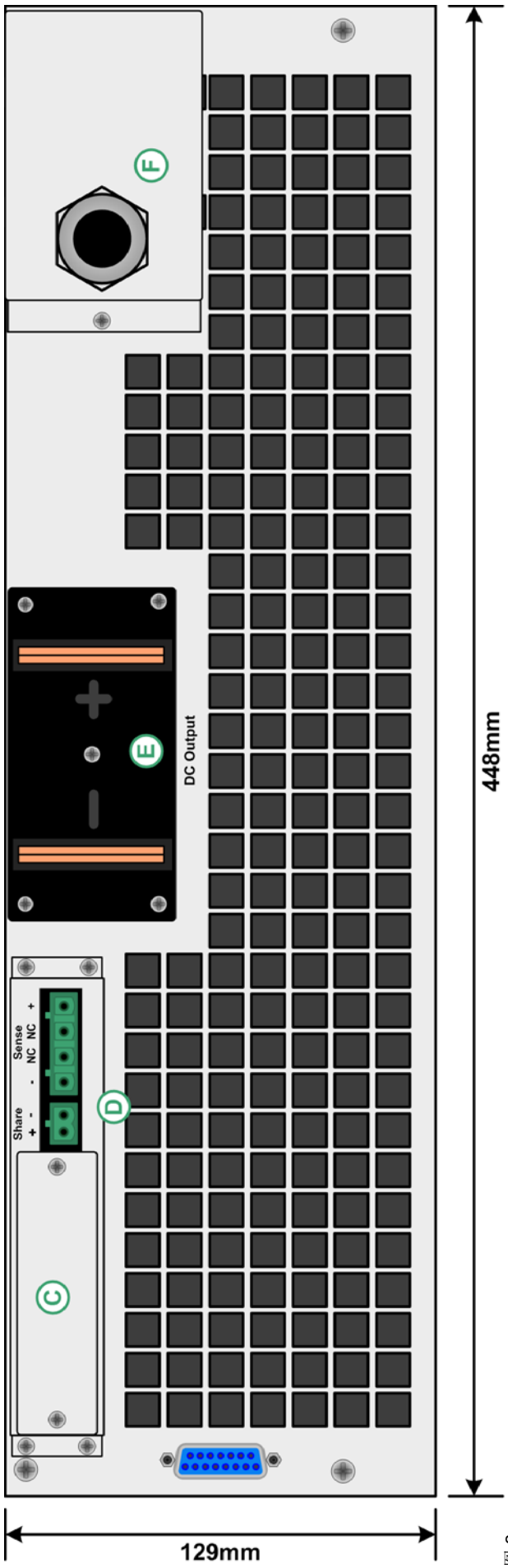


图 2

A - 电源开关
B - 控制面板
C - 接口卡插槽
D - 共享总线和远程感测端
E - 直流输出端
F - 交流输入端

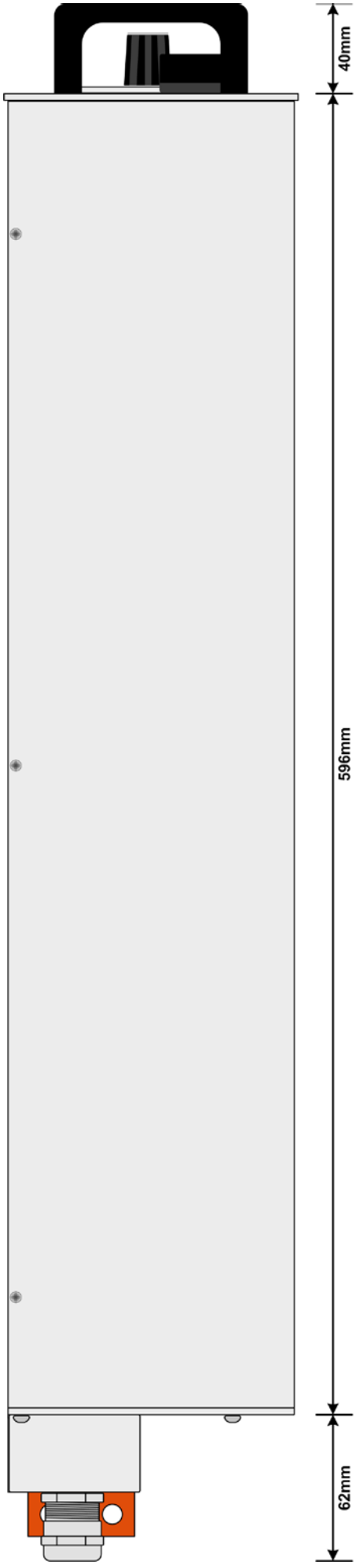


图 3

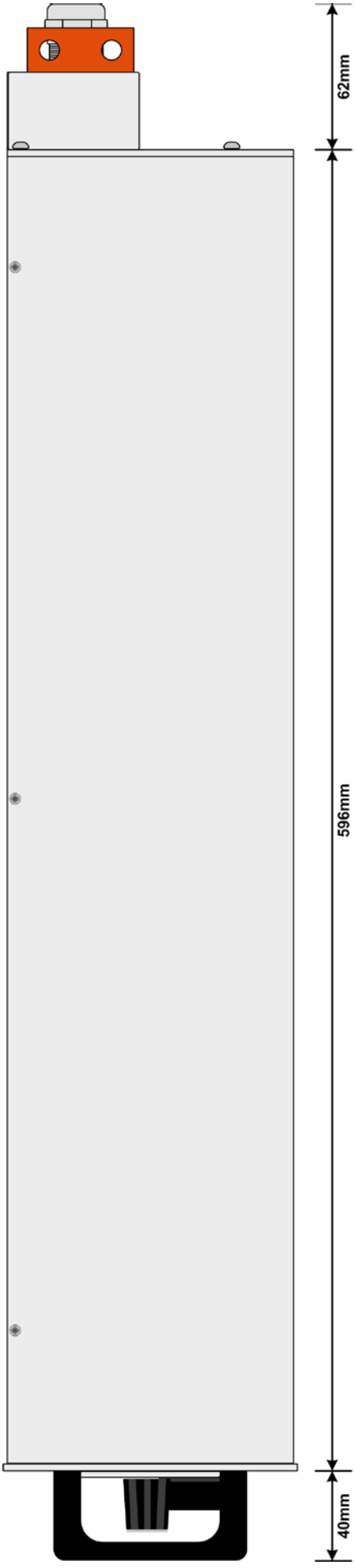


图 4

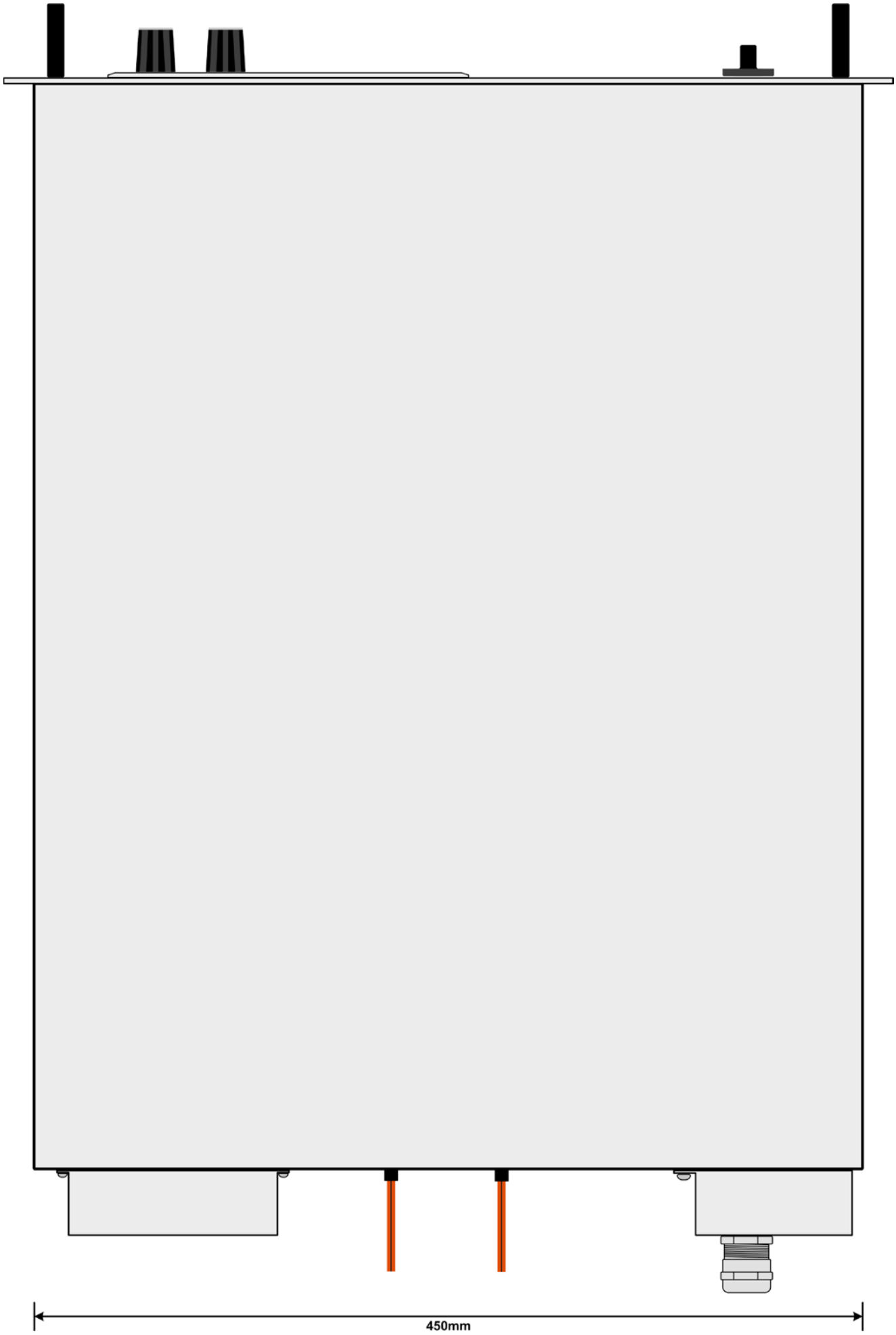


图 5

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 共享总线插头（已插上）

1 x 远程感测用插头（已插上）

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 打开产品

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方可进行相关维护或修理。

打开产品通常只为更换保险丝。

4.4 冗余操作

本系列部分型号还具有冗余操作功能。意思是，产品上含有两至三个功率段，只要有一个功率段维持工作，其他功率段因过热而被关闭，本电源仍将供电到输出端。详情可参考„2.2 各型号详细规格“，查看具有该功能的产品型号。

5. 安装

5.1 目检

收到产品拆包装后，请检查是否有外观受损痕迹。如有，请不要操作该产品，应立即联系您的供应商。

5.2 输入端连接（单机）

本系列产品的交流输入端必须连接两相（3.3kw/5kW型号）或三相，（6.6kW/10kW/15kW型号）的产品则要求连接带接地（PE）的三相供电电压。

该连接必须使用合适直径的连接线来完成。见下表举例，都针对单机连接的连接线：

	L1		L2		L3	
	ø	I_{max}	ø	I_{max}	ø	I_{max}
3.3kW	-	-	2,5mm²	11A	2,5mm²	11A
5kW	-	-	2,5mm²	16A	2,5mm²	16A
6.6kW	2,5mm²	19A	2,5mm²	11A	2,5mm²	11A
10kW	4mm²	28A	4mm²	16A	4mm²	16A
15kW	4mm²	28A	4mm²	28A	4mm²	28A

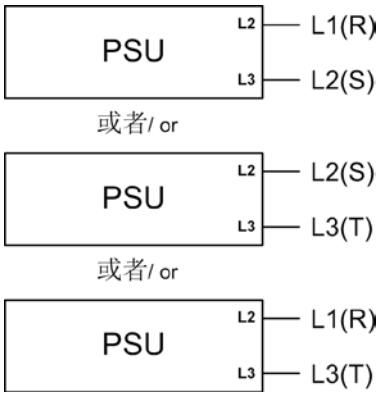
我们建议如下：

对于3.3kW/5kW/6.6kW型号： 至少为2,5mm²

对于10kW/15kW型号： 至少为4mm²

针对每相以及地(PE)。

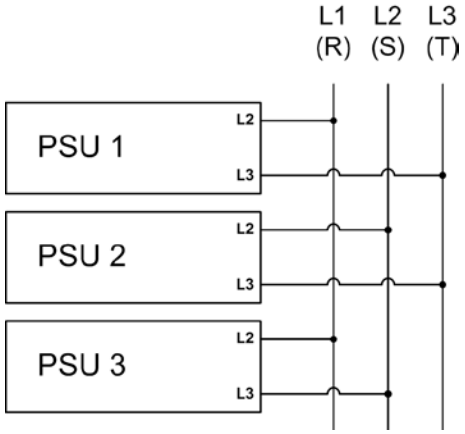
3.3kW/5kW单机型号使用的两相线可任意选择。意思是，不一定非为L2 (R)与L3 (S)：



5.3 输入端连接（多台机）

若有多台同功率级别或不同功率的产品连接到同一三相电压上，则需考虑相位间电流的分配，以达到平衡。如果连接一台或2台仅需两相电的产品，将会引起不均衡的电流分布，3台是最理想的。

下图以**3.3kW/5kW**型号产品的配置为例：



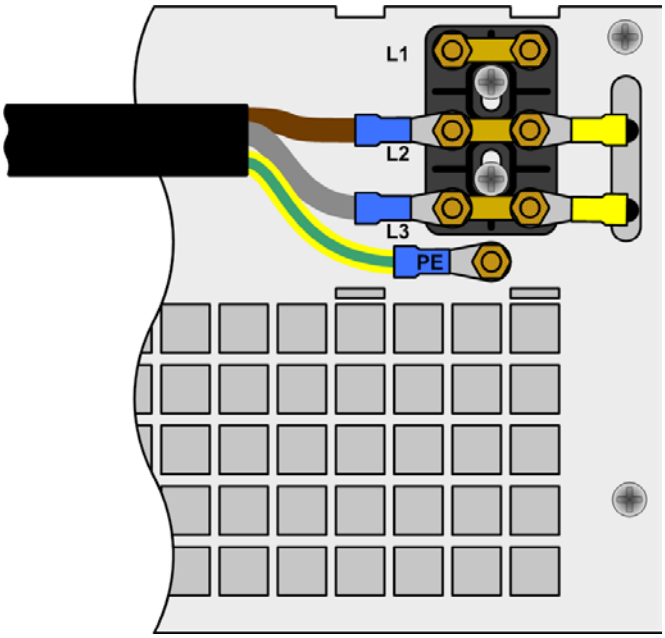


图6. 3.3kW/5kW产品输入端连接线图

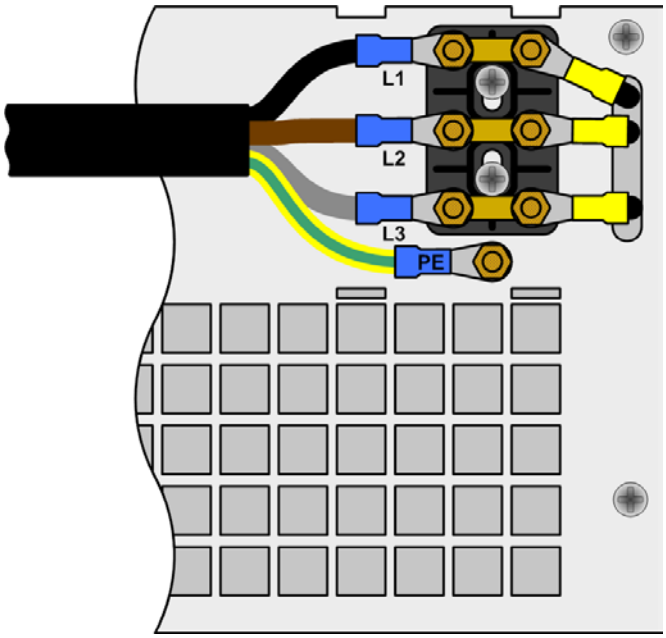
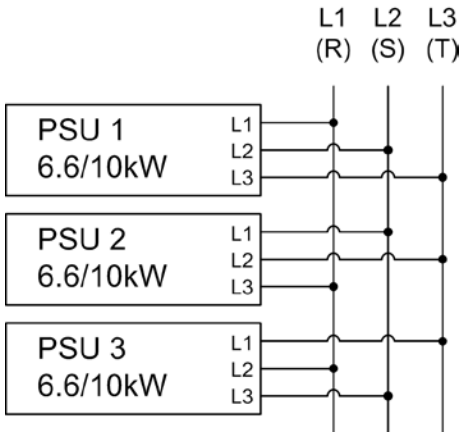


图7. 6.6kW/10kW/15kW产品输入端连接线图

6.6kW/10kW型号的有所不同。比如，L2(S)处已负载一台28A的产品，该情况下则建议更改相位图。意即，不必将L1(R)相接到产品输入端子的L1输入极。下图显示了一个电流几乎对称分布的范例，其中L1 = max. 44A, L2 = max. 56A 以及 L3 = max. 60A。

下图以**6.6kW/10kW**型号产品的配置为例：



5. 4 输入保险丝

本系列产品最多配有6个F16A/500V，6,3x32mm的保险丝熔断保护，都安装在产品内的主滤波板上，该板就在前面板后卖弄。如果需要更换号线泗，必须打开产品上盖。

5. 5 直流输出端

功率输出端位于产品后方。

该输出端**无**保险熔断！为避免负载应用损坏，需一直注意负载的额定值。

负载连线的直径由几个条件决定，如输出电流，线长和环境温度。

我们建议使用**1,5m**长的连线：

针对**30A**:	6mm²	针对**70A**:	16mm²
针对**90A**:	25mm²	针对**140A**:	50mm²
针对**170A**:	70mm²	针对**210A**:	95mm²
针对**340A**:	2x70mm²	针对**510A**:	2x120mm²

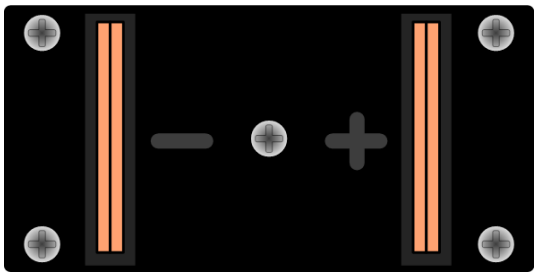
上面每个直流输出端连线的最小直径（软性线）。

例如70mm²的单线，也可用2条35mm²的连线代替。

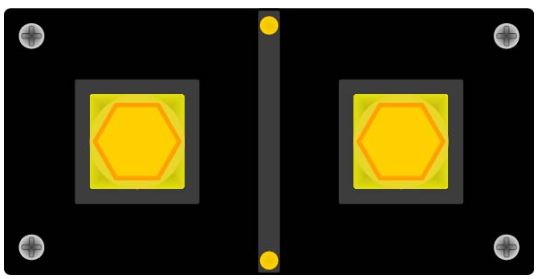
使用较长连线时，必须加大其直径，以免出现过大压降和发热过多。

5. 5. 1 输出端类型

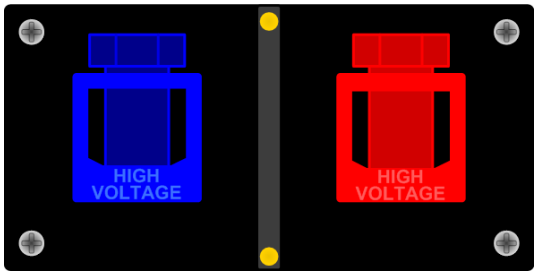
- **40V 或 80V** 型号：
  铜条上带有3个9mm配M8螺丝的螺丝孔
  建议：使用孔径为8mm的圆形接线片



- **160V/200V/240V** 型号：
  M8的螺柱固定于塑胶直流端子上
  建议：使用孔径为8mm的圆形接线片



- **400V**以上型号号：
  塑胶螺丝夹型端子
  建议：使用孔径为6mm的圆形接线片



5.6 输出端接地

注意！请仔细阅读下面的信息！

一般情况下可将单机与单机或者并联下多台机的直流负(-)输出端接地。额定电压为**300V**以下产品，只有其直流正（+)输出端方可接地。

串联时注意输出各极的电位转移！此时仅允许最低电压极接地。串联时允许最大电压为：**600V DC**。

注意！将直流输出极接地时，要注意消费端，如电子负载，是否也与其中一极接地了！因为这可能会导致短路！

5.7 “Sense”（远程感测）端

了补偿负载线上的压降，电源可“感测”负载上的电压，而不是输出端的电压。它将调整输出电压，以便能提供所需电压给负载。最大调整值可见章节„2.2 各型号详细规格“下的“远程感测补偿”。

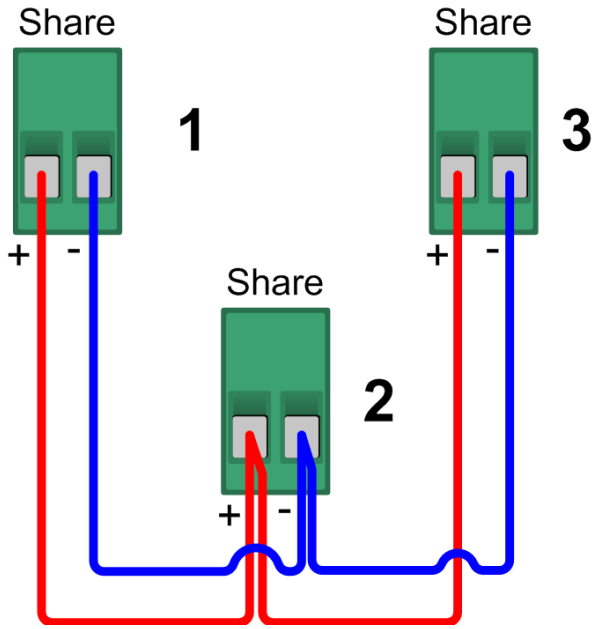
远程感测的连接点在产品后板“感测”端子上。也可见章节3.1。

(+)感测端只能与负载设备的(+)输出端相连，(–)感测端与(–)输出端相连！否则会损坏本产品。

面板其它信息请见章节8.7。

5.8 “Share”（共享）端

若想使用共享总线操作，只要将相关产品的“共享”端连在一起即可：



再无其它操作。关于共享总线操作详情请参考章节„11.1 共享总线模式下的并联“。

注意！不可将不同于3U系列的产品连接到共享总线端上，即使它也有共享总线连接功能。

5.9 接口卡插槽

本系列产品可配一接口卡。接口卡插槽位于产品后面。关于卡的详细信息请参考接口卡用户使用指南中章节„9. 数字接口卡“，以及接口卡快速安装指南。

6. 操作

6.1 显示

图8展示了图形显示器的总图。正常操作时，显示器显示实际和设定电压（左上排）和电流（右上排），以及功率（左下排）。而在设置模式下，显示参数和相关设置。

如果“内阻控制”解锁，内阻设定值可能代替功率设定值，随产品设置所选而定。

6.2 使用符号

下列描述的显示和操作元素以不同符号标示。

= 仅显示，所有只显示，代表状态的元素以这个符号标识

◆ = 参数，可更改值以该符号标识，且表示强调

= 菜单项目，可选择，指向下个分级或带参数的最低级

{...}括号表示可能的选项或参数的调节范围。

6.3 各显示元素简介

70.00 V 实际输出电压

35.00 A 实际输出电流

1.300kW 实际输出功率

正常操作期间，实际值以大写字母显示。

70.00 V 设定电压

期望输出电压的目标值（左旋钮）。可对该值粗调（见章节6.6的步宽）或细调（逗号右边的位数）。粗调和细调见得转换通过左旋转编译器上的按钮完成。

40.50 A 设定电流

期望输出电流的目标值（右旋钮）。可对该值粗调（见章节6.6的步宽）或细调（逗号最右边数位）。粗调和细调见得转换通过右旋转编译器上的按钮完成。要调节设定值必须先按 I◄ 按钮。

1.500kW 设定功率

期望最大输出功率的目标值（右旋钮）。要设定该值，必须在之前就按下 P◄ 按钮。该数值可粗调（见章节6.6的步宽），也可细调（逗号最右边数位）。

10.00 Ω 设定内阻（选项）

期望内阻的目标值（右旋钮）。如果内阻控制解锁，且在产品设置下选择了U/I/R模式，该设定值替代功率设定值。要设定该值，必须先按下 R◄ 按钮。

电源输出的状态显示于显示器右下角。

{ON,OFF} 电源输出状态

当前激活的控制模式显示于相应实际值的右边。比如，“CV”缩写显示于实际电压的旁边，表示“控制电压”模式正在运行。这些输出值由运行的控制模式限定：

CV - 由电压设定值限定 (= 恒压)

CP - 由功率设定值限定 (= 恒功率)

CC - 由电流设定值限定 (= 恒电流)

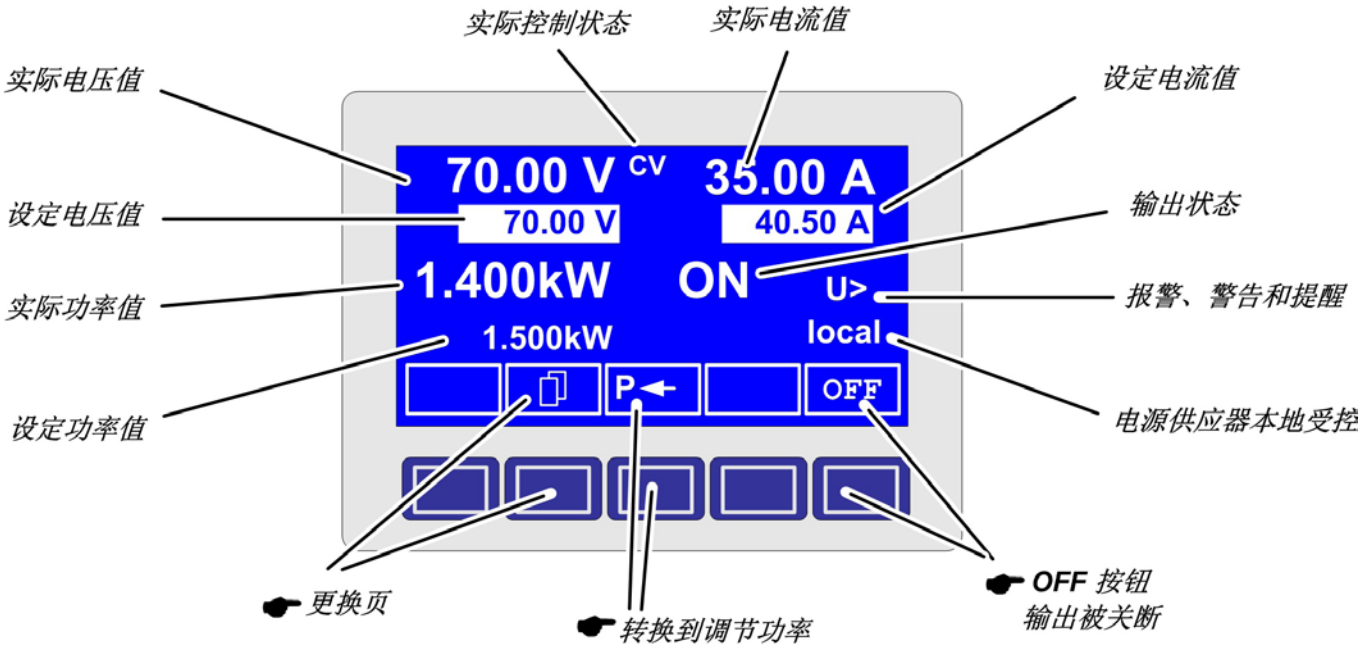


图 8

CR - 由设定内阻值限定(U/I/R模式下），显示于实际值旁
(= 恒阻)

另外与输出状态不同的，还有报警、警告或信号提示：

Alarm 如： ⚠ OT = 过温

Warnings 如： U> = 过压

Signals 如： I> = 过流

产品当前受控位置显示于输出状态下方。此位置表示用户在未改变位置时绝不可控制该仪器。

local 只能在该仪器上控制

remote 通过通讯接口（IF-C1, IF-R1, IF-U1 等。）进行远程控制

extern 通过内置或可选模拟接口的远程控制

6.4 打开功率输出

ON 只要未被内置模拟接口或可选模拟接口卡IF-A1的输入引脚“REM-SB”(13)覆盖，因这个引脚享有更高的优先权，按下**ON**按钮即可打开电源输出。如果该引脚阻止按钮打开输出，显示器会指示“**auto ON**”状态文字，提示用户，一旦清除该引脚的阻止，即可打开输出。

用**ON**按钮可将输出状态指示显示于显示屏上。

*提示：在**local**状态下（见章节6.9），模拟接口的REM-SB引脚（内部或外部）是无效的。*

显示器指示当前状态为“**ON**”。

OFF **OFF**按钮关闭电源输出。显示状态为“**OFF**”。

6.5 调节设定值

只要“**extern**”或“**remote**”未显示，都可手动调节电压、电流或功率设定值。

在产品设置◆Accept set value下选择模式，通过 M -> Profile -> General settings -> Control panel进入该设置。详情见„7.4 配置控制面板“。

直接设置设定值

用旋钮可直接设置设定值。

左旋钮调电压。当电压设定值被选定并调整时，数字反过来显示。

右旋钮既可以设置电流、功率设定值，也可以设置内阻设定值（当选择了模式，且该模式已解锁）。选定的设定值反向显示于屏幕上。

用**SELECT**键可选择：

P◄ 功率设定值

R◄ 内阻设定值或

I◄ 电流设定值

也可限制最大可调功率。

传送设定值

与设定值直接调节方式不同的，还可选择只有当提交设定值后用**RETURN**键方可设定这些参数。详情参考„7.4 配置控制面板“。设定值仍可用旋钮来更改，但只要没有提交就不会传到输出端。设定值未被修改时，只有单位才反向显示。修改后数值和单位都反向显示。

SELECT键可从电流调节转至功率调节，用右旋钮调节。此时选择的设定值未提交，也未设定。

↵ 按下**RETURN**键就提交设定值。

ESC 按下**ESC**键则取消新设定值，显示旧值。

注意：设定阻值的调节仅可在解锁了“内阻控制”选项（见章节7.8）后才可执行。

可从0Ω至20* Unom/Inom调节设定内阻。意思是，举例：当产品的Unom =80V和Inom = 510A，那我们可就可将它调至最大3.13Ω。

使用预设值

在菜单 **Preset List**下有一个由4组设定值组成的表格（见„7.2 预定义预设清单“）。用左旋钮选择预设清单，用**RETURN**按钮提交设定值，或用**ESC**按钮放弃使用。.

1→3 选定的设定值组目前仍为1。按下**RETURN**按钮后，第3组设定值被提交给店员。显示器则显示新的设定值组，第**3**组。

MEM**ORY**-按钮可用来直接跳跃到定义预设清单的菜单页，然后利用**RETURN**按钮，按照正常方法进行编辑和提交。

6.6 设定值调节步宽

电压			电流		
额定值	粗调	细调	额定值	粗调	细调
40V	0.25V	10mV	30A	0.2A	10mA
80V	0.5V	10mV	60A	0.5A	10mA
160V	1V	0.1V	70A	0.5A	10mA
200V	2V	0.1V	90A	1A	10mA
240V	2V	0.1V	170A	1A	0.1A
400V	2V	0.1V	210A	2A	0.1A
500V	5V	0.1V	340A	2A	0.1A
600V	5V	0.1V	510A	5A	0.1A
1000V	10V	1V			
1500V	10V	1V			

功率		
额定值	粗调	细调
3.3/5kW	0.050kW	0.001kW
6.6/10kW	0.10kW	0.01kW
15kW	0.10kW	0.01kW

重点！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。

6.7 转换按钮面板


PAGE按钮可转换至另一按钮面板。用户利用其他面板的新按钮锁定控制面板，转至函数管理器或设置位置模式。

6.8 锁定控制面板


“**锁定按钮面板**”按钮可锁住所有除它自身和旋钮外的任何其它键。这样产品被锁定后，不可手动进入，不能更改任何参数，也不可进入任何菜单。在菜单下可设定锁定模式。于是可使控制面板完全失效，或者用**OFF**键解除(产品被锁定但可通过**OFF**键打开和关闭)。可参考章节„7.4 配置控制面板“的“键盘锁定”。


控制面板锁定后，图标即变为这个。此按钮可用于再次解除控制面板的锁定，如果


按住此键2s。

6.9 更改定位模式


用**EXT**按钮，用户通过数字或模拟接口卡可启动远程控制，停用**local**模式。


用此手型按钮可将产品设为有限制性的**local**模式，从而仅可手动控制它，而且拒绝经任何模拟或数字接口的访问。

6.10 转至函数管理器


SEQ键将显示屏转至函数管理模式。

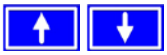
只有当产品处于待机状态(输出＝关闭)时方可转至函数管理器。且当前的电压、电流设定值为0V和0A。详情请参考章节„6.15 函数管理器“。

6.11 激活菜单


主菜单通过**MENU**键进入，显示屏转换到主菜单界面，出现如下文本菜单：

Profile	设置和选择用户档案
Function	设置函数列
Analogue interface	设置内部模拟接口
Communication	配置可插拔式接口卡
Options	默认设置，解锁功能，锁定产品配置
About...	生产商，服务，软件版等


按**ESC**按钮将进入上一级菜单页。

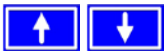

按**SELECT**键选择进入另一个菜单。


按**RETURN**键进入下一级子菜单。菜单最后一级总以参数页显示，详见下一个主题。

6.12 参数页

参数页为菜单最底级。在这您可更改多种不同参数来设置产品。


按**ESC**键进入参数页的上级菜单，不再接受任何参数。


用**SELECT** 键选择不同参数。所选参数会反向显示，用左旋钮可进行更改。


RETURN键将更改后并被接受和保存的参数提交出去。并退出参数页面，进入下一个上级菜单。

6.13 报警、警告和信号提示

报警，警告和简单提示(此被称作“信号提示”)以声音或可视信号发出。内置模拟接口或可选模拟接口卡IF-A1的“OT”或“OVP”引脚也报告过压或过温错误。也可见章节„7.4 配置控制面板“。

报警要优先于警告或信号提示。一次可显示多至四种报警，警告或信号提示，且以每两秒间隔时间循环一次。如显示的信号超过四个，再有报警出现，前面的警告或提示信号将被取消，用报警替代。

输出电压、输出电流，及真实值与设定值间的差异都能监控到。

下页表列出可能出现的错误种类和其代表意义，产品可配置的可选错误种类。

报警 会关断输出，必须确认后才可重新启动输出(见第„6.14 报警和警告的确认“)。

警告 如未被确认则一直显示于屏幕。如果“auto ON”由于某一特殊故障被激活，则暂时关断电源输出。例如：在系统链接模式下从属电源的输入电压瞬间缺失。

提示信号 仅显示，并持续至故障原因消失。如出现超过一个以上的提示信号，它们将以2s的间隔时间循环显示。

6.14 报警和警告的确认


QUIT键确认报警和警告。

用此键确认了出现的警告后，将转为信号并持续显示，不然被删除，不再显示。

6.15 函数管理器

函数管理器用于创建可自动控制产品的函数。函数f(U, I, Δt)创建后，用户可建立设定值曲线。函数管理器每隔2ms设置设定值，意指只有2ms的倍数时间才能设定，比如：50ms。如果两点间的电压或电流改变，将形成一个由一定步骤组成的跳跃。(Δt:2ms，形成25个步骤，如果设定值是50ms的话)

函数管理器控制电源，输入配置在函数内的设定值。输出值的实际发展由负载决定。

使用术语解释：

函数=由多达5组连接的序列头(在菜单 Setup function开始)构成，而一个函数可组成多达五组不同的配置序列。

函数排布=通过函数管理器在函数布局下的配置，可设定电源操作模式(U/I/P 或 U/I/R)。而且还可在此处设定函数的重复率和序列的任意秩序。根据函数布局，函数管理器在上个序列完成后处理下一列，并使用下列的序列控制设定值。

序列＝由序列控制和10个序列点构成。如果函数管理器即将处理一序列，首先设定序列控制给出的参数，连续设定10个序列点，按照某特定序列设定的重复率，重复整个处理程序。

序列控制(Sequence control)) ＝定义序列重复率和序列处理过程中最大功率设定值与内阻(选项，必须解锁)。

序列点＝一个序列通常由10个序列点组成。序列点由函数管理器从0点到9点连续处理。序列点的定义决定了要在给出时间Δt内达到设定的电压、电流值。这使得用户通过设定0ms或2ms的阶跃函数和4ms至99h99m时间坡度，创建阶跃函数。还可设定0ms的时间，但形成的真实时间会是2ms，因为设定值是以2ms为一阶跃阶段。

除函数外，您可设置和使用用户化设置内的监控电路。也可通过接口卡的链接控制函数管理器，其特点：您可在函数将要停止的地方设置一暂停点。

6.15.1 配置函数

M + Function +

菜单页 Function指向下列菜单选项：

- Setup function
- Sequence 1
- Sequence 2
- Sequence 3
- Sequence 4
- Sequence 5

6.15.2 函数布局

Setup function +

此处可定义电源的操作模式和重复率。

◆Function mode

= U/I/P　函数使用U/I/P运作模式

= U/I/R　函数使用U/I/R运作模式
（仅当“内阻”选项解锁后）

也可见章节„7.1 定义操作参数“。

◆Funct.cycles

= {1..254}　循环n次

= ∞　无限制循环

◆Link sequences to one function

Task:	1	2	3	4	5
Seq.:	{-,1..5}	{-,1..5}	{-,1..5}	{-,1..5}	{-,1..5}

用户可针对特定任务定义函数由哪一序列组成，以何种顺序排列。图标“-”表示该任务未被定义，因此将不被处理。

	错误类型				
显示	报警	警告	简单提示	根据	描述
OV	•				电源输出端过压
SYS	•				一般系统错误
FCT	•				不能存储和/或不能提交函数
OT	•			1)	过温错误
		•		2)	
CAN		•			CAN总线传输错误
U>	def.	def.	def.		超过过压监控阀值
U<	def.	def.	def.		超过欠压监控阀值
I>	def.	def.	def.		超过过流监控阀值
I<	def.	def.	def.		超过欠流监控阀值
U↗	def.	def.	def.		正向电压转换时设定值比较出错
U↘	def.	def.	def.		负向电压转换时设定值比较出错
I↗	def.	def.	def.		正向电流转换时设定值比较出错
I↘	def.	def.	def.		反向电流转换时设定值比较出错
P↗	def.	def.	def.		正向功率转换时设定值比较出错
P↘	def.	def.	def.		反向功率转换时设定值比较出错

1) OT disappear = OFF

2) OT disappear = auto ON

def. = 可定义

6. 15. 3 配置序列

菜单页 **Sequence {1..5}**指向序列编辑页。

Sequence {1..5} +

指向下列菜单选项：

Sequence {1..5} (要编辑的序列数)

- **Sequence control**
- **Sequence points 0-4**
- **Sequence points 5-9**

此处可设置序列重复率，最大功率和内阻(可选，要解锁)，以及序列点。

6. 15. 4 与序列有关的参数

Sequence control +

Function mode : U/I/P {U/I/R}

显示电源供应器的函数模式。

◆**Seq. cycles** {1..254, ∞ } 默认：1

= {1..254} 重复n次
= ∞ 重复无数次

◆**P seq=** {0…P_{nom}} 默认：P_{nom}

此处的最大功率影响整个序列。

仅在选择“内阻”项的情况下(可解锁)：

◆**R seq= {**0Ω...20 * Ri_{nom}**}** 默认：R_{nom}

此处的最大内阻影响整个序列。

6. 15. 5 函数运行时的显示

Sequence points 0-4 {5-9} +

一个序列由10个序列点组成。一个序列点由3组数据组成： 电压U, 电流I和时间Δt的设定值。

◆**Δt =** { 0…99:59h}

◆**U[V] =** { 0… U_{nom}}

◆**I[V] =** { 0… I_{nom}}

要了解序列如何处理，您需考虑每个序列周期的开始条件：

函数开始的设定值

函数通常这样开始
U_{set} = 0V 和 I_{set} = 0A

再次进入序列的设定值

如果序列重复，最后被处理的序列将改变下个序列循环的开始条件。

比如：将序列点9设为80V/50A/250ms，重复运行该序列，于是序列以80V/50A，和之前设为0序列点（如：500ms）的时间开始循环。在500ms这个时间段内，设定值将以线性地接近0序列点的定义值。

函数管理器显示全图：

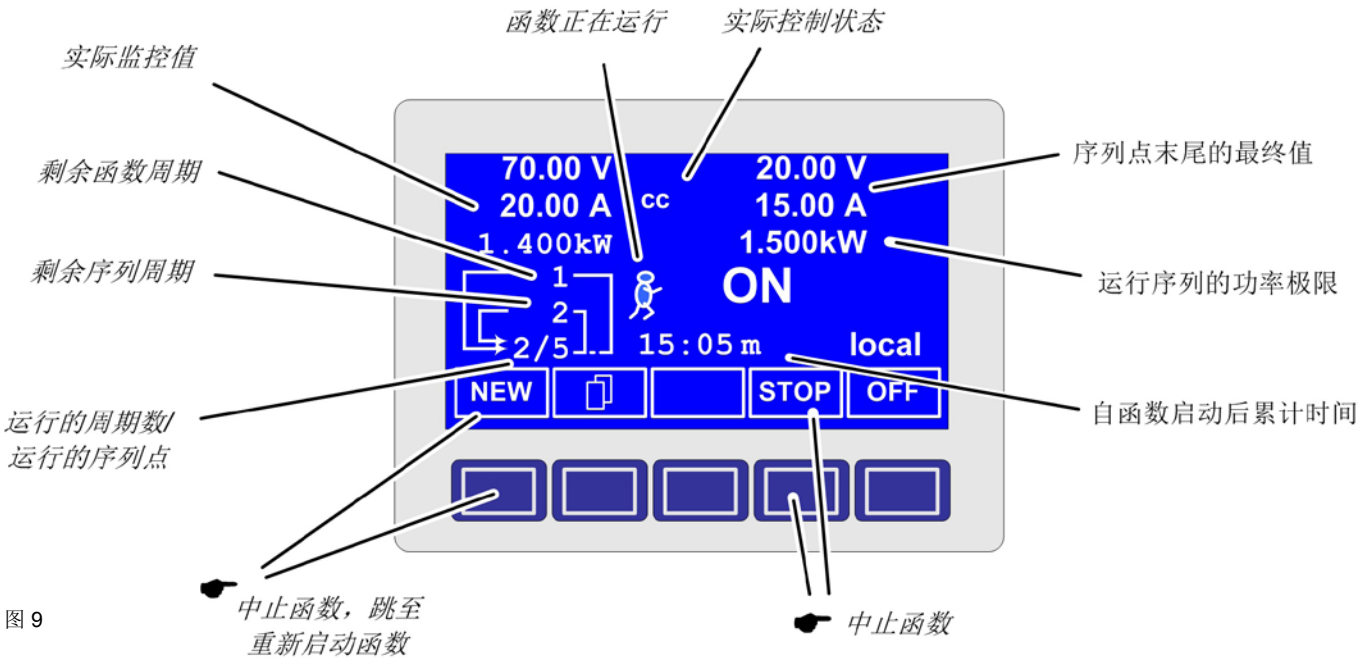


图 9

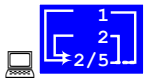
6. 15. 6 函数运行时的显示

也可见上页全图。

实际值的显示

在显示器左边，实际值值以小字体显示。运行的控制状态(CV/CC/CP)显示在对应值的右边。

序列处理完后即将到达的序列点设定值，显示于屏幕右边。



显示函数运作的状态，函数(1)和序列(2)的剩余重复次数，当前序列号(2/_)和现时运行的序列点(_/5)。


表示函数管理器暂停或尚未开始。


函数管理器正在运行。

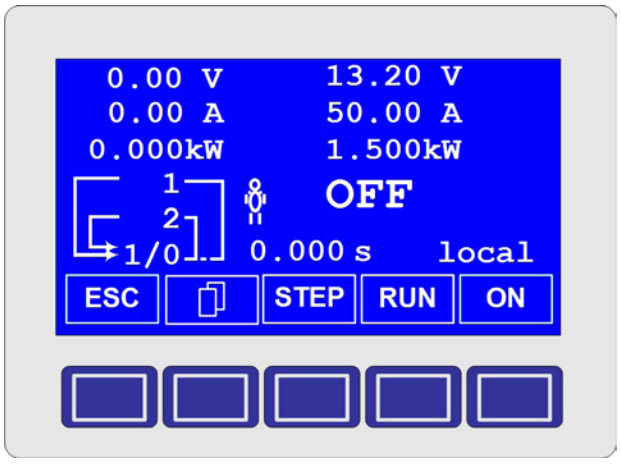
函数发生器启动后的累计时间也会显示出来。函数管理器停止，时间显示才停止。**STEP**，**RUN**或**GO**键以多种方式操作函数管理器，同时时间显示会持续累计。

{ON,OFF} 电源输出状态

除电源输出状态外，还显示报警，警告或信号提示状态。

6. 15. 7 函数管理器的控制

交互式控制面板给函数管理器提供多个控制键。利用这些按键用户可暂停、继续、重设为起始点或退出函数管理器。.



函数管理器真正设定电源前，可在显示屏幕上模拟此函数。在此操作过程中

- 不可打开输出，且
- 一步一步处理这些序列点，并按相同方法检验。

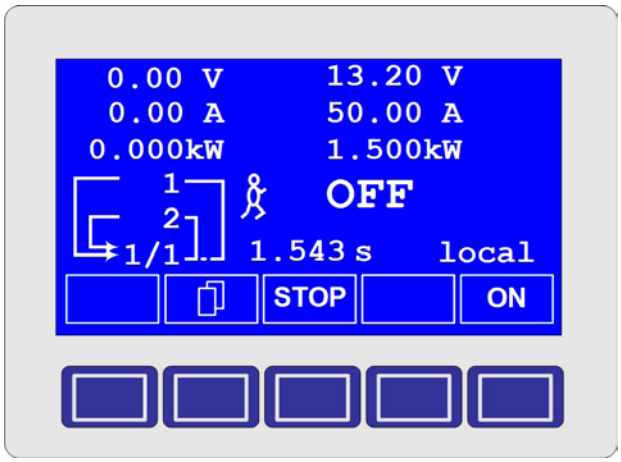
也可通过接口卡执行此操作。还可在50个序列点中额外地设置一停顿点。处理到这个点时，序列、函数就会暂停。

ESC键退出函数管理，并返回电源的前一状态。

STEP键逐步运行序列。按下此按钮，执行当前序列点。完成这个后，显示于屏幕右上角的设定值被设定。

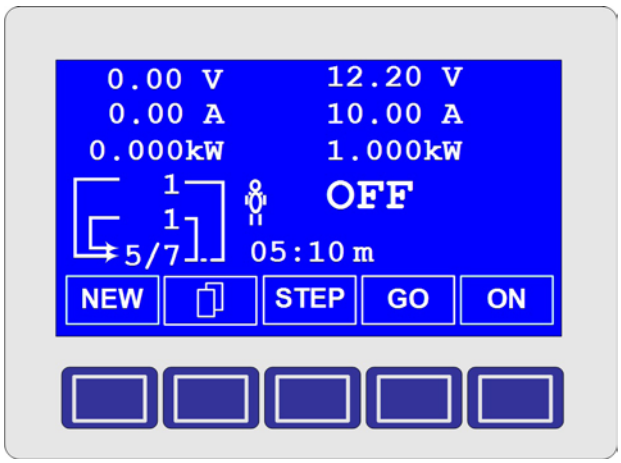
RUN键启动函数管理器，按定义值运行函数，然后持续处理序列点。

比如：待机时的模拟显示如下：



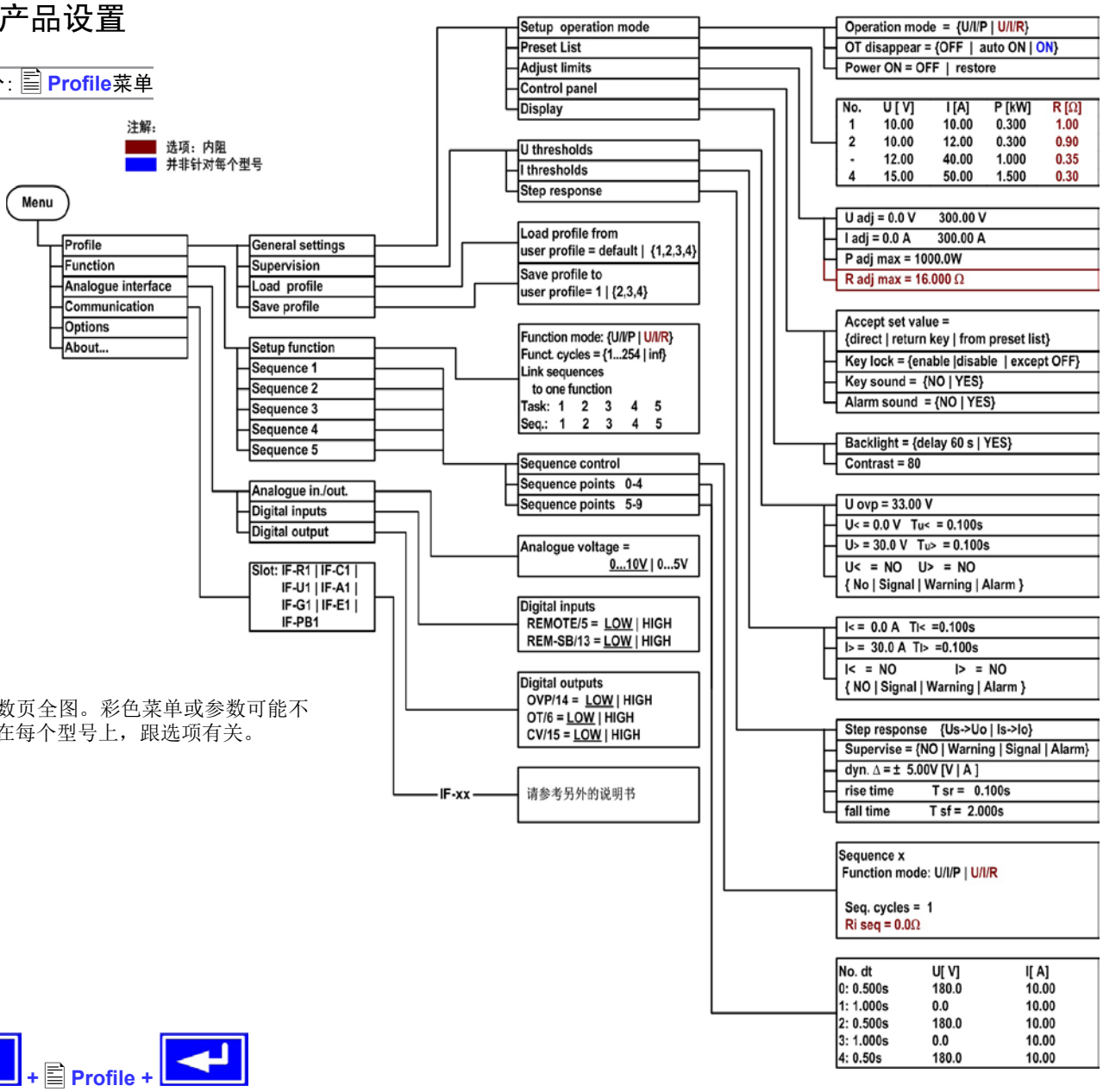
用**GO**键继续运行停止后的函数。

或者用**NEW**键可重设函数管理器，开始执行当前函数。



7. 产品设置

第1部分：Profile菜单



此为参数页全图。彩色菜单或参数可能不会出现在每个型号上，跟选项有关。

M + Profile + ↵

该配置文件意在减少不同用户设置产品时所需时间，或保留用户定义的设定参数，以便将来重复使用。最后使用的配置文件总在电源启动后上载。

进入 Profile菜单将出现下列选项：

- General settings
- Supervision
- Load profile
- Save profile

General settings + ↵

进入 General settings菜单，指向下列选项，可配置操作模式，显示界面，产品处理(调节)：

- Setup operation mode
- Preset list
- Adjust limits
- Control panel
- Display

Supervision + ↵

进入 Supervision 菜单，指向下列选项，可对报警、警告和信号提示，还有相应监控限制和反应时间进行设置。

- U thresholds
- I thresholds
- Step response

Load profile + ↵

◆ Load profile from user profile = {1..4, default}

当前配置文件被所选配置文件表代替。

Save profile + ↵

◆ Save profile to user profile = {1..4}

当前配置文件被存储于四个配置文件中的其中一个。.

7.1 定义操作参数

Setup operation mode +

在此可设置设定值的调节方式，即将使用的操作模式，主电源供电恢复后产品如何反应的设置，或产品出现过温异常后的行为。

U/I/P或 U/I/R 操作模式

◆**Setup op. mode** 默认： U/I/P

= U/I/P 功率级由设定电压、电流和功率控制。

= U/I/ R 功率级由电压、电流和内阻设定值，以及可设不可调的功率设定值（仅当“内阻控制”选项解锁后）控制。

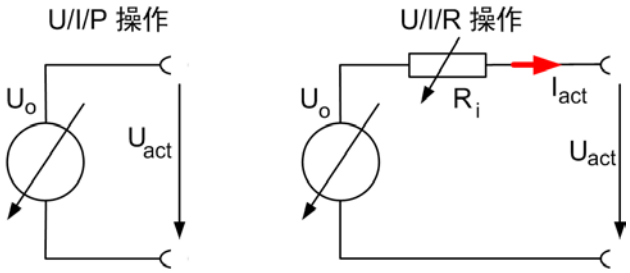
注意: U/I/R操作模式只有在 **Options**菜单中解锁后方可使用。解锁码可从售货公司买到。当购买产品时应要求告知序列号，因为解锁码与此相关。

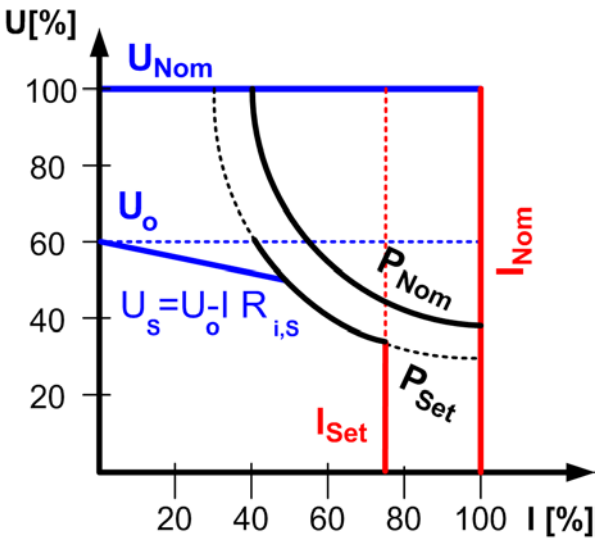
在U/I/R操作模式下，您可为电压源增加可调内阻。

设定电压与电源的空载电压U_0有关。$I_{ist} \cdot Ri_{soll}$可减少空载电压。该电压值的计算公式如下：

$$U_{soll} = (U_0 - I_{ist} \bullet Ri) \Big|^{Isoll,\ Psol}$$

图形解释：





CR 当内阻控制被激活，且设为U/I/R操作模式，将显示这个图标。

U/I/R模式被激活时，显示内阻Ri_{set}而不是功率P_{set}，但是功率实际值仍然显示。

过温错误出现后的恢复

◆**Output on OT** 默认：auto ON

=OFF 即使电源已经冷却，电源输出仍为关闭状态。错误 OT (过温)以报警形式显示。

= auto ON 当电源冷却到过温关闭极限以下，会自动打开。错误 OT(过温)以警告形式显示。

= ON 只要至少有一个功率级在工作，电源输出就保持打开状态，并一直提供电压。

警告与报警一样，只有当此动作被确认后才从显示屏消失(见章节„6.13 报警、警告和信号提示 “)。

“电源打开”后的输出状态

◆**Power ON** 默认：OFF

= OFF 市电恢复或电源被打开后其输出仍关闭。

= restore 电源供应器输出恢复到市电断电或电源供应器被关闭之前的状态。如果关闭产品时电源状态为ON，再次启动后，输出仍为ON。

7.2 预定义预设清单

Preset List +

可预先定义4组不同预设值。

No.	U[V]	I[A]	P[kW]	R[Ω]*
1:	0.00	0.00	1.500	20
2:	10.00	10.00	1.200	25
-:	0.00	0.00	1.500	50
-:	0.00	0.00	1.500	100

* 阻值(红色)仅在U/I/R模式解锁的情况下出现。

利用参数 ◆**Accept set value =** from preset list 您可从正常设定值转换到其中一组预设值，或在两组预设值之间转换。通过此选项实际上可在设定值之间“跳跃”。

7.3 调节极限

Adjust limits +

在此可定义最大和最小调整极限。这些极限常常在本地或远程模式(即：产品由电脑控制)下受干扰。

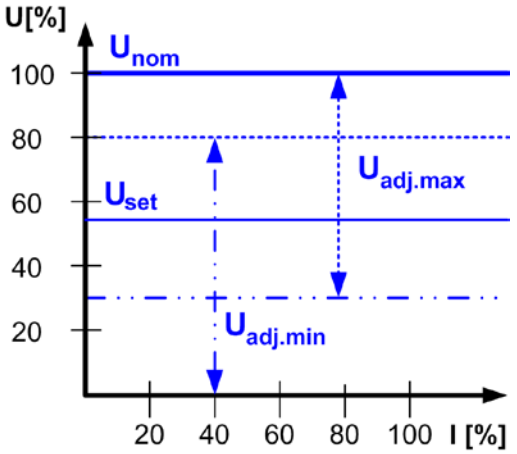
电压设定值极限

◆**U adj** 默认：0V, U_{nenn}

= {$U_{adj.min}$} {$U_{adj.max}$}

反之 $U_{adj.min}$ = {0...$U_{adj.max}$} und $U_{adj.max}$ = {$U_{adj.min}$...U_{nenn}}

在此可定义可调电压的上限和下限。超出极限的设定值不被接受，不管是由控制板还是由电脑远程控制(通过接口卡通讯)产生。



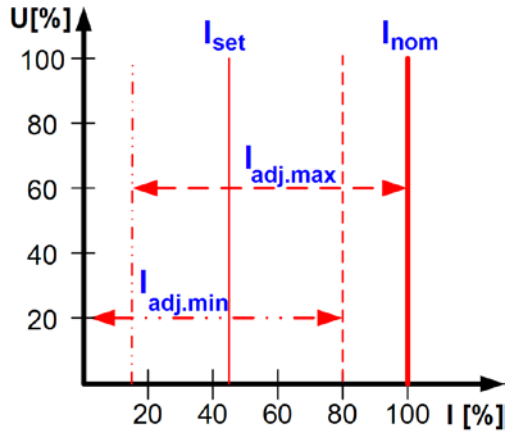
电流设定值界限

◆**I adj** 默认：0A, I_{nenn}

= {$I_{adj.min}$} {$I_{adj.max}$}

反之$I_{adj.min}$ = {0...$I_{adj.max}$} und $I_{adj.max}$ = {$I_{adj.min}$...I_{nenn}}

在此可定义可调电流的上限和下限。超出极限的设定值不被接受，不管是由控制板还是由电脑远程控制(通过接口卡通讯)产生。



功率设定值极限

◆**P adj max** 默认：P_{nenn}

= { 0 kW... P_{nenn} }

在此可定义可调功率的上限和下限。超出极限的设定值不被接受，不管是由控制板还是电脑控远程控制(通过接口卡通讯)产生。

内阻设定值极限

（可选项，仅在U/I/R模式解锁情况下）

◆**R adj max** 默认：0Ω

= { 0Ω...20 * Ri_{nenn} }

如果U/I/R模式已解锁，您可定义可调内阻的上限和下限。超出极限的设定值不被接受，不管是由控制板还是由电脑远程控制(通过用接口卡通讯)产生。

7.4 配置控制面板

Control panel +

菜单页 **Control panel** 能让您设置所有与图显和控制面板有关的参数。

配置设定值的调节方法

◆**Accept set value** 默认：direct

= direct	用旋钮更改设定值后，直接递交到产品功率级。
= return key	仅当用键提交后方可设定更改后的设定值。
= from preset list	用旋转编译器从 Preset List选择设定，然后用按钮提交。

控制面板的锁定

仅能在此配置控制面板的锁定。

◆**Key lock** 默认：except OFF

= except OFF	控制面板(按键和旋钮)将被锁定，但是OFF键除外。
= enable	旋钮和多数按钮将被锁定。
= disable	打开

控制面板的锁定是为了避免对设定值或其它设置进行不需要的更改。.

提示：该设定仅为暂时性设定。产品重启后或断电后重新获得供电时该设定被重设(=disable)。

声音

◆**Key sound** 默认：NO

= YES 按键有短“嘀”音提示

= NO 按键无声响

◆**Alarm sound** 默认：YES

= YES 如出现报警或警告，每间隔一短暂时间即发出“嘀”音信号。

= NO 报警/警告不带声音信号

7.5 配置图显

Display +

菜单页 **Display**设置所有与图显相关的参数。

◆**Backlight** 默认：ON

= YES 背光灯常亮

= delay 60s 最后一次使用按键或旋钮，60s后背光灯关闭。

◆**Contrast** 默认：70

= { 40...100 }

可按产品安装位置和能更清晰地观看数值来调节对比度。.

7.6 监控

Supervision +

菜单页**Supervision**配置对输出电压、电流和功率的监控，也可对阶跃函数监控。**Supervision**菜单页指向下列选项：

U thresholds

I thresholds

Step response

7.6.1 电压监控

U thresholds+

菜单页 **U thresholds**设置过压极限（OVP），以及过压与欠压的监控电路。

过压保护 (OVP)

◆**U ovp** 默认：1,1*U_{Nenn}

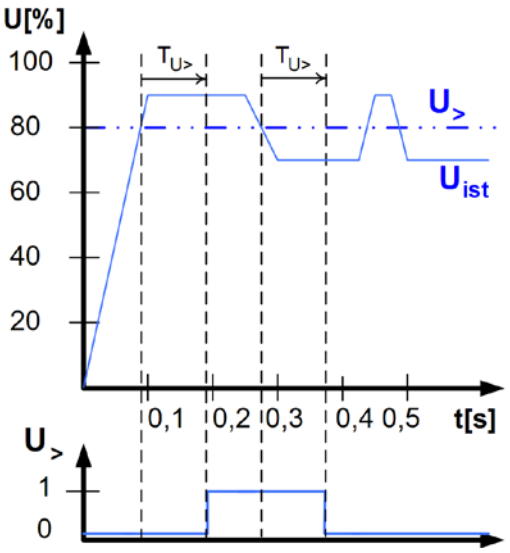
= {U>… 1,1*U_{Nenn}}

过压保护意在保护连接负载。应将过压保护阀值调至负载能承受且不受损的最大电压值。如果超过该极限值，会即刻关断输出。

举例： 一台80V产品的U_{ovp}最大能调到88V。

OV 这个是以报警显示的过压保护。
(见章节„6.13 报警、警告和信号提示“)

过压监控



◆**U>** 默认：U_{Nenn}

= { U<… U_{ovp}}

◆**Tu>** 默认：100 ms

= { 0…99:59h}

这与OVP(见上述)有稍微不同。在这也监控电压，但过了定义的延时◆Tu>时间后，以报警，警告或信号提示告知用户。如果在◆Tu>时间内电压下降至极限以下，该信号消失。因此您不是每次收到OVP错误信息，或者过压出现时间大于定义◆Tu>时间时只听到报警声，也可监控过压。

U> 报警：过压

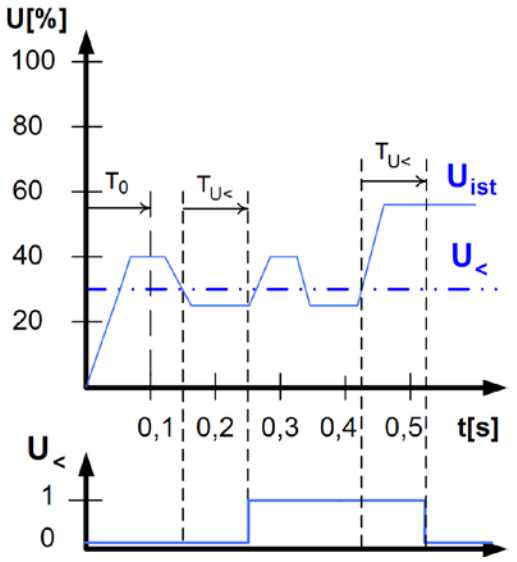
此错误关断电源输出。必须确认报警错误后，才能再次打开输出。

U> 警告：过压

此错误出现后并持续存在，直到信息被确认方才消失。

U> 信号提示：过压

欠压监控



◆**U<** 默认：0V
= { 0... U>}

◆**Tu<** 默认：100ms
= { 0...99:59h}

电压一下降至欠压极限以下，过了响应时间◆Tu<后，发出欠压信号。如果在◆Tu<内超过欠压极限，信号消失。在电源输出打开后，欠压错误仅维持T_0=100ms。

U< 报警：欠压

此错误关断电源输出。必须确认报警信息后，才能再次打开输出。

U< 警告：欠压

此错误出现后并持续存在，直到信息被确认后方才消失。

U< 信号提示： 欠压

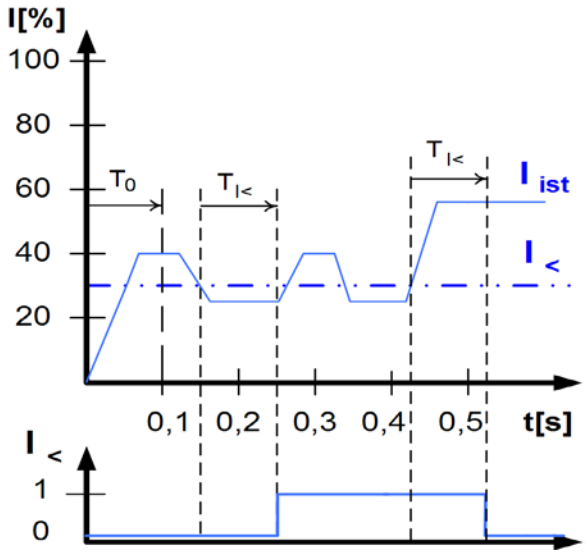
模拟接口(IF-A1,可选)可从其中一数字输出端发出过压或欠压信号。

7. 6. 2 电流监控

I thresholds +

菜单页 **I thresholds**配置欠流和过流监控电路。

欠流监控



◆**I<** 默认：0A
= { 0... I>}

◆**Ti<** 默认：100ms
= { 0...99:59h}

如果电流实际值降至已调欠流极限以下，过了响应时间◆**Ti<**后，发出欠流错误信号。如果在◆**Ti<**内实际电流超出极限，错误提示消失。再电源输出打开，欠压错误仅维持T_0=100ms。

I< 报警：欠流

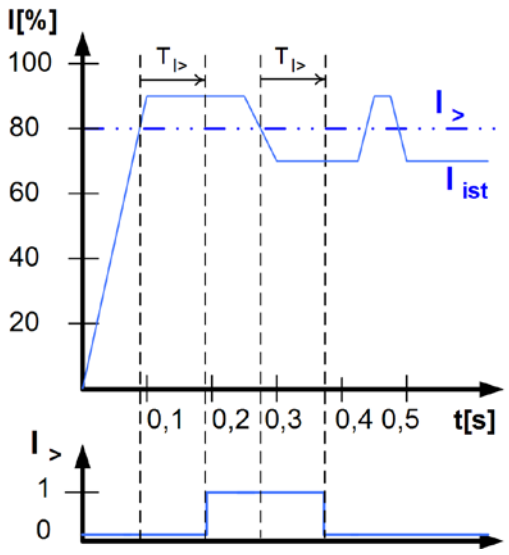
此错误关断电源输出。确认报警信息后，才能再次打开电源输出。

I< 警告：欠流

此错误出现后并持续存在，直到信息被确认后方才消失。

I< 信号提示：欠流

过流监控



◆I> 默认：I_{Nenn}
= { I<... I_{Nenn} }

◆Ti> 默认：100ms
= { 0...99:59h}

如果实际电流降至已调过流极限以下，过了响应时间◆Ti>后，发出过流错误信号。如果实际电流在◆Ti>内超出此极限值，错误提示消失。再电源输出打开后，过压错误仅维持T_0=100ms。

I> 报警：过流

此错误关断电源输出。必须确认报警信息后，才能再次打开电源输出。

I> 警告：过流

此错误出现后并持续，直到信息被确认后才消失。

I> 信号提示：过流

模拟接口(IF-A1,可选)可从其中一数字输出端发出过流或欠流信号。

7. 6. 3 阶跃响应监控

Step response +

菜单页 Step response配置实际值与设定值的动态和静态比较监控电路。

◆Step response: 默认：Us→Uo

Us→Uo	监控设定电压和实际电压的偏差
Is→Io	监控设定电压和实际电压的偏差

◆Supervise 默认：NO

NO	监控启动
Signal	监控报告一信号
Warning	监控报告一警告
Alarm	监控报告一报警

◆ dyn. Δ 默认：10% I_{nom} resp. U_{nom}

= ± {0...1,1*U_{nom}}	电压允许误差
= ± {0...I_{nom}}	电流允许误差

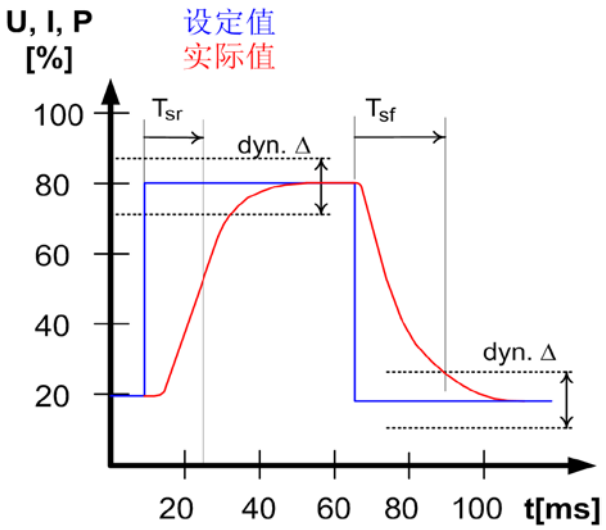
注意：电源供应器的设置过程取决于负载。当一组设定值被更改后，要过一定时间才能将期望值传到电源输出端。比如：在无负载或带很小负载的情况下，要花几秒钟的时间电压才从100%降到0V，因为输出电容需要一定的时间放电。

一个阶跃响应的监控

已调设定值与真实测量值进行比较。如果它们之间有差异，且差异大于误差值，过了设定时间◆Tsr后，监控器将发出错误信号。见下面数据：

◆rise time
Tsr = {0…99:59h} 默认：100ms

◆fall time
Tsf = {0…99:59h} 默认：2s}



设定/真实值比较的通知

例如：如果在设定时间◆Tsr内未完成较低设定值到较高设定值的跳跃，就会发出报警、警告或信号提示类的监控错误。

根据 Step response的配置，选择I 状态发出通知。

例如：如果在设定时间◆Tsf内未完成较低设定值到较高设定值的跳跃，就会发出报警、警告或信号提示类的监控错误。

根据 Step response的配置，选择I 状态发出通知。

第2部分：菜单 Options

Options + 

进入菜单 **Options**有下列选项：

Reset configuration

Enable R mode

Setup lock

7.7 恢复至默认配置

您可将所有设定的修改恢复到默认状态(产品出厂时的状态)。

进入选择相应菜单后，会再次提示您，是否选择恢复您当前的个人设置。

注意：即使产品配置用PIN码锁定，也会被该设置解锁和覆盖！

Reset configuration + 

◆**Are you sure ?** 默认：NO

= YES 恢复所有默认设置的修改

= NO 不更改

7.8 解锁U/I/R运行模式

R mode available:

YES U/I/R操作模式锁定已解除并可用

NO U/I/R操作模式还不可用

U/I/R运行模式只有用PIN码解锁后才可用。并在配置文件中进行配置。(见„7.1 定义操作参数“)

解锁U/I/R运行模式的识别码要另外购买。如果您有意使用此模式，在订购该产品时一起购买，也可以后再订购。

Enable R mode + 

◆**Activate R mode via pin code: 0 0 0 0**

此时使用您从供应商购买的识别码，它由0...15间的4个数字组成。

7.9 锁定产品配置

Setup lock + 

为安全起见，必须锁定产品配置。在此处输入一个由0至15之间的4个数字组成的PIN码。

注意！该功能仅影响产品用户配置文档，而非设定值或前板上的旋钮！

◆**Lock setup via pin code:** 输入PIN码 {0..15} {0..15} {0..15} {0..15}

只能用相同PIN码或用

Reset configuration

这会重新配置并设为出厂设置。也将删除特制设置，所以忘记PIN码的情况下也可使用该方法。

如果用PIN码激活锁定功能，只有再次输入PIN码才可更改配置。

8. 下列情形发生时的反应...

8.1 用电源开关打开

电源开关位于产品前端。打开电源开关后，显示器即显示这些信息：生产商名称，地址和商标，产品型号和固件版本。在设置模式下（见„7. 产品设置 “）有一 “„Power On“” 选项，它决定产品打开后的输出状态。默认状态下为„OFF“, 意思是，U、I、P的设定值和输出状态不会恢复为产品上次关闭时的状态。如果选项设为 “OFF”，每次打开产品，U和I的设定值为0，P的设定值为100%，输出也被打开。选项设为„restore“时，产品开启后设定值和输出状态即刻恢复。

8.2 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。

8.3 转至远程控制模式

a) *内置拟接口*：如果产品没被**local**模式限制，或早已启动数字接口的远程模式，通过设定值引脚VSEL（引脚1），CSEL（引脚2）和PSEL（引脚8），以及状态输入脚（引脚13），引脚5 “Remote” 可将产品转为远程控制。并立即设置引脚1，2，8和13（也可参考章节„10. 模拟接口 “）的输出状态和设定值。退回远程控制模式后，将关闭输出，并保留最后远程调整的U，I和P设定值。

注意：在产品设置菜单下有一些关于内置模拟接口的设定参数。关于数字引脚的逻辑级别等，在章节10.3中有详细描述。

b) *可选模拟接口IF-A1*：如果产品没被**local**模式限制，或早已启动数字接口的远程模式，“SEL-enable” 引脚22通过VSEL（引脚3），CSEL（引脚2）和PSEL（引脚1），以及REM-SB（引脚23）的设定值，将产品转为远程控制。输入1，2，3和23引脚（也可参考章节„10. 模拟接口 “）的设定值和输出条件即刻被设置。从远程控制退出，将关闭输出，并保留最后远程调整的U、I和P设定值。

注意：在产品设置菜单下有一些关于可选模拟接口的设定参数。关于数字引脚的逻辑级别等，在另外的接口卡说明书中有详细描述。10.5 章节下描述的范例也可用于25针模拟接口IF-A1，但是引脚号和引脚名称会有不同。

c) *可选数字接口*：如果产品没被**local**模式限制，或早已启动数字接口的远程模式，通过相关指令（此时为：对象）转为远程控制，并保留输出状态和设定值，直至被更改。

8.4 出现过压

过压错误可以因内部缺陷（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” 状态文本信息，内置模拟接口的 “OVP” 引脚14，模拟接口IF-A1(如果配有的话）的 “OVP” 引脚8，以及报警符号指示此错误。

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

如果过压原因消除，输出会再次打开，“OV” 状态文本信息消失。在此之前，需用 ⚠ 按钮或经数字接口的一个指令确认该报警信号。如果错误仍然存在，则不打开输出。

OVP错误以报警声记录于内部警报缓冲区。通过数字接口可读取该缓冲区内容。用另一指令可清楚缓冲区内容。

8.5 出现过温

一旦因一个或多个功率级内部过热而出现过温(OT)错误，显示器上会出现 “OT” 文本、警告标识，内置模拟接口的引脚6 “OT”，以及模拟接口的引脚9 “OT”（如果配有的话）也发出一状态信号。但输出并未总是被关断，根据设定（见„7.1 定义操作参数 “）不同可能继续输出电压。只有当内部所有功率级（3.3/5kW型号 = 1级, 6.6/10kW型号 = 2级, 15kW 型号= 3级）因过热而切断时输出电压才会为零。

OT错误要用 ⚠ 按钮或经可选数字接口发出相应指令进行确认。

OT错误以报警声记录于内部警报缓冲区。通过数字接口可读取该缓冲区内容。用另一指令可清楚缓冲区内容。

8.6 调整电压、电流和功率

电源输出电压和负载内阻决定输出电流。只要输出电流因电流设定值低于调整后设定电流值，产品以恒压(CV)模式操作。且以 “CV” 状态文本指示出来。

输出电流被设定电流或额定电流限制，产品转为恒流(CC)模式，且以 “CC” 状态文本指示出来。

本系列所有型号还有一特征，即0...P_{Nenn}的可调功率限制。假如实际电流和电压超过了调节功率极限，该功能被激活，且覆盖恒压或恒流调整模式。功率限制最初影响输出电压。因为电压、电流和功率限制是相互影响的，并有可能出现下列情形：

例1：产品处于恒压调整模式时，功率被限定在范围内。故输出电压被降低。较低的输出电压导致输出电流减小。如果负载内阻减小，输出电流会再次上升，输出电压降至更低。

例2：产品处于恒流调整模式时，输出电压由负载阻值决定。功率被限定在下限范围内。根据P = U * I公式，输出电压和电流被降低至一定数值。一旦电流设定值减小，输出电流也会减小，接着输出电压也一样。产品两数值，实际功率都会在之前设定的功率极限之下。产品将从恒功率调整（CP）转换到恒流调整（CC）。

CC，CV 和 CP相这三个状态也可通过可选模拟接口卡的几个合适引脚指示出来，借可选数字接口卡还可读取状态位元。

8.7 远程感测被激活

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

感测输入端位于产品后板**Sense**端子上，可按正确极性连线到此。电源会自动检测外部感应端，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。

最大补偿电压：见规格参数表，不同型号会有不同。

也可见下页图10。

8.8 市电出现欠压或过压

本产品需用到一400V相线电压的三相电源，其电压误差最大为±15%。从而形成340V...460V输入电压范围。在该范围内，产品操作无功率限制。340V AC以下的输入电压被视为欠压，将保存最后状态，并关闭输出。如电压超过460V AC，结果一样。

应避免输入端长期欠压或过压！

8.9 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。

9. 数字接口卡

9.1 一般信息

该电源支持多种通讯或模拟控制用接口卡。除Profibus卡IF-PB1外，所有卡都耐压2000V。Profibus卡耐压1000V。

数字接口卡IF-R1 (RS232)，IF-C1(CAN) 和 IF-U1(USB) 使用统一的通讯协议。一旦配上这些卡，一台电脑可一次性控制多达30台电源供应器。

GPIB数字接口卡IF-G1 (IEEE 488)卡为每条总线上的多达台产品提供一个SCP指令结构。模拟卡IF-A1电隔离，带可配置的输入、输出模拟接口。

新款以太网/LAN卡 IF-E1也提供SCPI指令集，但是必须经VXI11协议。它还特别配了一额外的USB端口，能够藉由IF-U1卡访问产品。

Profibus卡IF-PB1专为现场总线而设计。它具备DPV0和DPV1功能，总线速度高达12MBit/s，有125个现场总线地址，利用GSD文件可将32台设备轻易地融入一个总线段。还提供一额外的USB端口。它具有USB类接口卡IF-U1的完整功能。通过我们定制的二进制通讯协议可监控和控制该产品。该端口仅选择性地当Profibus端口用。

9.2 配置接口卡

接口卡必须被配置一次。通过菜单 **Communication** 完成。

M + **Communication** + ↵

◆**Device node** 默认：1

= {1..30} 总共可给一台产品配置30个设备结点(地址)。如果是控制多台产品，也只需设置一次设备节点。

除模拟接口卡外，使用其它接口卡时必须设置产品地址(◆**Device node**)，只有这样才能正确识别产品。

Slot A: { IF-... } 根据本机原配型号

本产品会自动识别插上的接口卡。菜单选项显示插入卡的产品编号。

配置不同的接口卡

因为不同的卡有不同的参数要配置，这些在相应卡用户手册中有详细描述。请见那些参考。

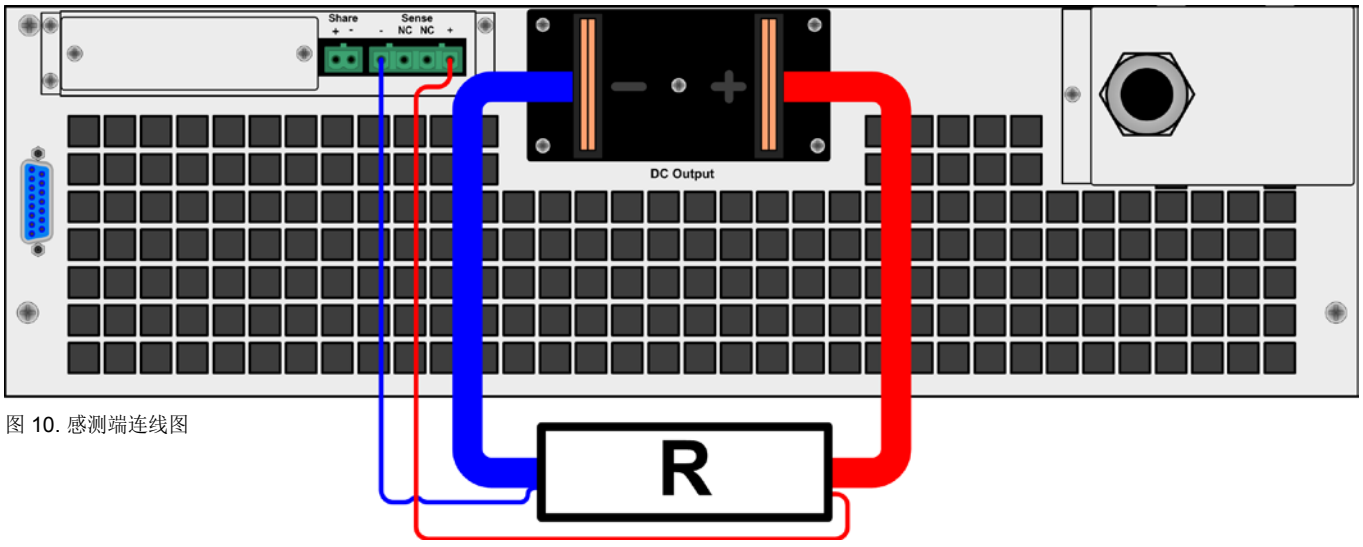


图 10. 感测端连线图

10. 模拟接口

10.1 一般信息

内置15芯模拟接口卡插在产品前板，除基本功能外还具有下列功能：

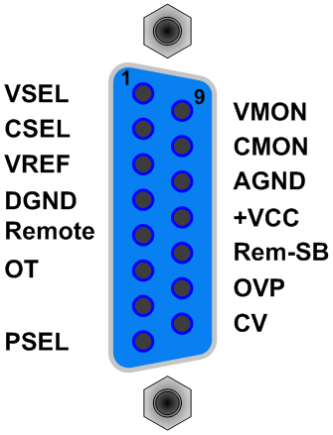
- 远程控制输出电流、电压和功率
- 远程监控(OT，OVP，CC，CV)状态
- 远程监控U，I，P实际值
- 远程打开/关闭输出

设定值输入脚可在0...5V或0...10V电压范围下操作。在产品设置菜单下选择合适的电压范围。请参考章节„7. 产品设置“。输出引脚3的参考电压与所选设定有关，可为5V，也可为10V。

使用说明：

- 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，要保证所有线连接正确，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(远程待机，13引脚)引脚要优先于**On**按钮。意思是，如果该引脚定义输出状态为“off”，就不能用该按钮打开输出。故它可当紧急断电开关用。但不适用于控制位置设为**local**的情况。详情页可参考章节6.9。
- VREF输出引脚给设定值输入脚VSEL、CSEL和PSEL创建设定值，如仅需电流控制，可将VSEL和PSEL脚连到VREF脚，然后通过一外电压(0...5V或0...10V)来供电，或通过VREF与地间的电位器来给CSEL供电。也可参考下一章节。
- 输入高于设置菜单下规定的数值会限制在100%以内。低于规定值也一样，则会被限制到0%。
- 模拟接口的地与输出负极相连。

10.2 引脚图



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！

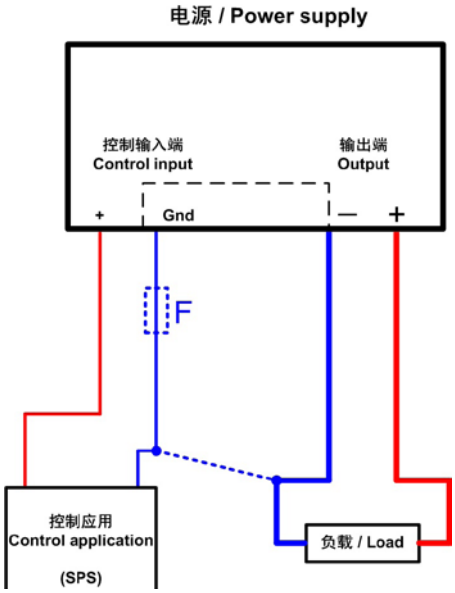


图 11

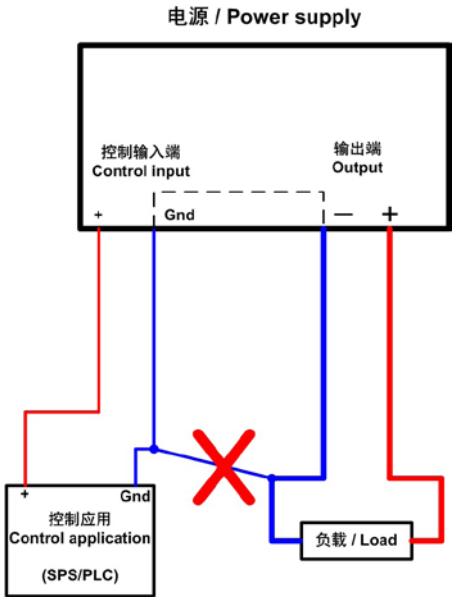
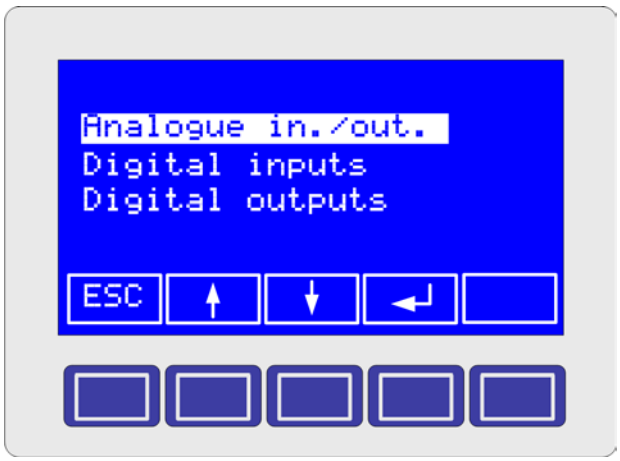


图 12

10.3 产品设置下的设定

M + Analogue interface +

设置菜单允许对内置模拟接口设定参数的访问：



◆**Analogue voltage** 默认：0...10V

= { 0...5V | 0...10V } 为模拟输入和输出引脚选择电压范围，它对应0...100%的设定/实际值定

◆**REMOTE /5** 默认：LOW

◆**REM-SB /13** 默认：LOW

= { LOW | HIGH} 定义数字输入脚是否通过LOW或HIGH级别对其指定功能反应。关于LOW和HIGH级别请参考章节10.4。

提示：上述两引脚内部上拉至HIGH级别。意思是，如果选择了HIGH设定，而无任何设备连到模拟接口，REMOTE引脚将立即转至永久远程控制模式，而且REM-SB引脚会永久关闭输出。

◆**OVP /14** 默认：LOW

◆**OT /6** 默认：LOW

◆**CV /6** 默认：LOW

= { LOW | HIGH} 定义数字输出脚是否通过LOW或HIGH级别报告他们的指定状态。关于LOW和HIGH级别请参考章节10.4。

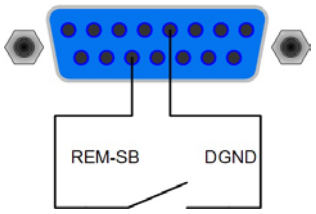
10.4 应用举例

输出关闭

“REM-SB”引脚13一直都为工作状态，因此它不依附于远程模式。故在不利用外部手段的条件下用它可关闭输出，除非产品已设为**local**模式，于是该引脚不起任何作用。用一低阻连接片，如开关、开集三极管或继电器，将该引脚与地(DGND)相连，即可关闭输出，如果REM-SB引脚（见章节10.3）选择“LOW”设定。若设为“HIGH”，则刚好相反，且连接片要打开，以便关不输出（紧急关闭原则）。

注意：PLC的数字输出脚可能无法正确执行其功能，也许是因为连接片阻值不够低。故需检查外部控制设备的技术参数再选择合适的阻值。

图形解释：

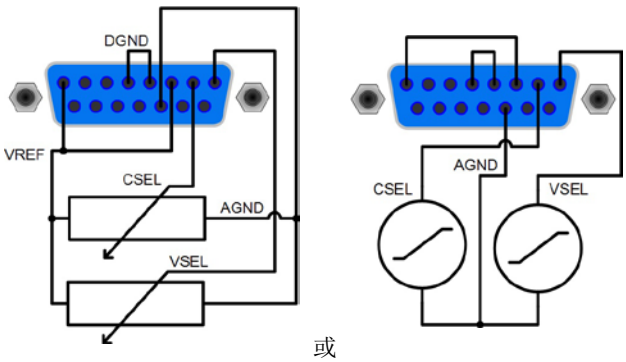


远程控制电流和电压

注意：经模拟接口的远程控制一定要输入所有三组设定值。

VREF与接地脚之间有两电位器，VSEL与CSEL输入脚间有一滑动器。功率设定值引脚PSEL与VREF相连，故可设为100%。利用前板上的旋钮可控制本电源，将它当作电流源或电压源用。如果VREF输出脚的电流最大为5mA，则需使用至少为4.7kOhm的电位器。

或者，可用外部电压源控制设定输入脚（见例二）。



或

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。

10.5 模拟接口各引脚分布

引脚	名称	类型*	描述	状态	电气参数
1	VSEL	AI	设定值：电压	0…10V对应0..100% of U_{nom}	精确度< 0.2% 阻值 R_i >100k
2	CSEL	AI	设定值：电流	0…10V对应0..100% of I_{nom}	
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	DO	过温错误	OT = HIGH，U_{high} > 4V 无OT =LOW，U_{low} <1V ***	准开集电极上拉至Vcc ** 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	AI	设定值：功率	0…10V对应0..100% of P_{nom}	精确度< 0,5% 阻值 R_i >100k
9	VMON	AO	实际值：电压	0…10V对应0..100% of U_{nom}	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对应0..100% of I_{nom}	
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 ** 输出5V时，电流最大+1mA U_{ce} = 0.3V时，I_{max} = -10mA at U_{max} = 0...30V 短路保护对DGND
15	CV	DO	指示电压调整启用	CV = LOW, U_{low} <1V *** CC = HIGH, U_{high} >4V	

* AI = 模拟输入脚，AO =模拟输出脚，DI = 数字输入脚，DO = 数字输出脚，POT =电位脚

** 内部 Vcc = 13.8V

*** 默认设定，可在菜单设置下更改

11. 其它应用

11.1 共享总线模式下的并联

共享总线操作为了使并联下运行的多台设备获得均衡的负载电流。

重点：在该操作模式下，输出电压最高的产品控制并决定整个并联连接下产品的输出电压。意思是，系统内的任何产品都可能但当此角色。故建议选择某一台机来控制整个系统的同时，要将其余机台的设定电压设为需求最小值。电压和功率设定值也可设为100%。若不用这样，对每台机设定平均值，这样方可获得所需总值。

若有一台机坏掉，会终止运作。而并联连接上的其他产品则继续工作，且无间断。这就是冗余操作。

若产品出现错误，如过温（OT）或过压，输出电压会上升或下降至剩余产品中电压最高的值。

共享总线操作“Share”端子的连线方式在„5.8 “Share”（共享）端“章节内有详细解释。也可参考下页图13。

注意：若需使用远程感测，建议仅连到决定整个系统电压值的主机“Sense”输入端上。

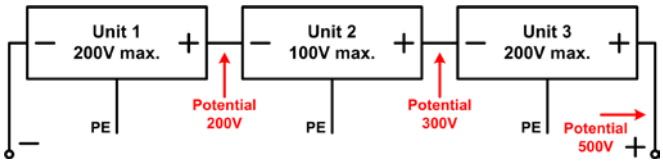
注意！此为纯粹的模拟连接。任何单机上不形成总实际值。

11.2 串联

一般可串联两台或两台以上产品。但是考虑安全和隔离因素，需遵循下面限制和规则：

- **串联中任何一台产品的直流输出负极对地(PE)的电压不可超过300V**！
- 分开调节每一台产品，无主-从连接。
- **禁止连接Share bus**！
- **禁止将串联中各产品模拟接口的地(AGND, DGND相互连接**！
- **禁止连接Remote sense**！
- 建议对同型号产品进行串联。

举例：如可将PSI 8200-70 3U，输出电压为200V的三台同型号产品串联。计算起来，串联中的总电压可能高达600V。看看下面产品输出负极的电位，如果所有产品都输出最大电压，第三台机直流输出负极电压可能会上升至400V。这是决不能允许的！所以应将其中一台较低电压产品限制到某一最大值。下图显示最后总电压可能仅500V。



11.3 其它附件和选项功能

可供下列附件：

a) 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。每款产品型号都有一个接口卡插槽。

b) 扩展模拟接口卡

还配可插拔式、电隔离、25针模拟接口卡。关于详细介绍，请参考接口卡说明书.

可供下列选项：

a) High Speed Ramping

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增加！

注意：这是个永久性更改，不可更改回来。

b) 水制冷

本产品可内置水制冷模块。水制冷用来防止因过热而过早关断功率输出。

c) 内阻调整

该选项可以后购买，并在产品设置菜单下用代码解锁。
解锁后，用户可选择U/I/P或U/I/R操作。在U/I/R模式下不可调节功率设定值，只能在产品设置下定义极限。

注意：在解锁这个选项前，最终需要更新产品固件。请咨询您的供货商！

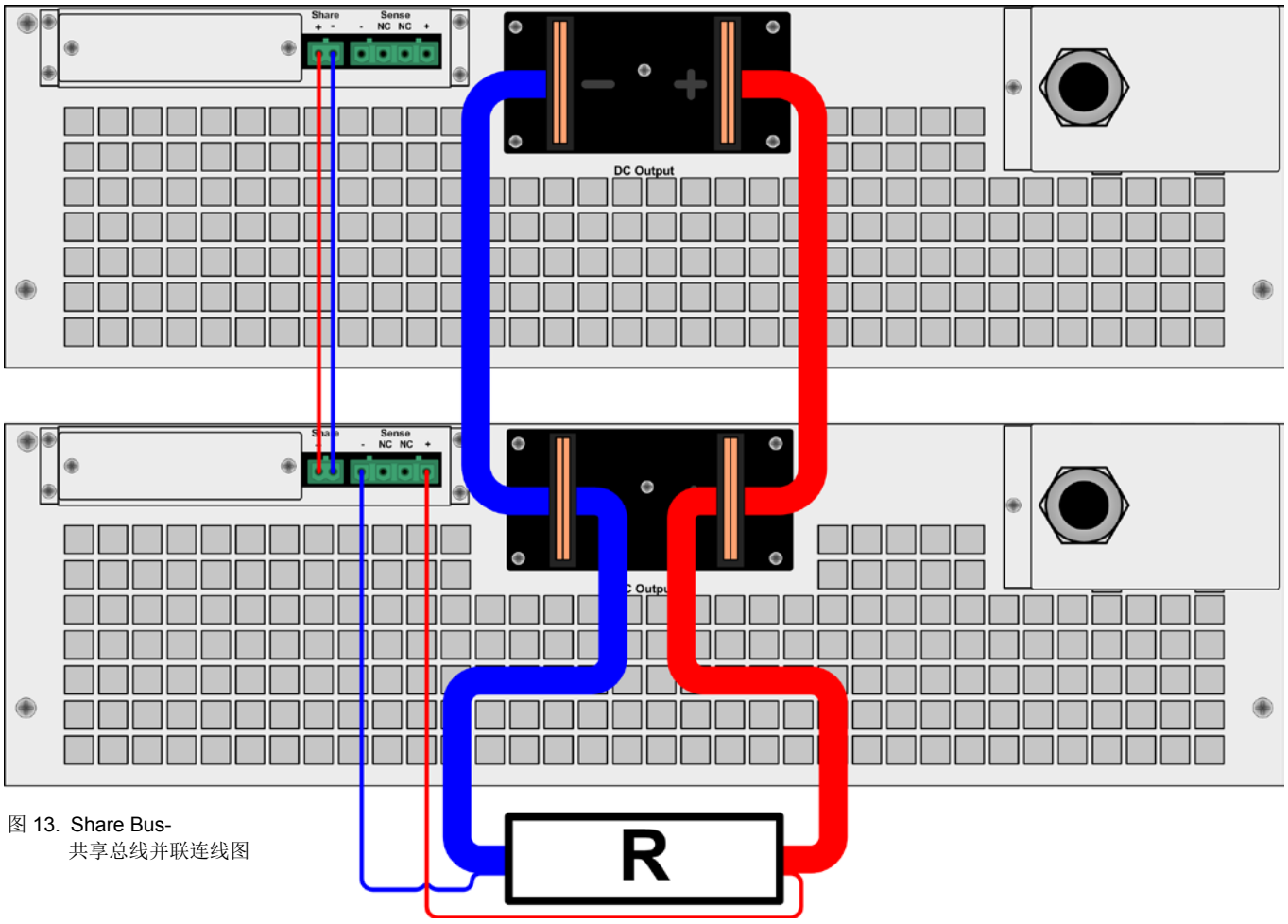


图 13. Share Bus-
共享总线并联连线图

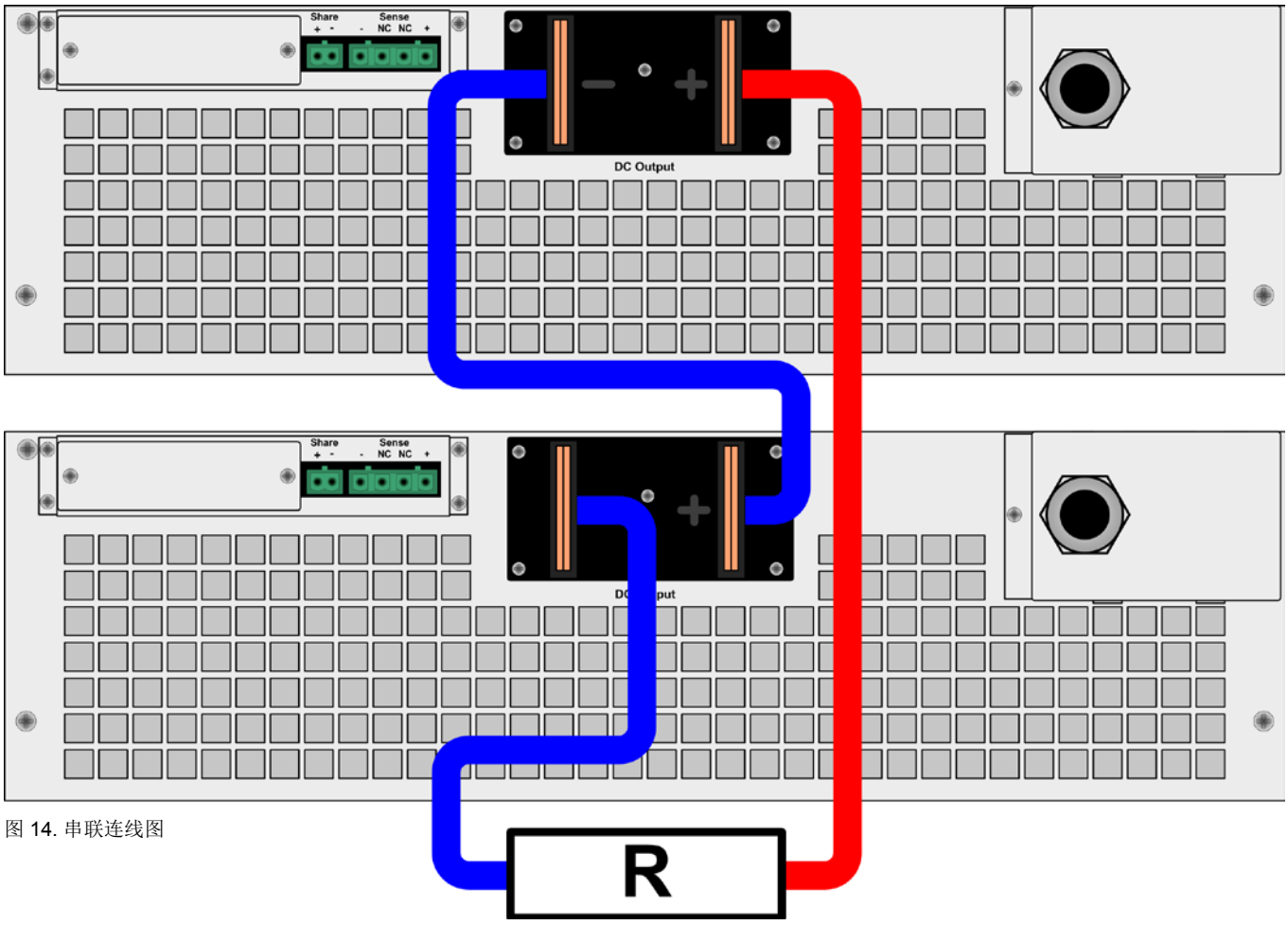


图 14. 串联连线图

11.4 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，Profibus）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（见„7. 产品设置“）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。

11.5 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。

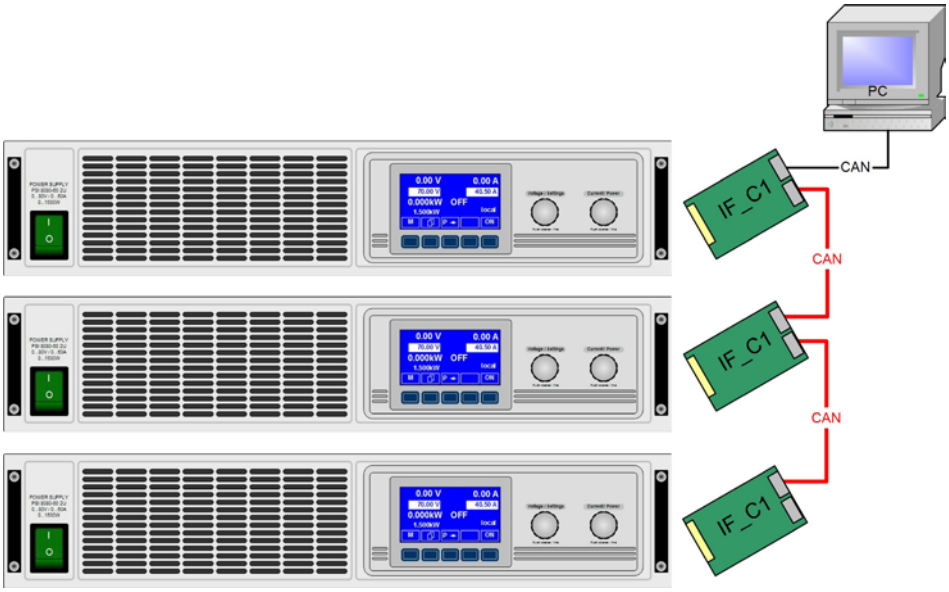


图15. 通过USB或RS232连网

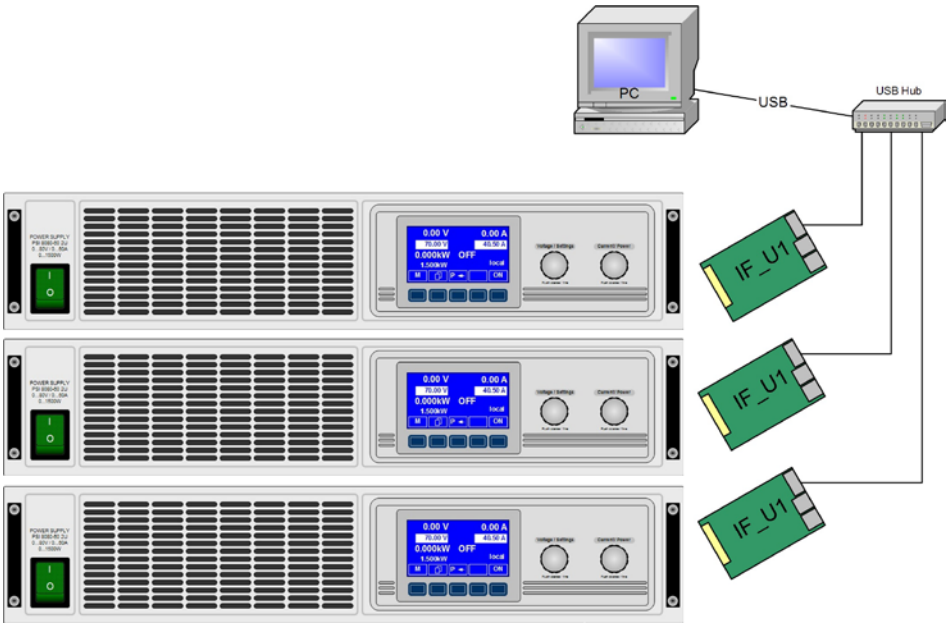


图16. CAN 连网举例，也适用于GPIB

Safety instructions

- Only operate the device at a mains voltage as stipulated on the type plate!
- Never insert mechanical parts, especially from metal, through the air ventilation slots!
- Avoid any use of liquids of any kind in the proximity of the device! They might get into it.
- Do not connect voltage sources to the device which are able to generate voltages higher than the nominal voltage of the device!
- 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)!

Important notes

- Aging of the device, as well heavy use may result in unpredictable behaviour of control elements like pushbuttons and rotary knobs.

1. Introduction

The high efficiency power supplies of the series PSI 8000 3U 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 different presets of set values, supervise set values and actual values by definable limits or create function runs of configurable preset values with the integrated function manager.

Optionally available, digital interface cards provide an even wider spectrum of control and monitoring functions by means of a PC. Another optionally available extension card is the galvanically isolated analogue interface IF-A1 which can serve to control the device by external means, like a PLC.

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.

All models feature an adjustable power regulation circuit, as well as a „Share Bus“ terminal which enables parallel connection with symmetric current distribution.

The main functions at a glance:

- Set voltage, current and power, each with 0...100%
- Adjustable overvoltage threshold 0...110% U_{Nom}
- Optional, pluggable interface cards (CAN, USB, RS232, IEEE/GPIB, Ethernet/LAN, Profibus)
- Optional, analogue interface for external control and monitoring with extended features
- Power ratings of 3.3kW, 5kW, 6.6kW, 10kW or 15kW; in cabinets extendable up to 150kW
- Temperature controlled fans
- Status indication (OT, OV, CC, CV) in the display
- 4 selectable memory sets, supervision function
- Function manager
- Adjustable internal resistance (optional)
- High speed ramping (optional)
- Parallel connection with Share bus

2. Technical specifications

2.1 Control panel and display

Type

Display	Graphics display 128x64 dots
Operating controls:	6 pushbuttons, 2 rotary knobs

Displayed formats

The nominal values limit the maximum adjustable range.

Actual values and set values for voltage, current and power are displayed simultaneously, the set value of the overvoltage threshold is displayed seperately.

Display of voltage values

Resolution:	4 digits
Formats:	0.00V…99.99V
	0.0…999.9V
	0V...9999V

Display of current values

Resolution:	4 digits
Formats:	0.00A…99.99A
	0.0A…999.9A

Display of power values

Resolution:	4 digits
Formats:	0.000kW...9.999kW
	0.00kW…99.99kW

Display of resistance values

(only with unlocked option „internal resistance control“)

Resolution:	4 digits
Formats:	0.00mΩ…99.99mΩ
	0.000Ω..9.999Ω
	0.00Ω…99.99Ω
	0.0Ω…999.9Ω
	0Ω…9999Ω

Time displays

Times are displayes in 4 automatically switched ranges.

Resolution:

Range 1:	2ms to 9.999 s
Range 2:	10ms to 59.99s
Range 3:	1:00m to 59:59min
Range 4:	1:00h to 99:59h

Accuracy:

Range 1:	2ms
Range 2:	10ms
Range 3:	1s
Range 4:	1 min

2.2 Device specifications

	PSI 8040-170 3U	PSI 8080-170 3U	PSI 8200-70 3U	PSI 8500-30 3U	PSI 8040-340 3U
Mains input					
Input voltage range	340…460V AC	340…460V AC	340…460V AC	340…460V AC	340…460V AC
Input voltage range optional	-	-	-	-	-
Required phases	L1, L2, PE	L1, L2, PE	L1, L2, PE	L1, L2, PE	L1, L2, L3, PE
Input frequency	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz
Input fuse	2x T16A	2x T16A	2x T16A	2x T16A	4x T16A
Input current	max. 11A	max. 16A	max. 16A	max. 16A	max. 29A
Power factor	> 0.99	> 0.99	> 0.99	> 0.99	> 0.99
Output - Voltage					
Nominal voltage U_{Nom}	40V	80V	200V	500V	40V
Adjustable range	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}
Stability at mains fluctuation ±10% ΔU_{IN}	< 0.02%	< 0.02%	< 0.02%	< 0.02%	< 0.02%
Stability at 0…100% load	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
Ramp-up time 10...90% at 100% load	max. 30ms	max. 30ms	max. 30ms	max. 30ms	max. 30ms
Ripple @ BWL 20MHz	< 100mVpp < 10mVrms	< 100mVpp < 10mVrms	< 200mVpp < 25mVrms	< 250mVpp < 70mVrms	< 150mVpp < 10mVrms
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	10mV	10mV	100mV	100mV	10mV
Remote sense compensation	max. 2.5V	max. 2.5V	max. 6V	max. 10V	max. 2.5V
Overvoltage protection threshold (adjustable)	0…44V	0…88V	0…220V	0….550V	0…44V
Output - Current					
Nominal current I_{Nom}	170A	170A	70A	30A	340A
Adjustable range	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}
Stability at mains fluctuation ±10% ΔU_{IN}	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
Stability at 0…100% ΔU_{OUT}	< 0.15%	< 0.15%	< 0.15%	< 0.15%	< 0.15%
Ripple @ BWL 20MHz	< 528mApp < 106mArms	< 300mApp < 40mArms	< 44mApp < 11mArms	< 14mApp < 8mArms	< 600mApp < 80mArms
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	100mA	100mA	10mA	10mA	100mA
Transient recovery time 10….90% load	< 2ms	< 2ms	< 2ms	< 2ms	< 2ms
Output - Power					
Nominal power P_{Nom}	3300W	5000W	5000W	5000W	6600W
Nominal power at derating	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	0.001kW	0.001kW	0.001kW	0.001kW	0.001kW
Efficiency	93%	93%	95.20%	95.50%	93%
Miscellaneous					
Ambient temperature	0….50°C	0….50°C	0….50°C	0….50°C	0….50°C
Storage temperature	-20….70°C	-20….70°C	-20….70°C	-20….70°C	-20….70°C
Humidity rel.	< 80%	< 80%	< 80%	< 80%	< 80%
Dimensions (WxHxD) **	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm
Weight	19.8kg	19.8kg	19.8kg	19.8kg	25.5kg
Redundancy	no	no	no	no	yes
Isolation +output to enclosure	500V DC	500V DC	500V DC	1000V DC	500V DC
Isolation -output to enclosure	300V DC				
Isolation input to output	4200V DC				
Cooling	by fans, air inlet on the front, air exhaust on the rear				
Safety	EN 60950				
EMC standards	EN 61326, EN 55022 Class B				
Overvoltage class	2				
Protection class	1				
Pollution degree	2				
Operational altitude	<2000m				
Series operation					
max. series connection voltage	600V				
Master-Slave	no				
Parallel operation					
max. parallel connection voltage	1500V				
Master-Slave	yes, via Share bus				
Analogue programming					
Input range	0…5V or 0…10V, selectable				
Accuracy	≤ 0.2%				
Input impedance	53kOhm				
Article number	09230445	09230430	09230440	09230435	09230446

* 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.

** Enclosure dimensions only, not overall dimensions

	PSI 8040-510 3U	PSI 8080-340 3U	PSI 8160-170 3U	PSI 8200-140 3U	PSI 8400-70 3U
Mains input					
Input voltage range	340…460V AC	340…460V AC	340…460V AC	340…460V AC	340…460V AC
Input voltage range optional	-	-	-	-	-
Required phases	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE
Input frequency	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz
Input fuse	6x T16A	4x T16A	4x T16A	4x T16A	4x T16A
Input current	max. 28A	max. 28A	max. 28A	max. 28A	max. 28A
Power factor	> 0.99	> 0.99	> 0.99	> 0.99	> 0.99
Output - Voltage					
Nominal voltage U_{Nom}	40V	80V	160V	200V	400V
Adjustable range	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}
Stability at mains fluctuation ±10% ΔU_{IN}	< 0.02%	< 0.02%	< 0.02%	< 0.02%	< 0.02%
Stability at 0…100% load	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
Ramp-up time 10...90% at 100% load	max. 30ms	max. 30ms	max. 30ms	max. 30ms	max. 30ms
Ripple @ BWL 20MHz	< 150mVpp < 10mVrms	< 150mVpp < 10mVrms	< 300mVpp < 30mVrms	< 200mVpp < 25mVrms	< 300mVpp < 40mVrms
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	10mV	10mV	100mV	100mV	100mV
Remote sense compensation	max. 2.5V	max. 2.5V	max. 5V	max. 6V	max. 12V
Overvoltage protection threshold (adjustable)	0…44V	0….88V	0….176V	0…220V	0…440V
Output - Current					
Nominal current I_{Nom}	510A	340A	170A	140A	70A
Adjustable range	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}
Stability at mains fluctuation ±10% ΔU_{IN}	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
Stability at 0…100% ΔU_{OUT}	< 0.15%	< 0.15%	< 0.15%	< 0.15%	< 0.15%
Ripple @ BWL 20MHz	< 900mApp < 120mArms	< 600mApp < 80mArms	< 300mApp < 60mArms	< 89mApp < 22mArms	< 33mApp < 9mArms
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	100mA	100mA	10mA	100mA	10mA
Transient recovery time 10….90% load	< 2ms	< 2ms	< 2ms	< 2ms	< 2ms
Output - Power					
Nominal power P_{Nom}	10000W	10000W	10000W	10000W	10000W
Nominal power at derating	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	0.01kW	0.01kW	0.01kW	0.01kW	0.01kW
Efficiency	93%	93%	93%	95.20%	95.20%
Miscellaneous					
Ambient temperature	0….50°C	0….50°C	0….50°C	0….50°C	0….50°C
Storage temperature	-20….70°C	-20….70°C	-20….70°C	-20….70°C	-20….70°C
Humidity rel.	< 80%	< 80%	< 80%	< 80%	< 80%
Dimensions (WxHxD) **	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm
Weight	33kg	25.5kg	25.5kg	25.5kg	25.5kg
Redundancy	yes	yes	no	yes	no
Isolation +output to enclosure	500V DC	500V DC	500V DC	500V DC	900V DC
Isolation -output to enclosure	300V DC				
Isolation input to output	4200V DC				
Cooling	by fans, air inlet on the front, air exhaust on the rear				
Safety	EN 60950				
EMC standards	EN 61326, EN 55022 Class B				
Overvoltage class	2				
Protection class	1				
Pollution degree	2				
Operational altitude	<2000m				
Series operation					
max. series connection voltage	600V				
Master-Slave	no				
Parallel operation					
max. parallel connection voltage	1500V				
Master-Slave	yes, via Share bus				
Analogue programming					
Input range	0…5V or 0…10V, selectable				
Accuracy	≤ 0.2%				
Input impedance	53kOhm				
Article number	09230447	09230431	09230433	09230441	09230443

* 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.

** Enclosure dimensions only, not overall dimensions

	PSI 8500-60 3U	PSI 81000-30 3U	PSI 8080-510 3U	PSI 8200-210 3U	PSI 8240-170 3U
Mains input					
Input voltage range	340…460V AC	340…460V AC	340…460V AC	340…460V AC	340…460V AC
Input voltage range optional	-	-	588…796V AC +MP	588…796V AC +MP	588…796V AC +MP
Required phases	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE
Input frequency	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz
Input fuse	4x T16A	4x T16A	6x T16A	6x T16A	6x T16A
Input current	max. 28A	max. 28A	max. 28A	max. 28A	max. 28A
Power factor	> 0.99	> 0.99	> 0.99	> 0.99	> 0.99
Output - Voltage					
Nominal voltage U_{Nom}	500V	1000V	80V	200V	240V
Adjustable range	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}
Stability at mains fluctuation ±10% ΔU_{IN}	< 0.02%	< 0.02%	< 0.02%	< 0.02%	< 0.02%
Stability at 0…100% load	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
Ramp-up time 10...90% at 100% load	max. 30ms	max. 30ms	max. 30ms	max. 30ms	max. 30ms
Ripple @ BWL 20MHz	< 300mVpp < 70mVrms	< 800mVpp < 200mVrms	< 150mVpp < 10mVrms	< 250mVpp < 25mVrms	< 500mVpp < 20mVrms
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	100mV	1V	10mV	100mV	100mV
Remote sense compensation	max. 10V	max. 20V	max. 2.5V	max. 6V	max. 7.5V
Overvoltage protection threshold (adjustable)	0…550V	0…1100V	0…88V	0…220V	0…264V
Output - Current					
Nominal current I_{Nom}	60A	30A	510A	210A	170A
Adjustable range	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}
Stability at mains fluctuation ±10% ΔU_{IN}	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
Stability at 0…100% ΔU_{OUT}	< 0.15%	< 0.15%	< 0.15%	< 0.15%	< 0.15%
Ripple @ BWL 20MHz	< 33mApp < 16mArms	< 22mApp < 11mArms	< 900mApp < 120mArms	< 167mApp < 33mArms	< 333mApp < 27mArms
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	10mA	10mA	100mA	100mA	100mA
Transient recovery time 10….90% load	< 2ms	< 2ms	< 2ms	< 2ms	< 2ms
Output - Power					
Nominal power P_{Nom}	10000W	10000W	15000W	15000W	15000W
Nominal power at derating	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	0.01kW	0.01kW	0.01kW	0.01kW	0.01kW
Efficiency	95.50%	95.50%	93%	95.20%	93%
Miscellaneous					
Ambient temperature	0….50°C	0….50°C	0….50°C	0….50°C	0….50°C
Storage temperature	-20….70°C	-20….70°C	-20….70°C	-20….70°C	-20….70°C
Humidity rel.	< 80%	< 80%	< 80%	< 80%	< 80%
Dimensions (WxHxD) **	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm
Weight	25.5kg	25.5kg	33kg	33kg	33kg
Redundancy	yes	no	yes	yes	no
Isolation +output to enclosure	1000V DC	1500V DC	500V DC	500V DC	500V DC
Isolation -output to enclosure	300V DC				
Isolation input to output	4200V DC				
Cooling	by fans, air inlet on the front, air exhaust on the rear				
Safety	EN 60950				
EMC standards	EN 61326, EN 55022 Class B				
Overvoltage class	2				
Protection class	1				
Pollution degree	2				
Operational altitude	<2000m				
Series operation					
max. series connection voltage	600V				
Master-Slave	no				
Parallel operation					
max. parallel connection voltage	1500V				
Master-Slave	yes, via Share bus				
Analogue programming					
Input range	0…5V or 0…10V, selectable				
Accuracy	≤ 0.2%				
Input impedance	53kOhm				
Article number	09230436	09230438	09230432	09230442	09230434

* 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.

** Enclosure dimensions only, not overall dimensions

	PSI 8500-90 3U	PSI 8600-70 3U	PSI 81500-30 3U
Mains input			
Input voltage range	340…460V AC	340…460V AC	340…460V AC
Input voltage range optional	588…796V AC +MP	588…796V AC +MP	588…796V AC +MP
Required phases	L1, L2, L3, PE	L1, L2, L3, PE	L1, L2, L3, PE
Input frequency	50/60Hz	50/60Hz	50/60Hz
Input fuse	6x T16A	6x T16A	6x T16A
Input current	max. 28A	max. 28A	max. 28A
Power factor	> 0.99	> 0.99	> 0.99
Output - Voltage			
Nominal voltage U_{Nom}	500V	600V	1500V
Adjustable range	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}
Stability at mains fluctuation ±10% ΔU_{IN}	< 0.02%	< 0.02%	< 0.02%
Stability at 0…100% load	< 0.05%	< 0.05%	< 0.05%
Ramp-up time 10...90% at 100% load	max. 30ms	max. 30ms	max. 30ms
Ripple @ BWL 20MHz	< 300mVpp < 70mVrms	< 400mVpp < 80mVrms	< 1000mVpp < 350mVrms
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	100mV	100mV	1V
Remote sense compensation	max. 10V	max. 18V	max. 30V
Overvoltage protection threshold (adjustable)	0…550V	0…660V	0…1650V
Output - Current			
Nominal current I_{Nom}	90A	70A	30A
Adjustable range	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}
Stability at mains fluctuation ±10% ΔU_{IN}	< 0.05%	< 0.05%	< 0.05%
Stability at 0…100% ΔU_{OUT}	< 0.15%	< 0.15%	< 0.15%
Ripple @ BWL 20MHz	< 50mApp < 23mArms	< 30mApp < 12mArms	< 19mApp < 13mArms
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	10mA	10mA	10mA
Transient recovery time 10….90% load	< 2ms	< 2ms	< 2ms
Output - Power			
Nominal power P_{Nom}	15000W	15000W	15000W
Nominal power at derating	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	0.01kW	0.01kW	0.01kW
Efficiency	95.50%	95.20%	95.50%
Miscellaneous			
Ambient temperature	0….50°C	0….50°C	0….50°C
Storage temperature	-20….70°C	-20….70°C	-20….70°C
Humidity rel.	< 80%	< 80%	< 80%
Dimensions (WxHxD) **	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm
Weight	33kg	33kg	33kg
Redundancy	yes	no	no
Isolation +output to enclosure	500V DC	1000V DC	1000V DC
Isolation -output to enclosure	300V DC		
Isolation input to output	4200V DC		
Cooling	by fans, air inlet on the front, air exhaust on the rear		
Safety	EN 60950		
EMC standards	EN 61326, EN 55022 Class B		
Overvoltage class	2		
Protection class	1		
Pollution degree	2		
Operational altitude	<2000m		
Series operation			
max. series connection voltage	600V		
Master-Slave	no		
Parallel operation			
max. parallel connection voltage	1500V		
Master-Slave	yes, via Share bus		
Analogue programming			
Input range	0…5V or 0…10V, selectable		
Accuracy	≤ 0.2%		
Input impedance	53kOhm		
Article number	09230437	09230444	09230439

* 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.

** Enclosure dimensions only, not overall dimensions

3. Device description

3.1 Views

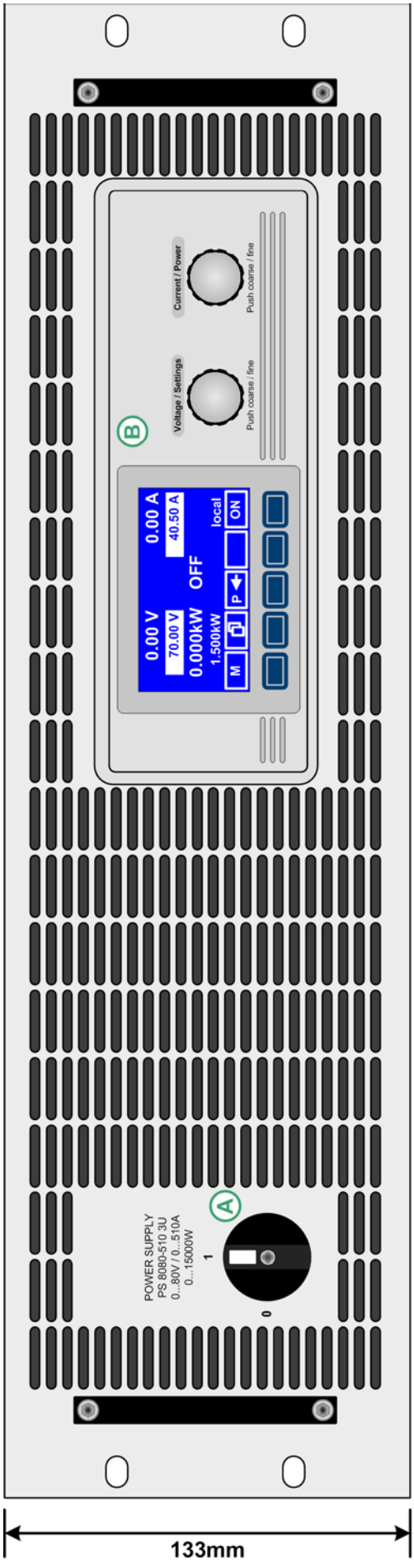


Figure 1

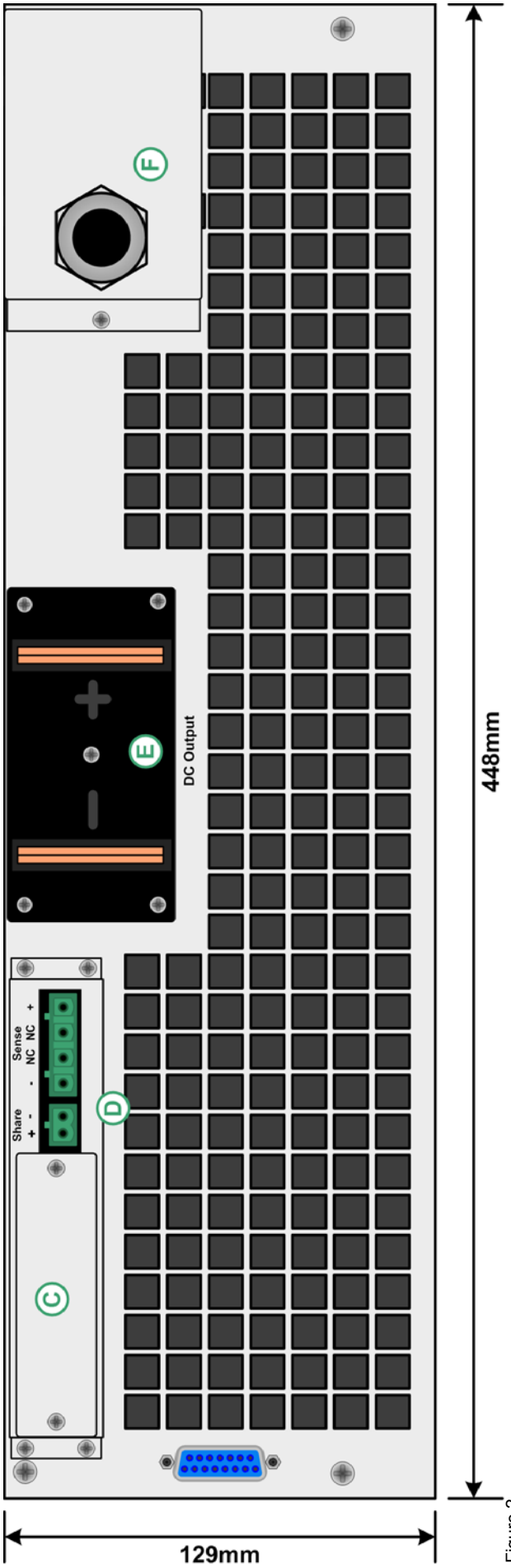


Figure 2

A - Mains switch
B - Control panel
C - Interface card slot
D - Share bus and remote sense terminals
E - DC output (figure shows output terminal type of 80V models)
F - AC input

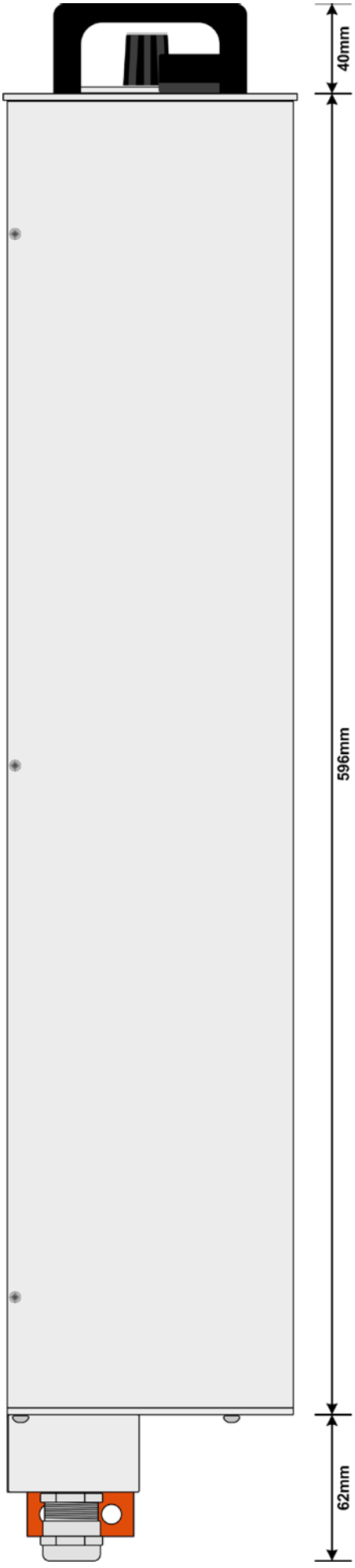


Figure 3

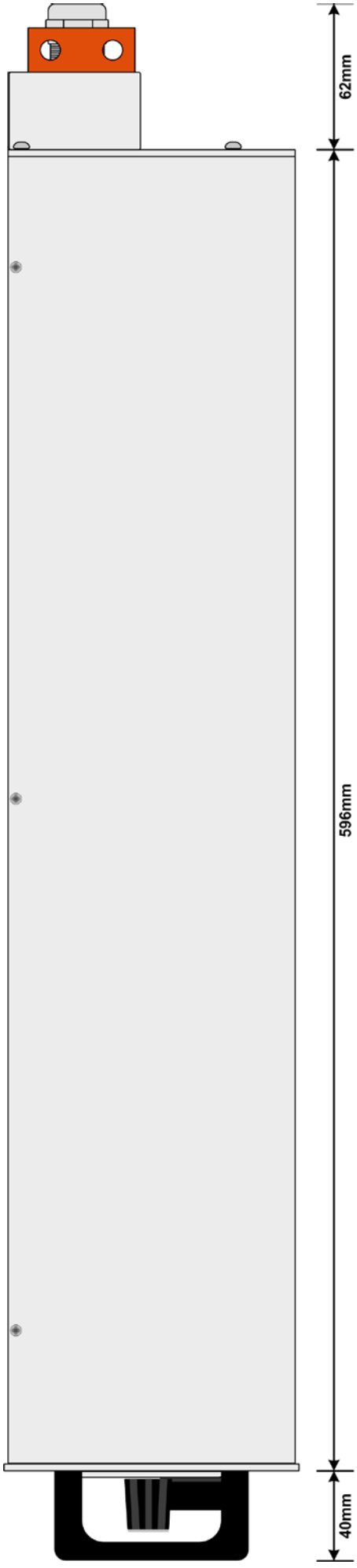


Figure 4

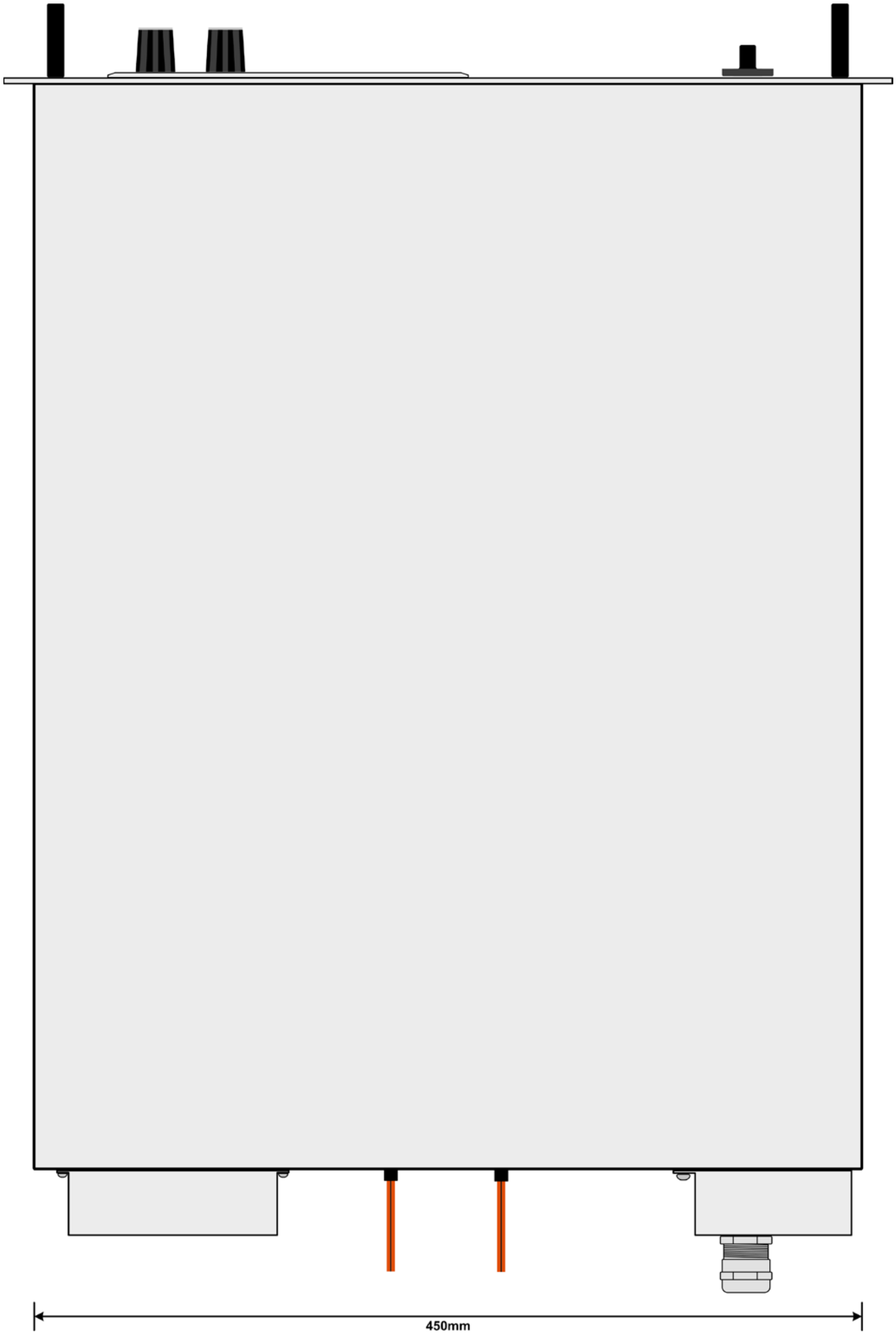


Figure 5

3.2 Scope of delivery

1 x Power supply unit

1 x Printed user manual(s)

1 x Plug for Share bus (plugged)

1 x Plug for remote sense (plugged)

4. General

4.1 Prologue / Warning

This 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 20cm distance at the rear to any surrounding objects in order to guarantee unimpeded air flow.

4.3 Opening the device

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.

Opening the unit is normally only required to replace a fuse.

4.4 Redundancy

Certain models feature redundancy. It means, they contain two or three power stages and if at least one power stage is remaining operable, because other power stages have switched off due to overheating, the power supply will continue to provide power to the output. Refer to section „2.2 Device specifications“ to find out which models feature redundancy.

5. Installation

5.1 Visual check

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

5.2 Input connection (single unit)

The unit‘s AC input requires two (3.3kw/5kW models) or three phases (6.6kW/10kW/15kW) models of a three-phase supply, plus ground (PE).

The connection is done with cables of proper cross section. See table for examples. The table takes regard of connecting one unit.

	L1		L2		L3	
	ø	I_{max}	ø	I_{max}	ø	I_{max}
3.3kW	-	-	2,5mm²	11A	2,5mm²	11A
5kW	-	-	2,5mm²	16A	2,5mm²	16A
6.6kW	2,5mm²	19A	2,5mm²	11A	2,5mm²	11A
10kW	4mm²	28A	4mm²	16A	4mm²	16A
15kW	4mm²	28A	4mm²	28A	4mm²	28A

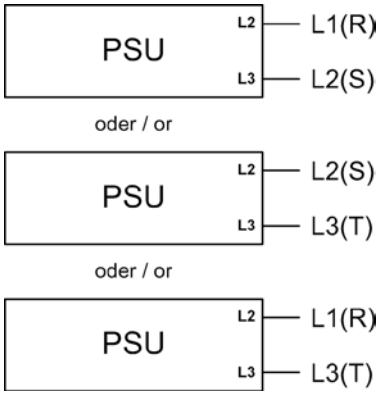
We recommend to use

for 3.3kW/5kW/6.6kW models: at least 2.5mm²

for 10kW/15kW models at least 4mm²

for every phase and ground (PE).

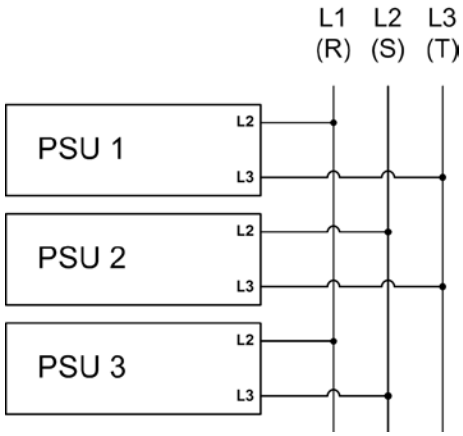
The selection of the phase pair to use for a 3.3kW or 5kW model is arbitrary for one unit. Means, it does not necessarily has to be L2(R) and L3(S):



5.3 Input connection (multiple units)

If multiple units of same or different power rating are connected to the same three-phase main connection, it is required to consider the current distribution of the phases in order to gain a balanced one. Models that require only two phases will result in an unbalanced current distribution when using 1 or 2 units. On the other hand, 3 units would be ideal.

Example configuration for **3.3kW/5kW** models:



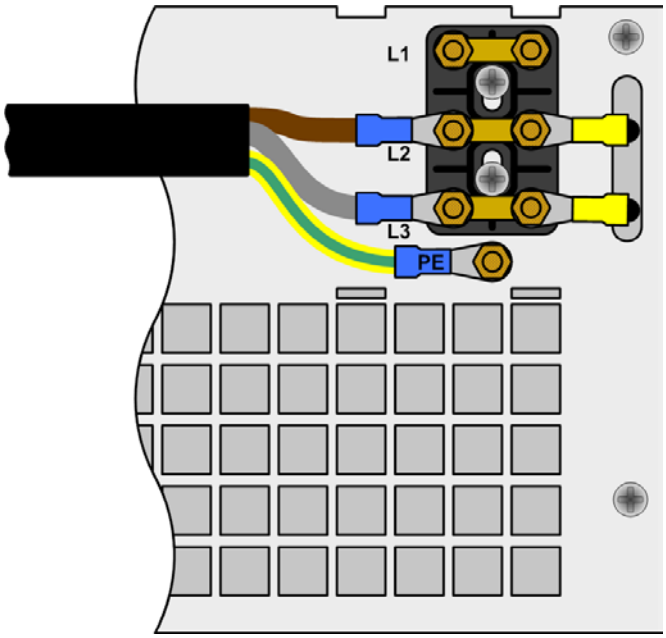


Figure 6. Input connection 3.3kW/5kW

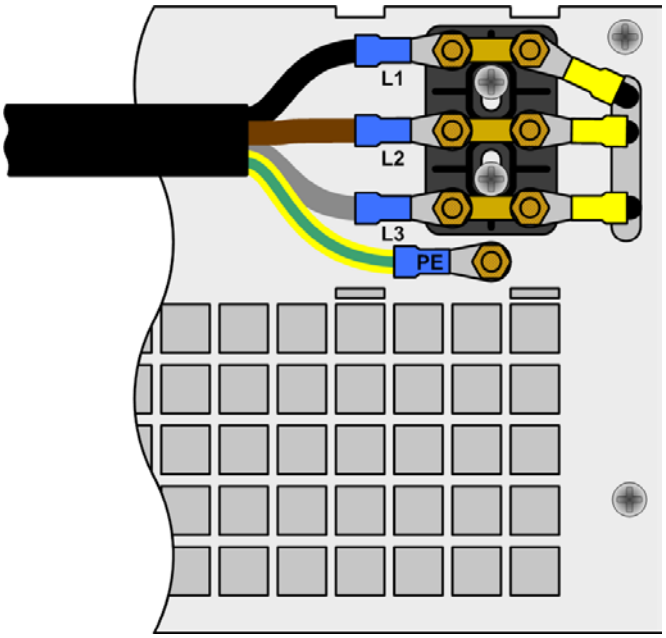
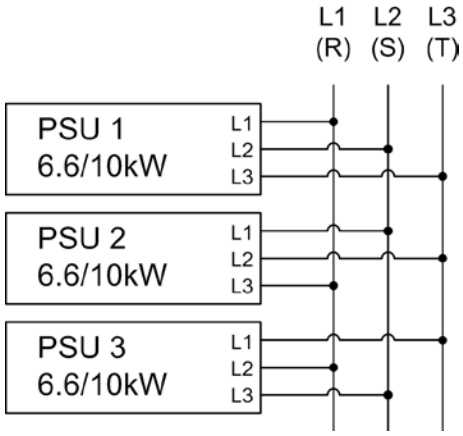


Figure 7. Input connection 6.6kW/10kW/15kW

The **6.6kW/10kW** models are different. Phase L2(S) is here loaded with 28A by already one unit. In this case it is recommended to alter the phase mapping. It means, not to necessarily connect phase L1(R) to the L1 input of the unit's input terminal etc. The example below shows an almost symmetric input current distribution scheme which results in L1 = max. 44A, L2 = max. 56A and L3 = max. 60A.

Example configuration for **6.6kW/10kW** models:



5.4 Input fuses

Fuse protection of the unit is done with up to 6 fuses of type Littlefuse F16A/500V and size 6.3x32mm. They are located inside the unit on a mains filter board which is located behind the front plate. In case fuses need to be replaced, the top cover has to be removed.

5.5 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** cable length we recommend to use:

up to **30A**:	6mm²	up to **70A**:	16mm²
up to **90A**:	25mm²	up to **140A**:	50mm²
up to **170A**:	70mm²	up to **210A**:	95mm²
up to **340A**:	2x70mm²	up to **510A**:	2x120mm²

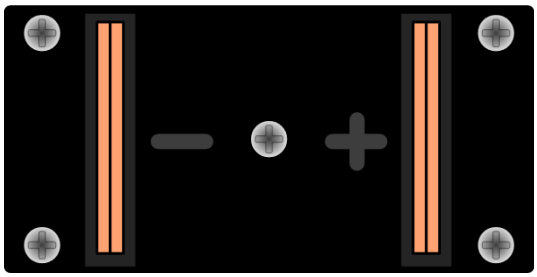
at least per DC output pole (flexible wire).

Single cables like, for example, 70mm² can also be replaced by 2x 35mm².

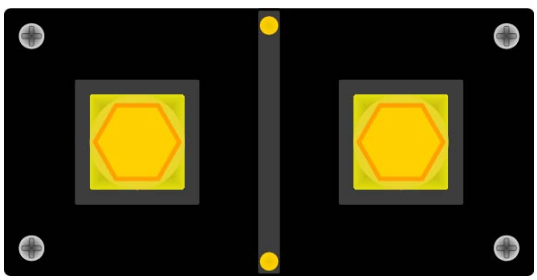
When using longer cables it is required to increase cross section in order to avoid voltage drops and unwanted heating.

5.5.1 Terminal types

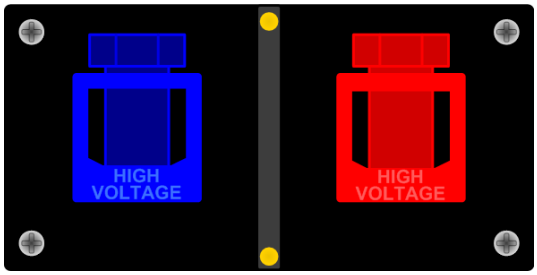
- **40V or 80V** models:
  Copper bars with 3x drilling holes 9mm for M8 screws
  Recommendation: ring cable lugs 8mm



- **160V/200V/240V** models:
  Screw fastening M8 on a plastic DC terminal
  Recommendation: ring cable lugs 8mm



- Models **from 400V** output voltage
  Screw-clamp terminal, plastic
  Recommendation: ring cable lugs 6mm



5.6 Grounding the output

Attention! Read carefully!

Grounding of the DC minus (-) output of single units or multiple units in parallel is always possible. Grounding the DC plus (+) output is only allowed for models of up to 300V nominal voltage!

Watch the potential shift of the output poles when using series connection! Grounding is hereby only allowed for the pole with the lowest potential against ground. Maximum allowed voltage of a series connection: 600V DC.

Attention! When grounding one of the DC output pole take care if the consumer, for example an electronic load, is also grounded on one of its poles! It may become a short-circuit!

5.7 Terminal „Sense“ (Remote sense)

In order to compensate the voltage drop along the load cables, 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. For maximum regulation see section „2.2 Device specifications“, information „Remote sense compensation“.

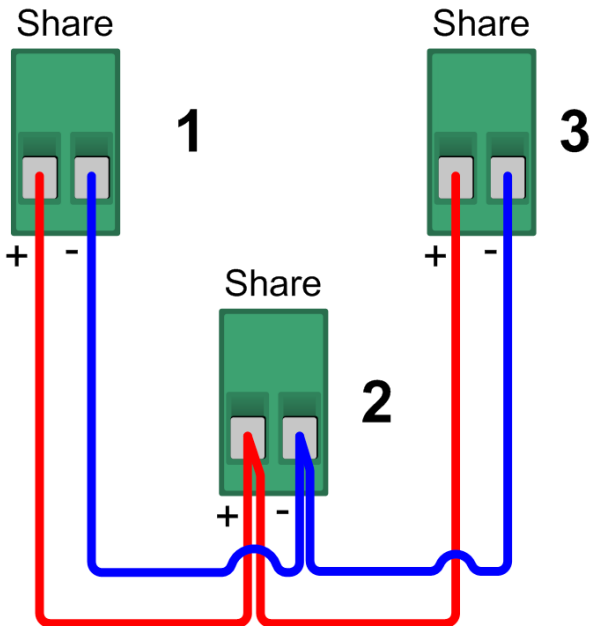
The connection for remote sense is done at the terminal „Sense“ on the rear side. Also see section 3.1.

(+) 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 see section 8.7.

5.8 Terminal „Share“

In case Share bus operation is wanted, the „Share“ terminal of the concerning units just have to be connected to each other:



Nothing more required. For details about Share bus operation refer to section „11.1 Parallel connection in Share bus mode“.

Attention! Share bus connection with units different to 3U series, which also feature a Share bus, is not allowed!

5.9 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“, in the separate instruction manual for the interface cards and on the quick installation guide for the interface cards.

6. Handling

6.1 The display

Figure 8 below shows an overview of the graphical display. During normal operation, the display shows the actual and set values of voltage (upper left), current (upper right) and power (lower left). In device setup mode, it display parameters and settings.

In case the optional „internal resistance control“ is unlocked, the power set value might be replaced by the internal resistance set value, depending on what is selected in the device setup.

6.2 Used symbols

In the following description the display and operating elements are marked by different symbols.

= Displayed only, all elements which are only displayed and which represent a state are marked with this symbol

◆ = Parameter, changeable values are marked with this symbol and are emphasised

= Menu items, selectable, lead to the next sublevel or to the bottom level with parameters

Brackets {…} mark possible options or adjustment ranges for parameters.

6.3 Short overview about the display elements

70.00 V Actual value of the output voltage

35.00 A Actual value of the output current

1.300kW Actual value of the output power

During normal operation the actual values are displayed by bigger numbers.

70.00 V Set value of voltage

Target value of the desired output voltage (left knob). The value is adjusted in coarse (see section 6.6 for step widths) or fine (always rightmost digit). Switching between coarse and fine is done with the pushbuttons on the left rotary knob.

40.50 A Set value of current

Target value of the desired output current (right knob). The value is adjusted in coarse (see section 6.6 for step widths) or fine (always rightmost digit). Switching between coarse and fine is done with the pushbuttons on the right rotary knob. It might be required to push button I◄ before the set value is adjustable.

1.500kW Set value of the power

Target value of the desired maximum output power (right knob). In order to set the value, button P◄ has to be pushed before. The value is adjusted in coarse (see section 6.6 for step widths) or fine (always rightmost digit).

10.00 Ω Set value of internal resistance (optional)

Target value of the desired internal resistance value (right knob). This set value replaces the power set value if the internal resistance control is unlocked and U/I/R mode has been selected in the device setup. In order to set the value, button R◄ has to be pushed before.

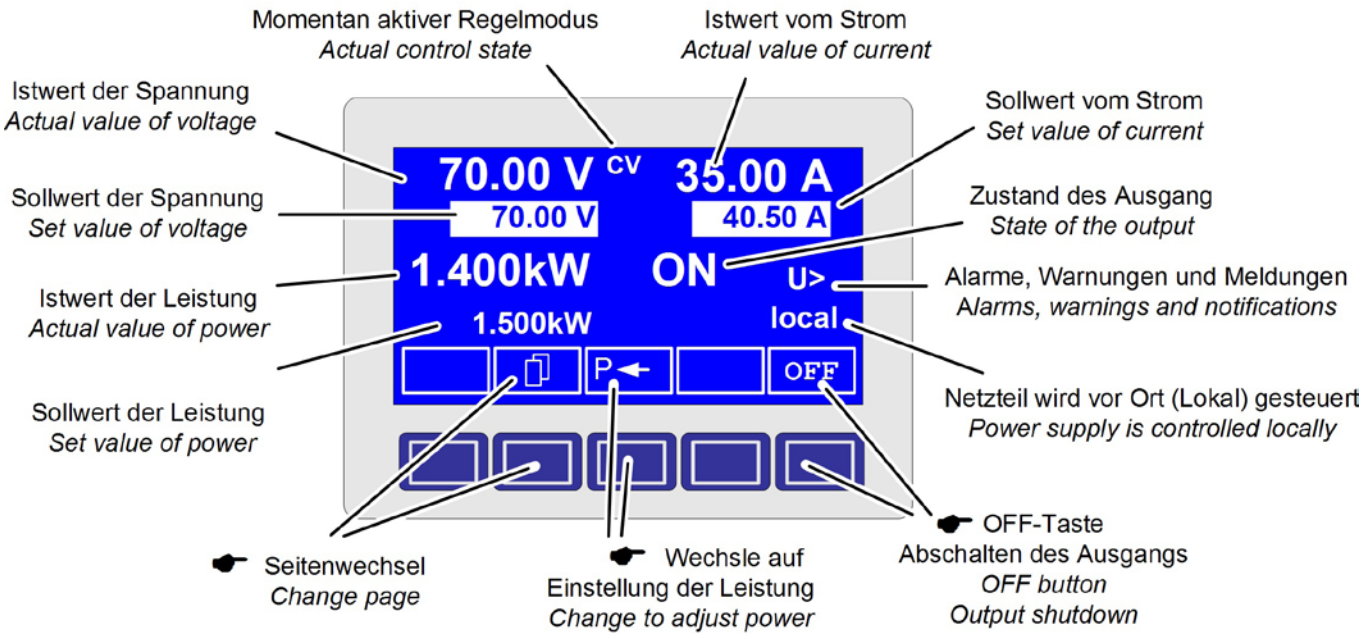


Figure 8

The state of the power output is displayed in the bottom right corner of the display.

{ON,OFF} State of the power output

The presently active control mode is displayed to the right of the related actual values. For instance, the abbreviation „CV“ is displayed next to the actual value of voltage, because it means that „Constant voltage“ mode is active. The output values are limited by the active control mode:

CV - limited by the voltage set value
(= Constant Voltage)

CP - limited by the power set values
(= Constant Power)

CC - limited by the set value of current
(= Constant Current)

CR - limited by the set value for internal resistance (optional at U/I/R mode), indicated next to the actual voltage
(= Constant Resistance)

Additionally to the state of the output an alarm, a warning or a signal can be displayed:

Alarm Example: ⚠ OT = Overtemperature

Warnings Example: U> = Overvoltage

Signals Example: I> = Overcurrent

The location from where the unit is currently controlled is displayed below the output state. This location is absolute, which means that you cannot control the unit from elsewhere without changing the location.

local Control only possible at the unit

remote Remote control via communication interfaces (IF-C1, IF-R1, IF-U1 etc.)

extern Remote control via built-in or optional, analogue interface

6.4 Switching the power output on

ON By pressing the **ON** button the power supply output is switched on, as long as it is not overridden by the input pin „REM-SB“ (13) of the built-in analogue interface or optional analogue interface card IF-A1, because the pin has higher priority. If so and when trying to switch the output on by the button, the display will indicate the status text „**auto ON**“, noticing the user that the output will switch on as soon as the override from the pin is removed.

The output state is indicated in the display with **ON**.

*Note: in **local** state (see section 6.9), the pin REM-SB of the analogue interface (internal or external) is inoperative.*

The display shows the current state with „**ON**“.

OFF The **OFF** button switches the power supply output off. This state is displayed with **OFF**.

The display shows the current state with „**ON**“.

OFF The **OFF** button switches the power supply output off. This state is displayed with „**OFF**“.

6.5 Adjusting set values

As long as „**extern**“ or „**remote**“ are not shown in the display, the set values for voltage, current or power can be set manually.

The mode is selected in the device setup at ◆Accept set value. The setting can be accessed with **M** -> Profile -> General settings -> Control panel. See „7.4 Configuring the control panel“ for details.

Direct setting of the set values

Using the rotary knobs directly sets the set values.

The left rotary knob adjusts the voltage. The set value of the voltage is displayed invertedly while it is selected and adjusted.

The right rotary knob either sets the set value for the current, for the power or internal resistance (optional, unlockable, with U/I/R mode chosen). The selected set value is displayed invertedly.

With the **SELECT** keys

P◄ the set value for the power, with

R◄ the set value for the internal resistance or with

I◄ the set value for the current is selected.

The maximum adjustable power can also be limited.

Set values are submitted

Alternatively to the direct adjustment of set values you can choose to set the set values only after submitting them with the **RETURN** button. See section „7.4 Configuring the control panel“ for details. The set values can still be changed with the rotary knobs, but are not set to the output as long as they’re not submitted. While the set value is unchanged, only its unit is displayed invertedly. If the set value is changed it is also displayed invertedly.

The **SELECT** keys switch from current adjustment to power adjustment for the right rotary knob. The chosen set values are not submitted to and set by the power supply until then.

↵ Pressing the **RETURN** button submits the set values.

ESC Pressing the **ESC** button discards the new set values and the old set values are displayed again.

Note: the adjustment of the resistance set value is only accessible after the optional „internal resistance control“ is unlocked (see section 7.8).

The resistance set value is adjustable from 0Ω up to 20* Unom/Inom. Means, for example, at a device with Unom = 80V and Inom = 510A it can be adjusted to a maximum of 3.13Ω.

Using predefined set values

A table of up to 4 sets of set values is accessible in the menu

Preset List (see „7.2 Predefining preset lists“). The left knob selects the preset list and with the RETURN button the set is submitted or discarded with the ESC button.

1→3 The chosen set is still 1. After the RETURN button is pressed, the set values of set 3 are submitted to the power supply. The display then shows the new set values of set **3**.

The MEMORY button can be used to jump straight to the menu page where the preset lists are defined and there they‘re edited and submitted with RETURN as usual.

6.6 Step widths for set value adjustment

Voltage			Current		
Nom. val	Coarse	Fine	Nom. val	Coarse	Fine
40V	0.25V	10mV	30A	0.2A	10mA
80V	0.5V	10mV	60A	0.5A	10mA
160V	1V	0.1V	70A	0.5A	10mA
200V	2V	0.1V	90A	1A	10mA
240V	2V	0.1V	170A	1A	0.1A
400V	2V	0.1V	210A	2A	0.1A
500V	5V	0.1V	340A	2A	0.1A
600V	5V	0.1V	510A	5A	0.1A
1000V	10V	1V			
1500V	10V	1V			

Power		
Nom. val	Coarse	Fine
3.3/5kW	0.050kW	0.001kW
6.6/10kW	0.10kW	0.01kW
15kW	0.10kW	0.01kW

Important! *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.*

6.7 Switching the button panel

The button PAGE is used to switch to another button panel. The new button assignments of the other panel allow the user to lock the control panel, switch to the function manager or set the location mode.

6.8 Locking the control panel

The button „Lock button panel“ locks all buttons, except itself, and the rotary knobs. The unit is now locked from manual acess, so that no set value can be changed or no menu is accessible. The locking mode can be set up in the menu. The control panel can be either completely inactive or it can exclude the OFF button (the unit is then locked but can be switched off and on by the OFF button). See also „Control panel lock“ in section „7.4 Configuring the control panel“.

After the control panel was locked it changes to this icon. The button can be used to unlock the control panel again, if button

is pressed within 2s.

6.9 Changing the location mode

EXT With the button EXT the user enables the remote control of the unit via a digital or analogue interface card and deactivates the local mode.

With the hand button the user sets the unit into strict local mode, so that it is only manually controllable. Access by any interface, analogue or digital, is then blocked.

6.10 Switching to the function manager

SEQ The SEQ button switches the display to the function manager mode.

Switching to the function manager is only possible while the unit is in standby (output = off). The set values of voltage and current are set to 0V and 0A. For details about the function manager see section „6.15 The function manager“.

6.11 Activating the menu

M The main menu is acessed with the MENU button and the display changes to the main menu level. A text menu like this appears:

Profile	Setting up and selecting user profiles
Function	Setting up a function sequence
Analogue interface	Settings for the internal analogue interface
Communication	Configure the pluggable interface card
Options	Default setup, unlock features, lock device configuration
About…	Manufacturer, service, SW version etc.

ESC A menu page is left to the next higher level by pressing the ESC button.

The SELECT keys are used to select another menu entry.

The RETURN button then enters the menu entry into the next sublevel by pressing it. The lowest menu level always shows up as a parameter page. See next topic for details.

6.12 Parameter pages

The parameter page is the lowest menu level. Here you can change many different parameters in order to set up the device.

By pressing the **ESC** button the parameter page is left to the next higher level and no parameters are accepted.


The **SELECT** keys are used to select a different parameter. The selected parameter is then displayed invertedly and can be changed with the left rotary knob.


The **RETURN** button submits the changed parameters, which are accepted and stored and used. The parameter page is also exited to the next higher level.

6.13 Alarms, warnings and signals

Alarms, warnings and simple notifications (here called „signals“) can be acoustically signallised or optically in the display. The pins „OT“ or „OVP“ of the built-in analogue interface or the optional analogue interface card IF-A1 are also reporting overvoltage or overtemperature. Also see section „7.4 Configuring the control panel“.

An alarm has a higher priority than a warning or signal. Up to four alarms, warnings or signals can be displayed, which will cycle in an interval of two seconds. If an alarm occurs, one previous warning or signal will be suppressed if the total number exceeds four.

The output voltage, the output current and the difference between actual and set value can be monitored.

The table below gives an overview of the possible errors and their meanings, as well as the selectable error types, as far as these are configurable.

An ***alarm*** will shut down the output and has to be acknowledged before the output can be switched on again (also see section „6.14 Acknowledging alarms and warnings“).

A ***warning*** remains in display as long as it is not acknowledged and can temporarily switch off the power output, if „auto ON“ has been activated for a particular error.

A ***signal*** is only displayed and only as long as the cause of the error is persistent. If more than one signal is notified, they will cycle in the display in a 2s interval.

6.14 Acknowledging alarms and warnings


You can acknowledge alarms and warnings with the **QUIT** button.

If you acknowledge a warning with this button while it still persists, it is turned into a signal and displayed furthermore. Else it is deleted and not displayed anymore .

Indication	Error type: Alarm	Warning	Simple notification	Depending on	Description
OV	•				Overvoltage at the power output
SYS	•				General system error
FCT	•				Function could not be saved and/or submitted
OT	•			1)	Overtemperature error
		•		2)	
CAN		•			CAN bus transmission error
U>	def.	def.	def.		Overvoltage supervision threshold exceeded
U<	def.	def.	def.		Undervoltage supervision threshold exceeded
I>	def.	def.	def.		Overcurrent supervision threshold exceeded
I<	def.	def.	def.		Undercurrent supervision threshold exceeded
U↗	def.	def.	def.		Set-actual comparison error at a positive voltage transition
U↘	def.	def.	def.		Set-actual comparison error at a negative voltage transition
I↗	def.	def.	def.		Set-actual comparison error at a positive current transition
I↘	def.	def.	def.		Set-actual comparison error at a negative current transition
P↗	def.	def.	def.		Set-actual comparison error at a positive power transition
P↘	def.	def.	def.		Set-actual comparison error at a negative power transition

1) OT disappear = OFF

2) OT disappear = auto ON

def. = definable

6.15 The function manager

The function manager is used to create functions which can control the unit automatedly. The user can build curves of set values after the function f(U, I, Δt) with it. The function manager sets the set values in an interval of 2ms. This means, that only times for Δt of a multiple of 2ms can be set, for instance 50ms. If voltage or current changes between two points, a ramp which consists of a certain number of steps (Δt : 2ms, results in 25 steps for the example above) is built.

The function manager controls the power supply and puts the set values, which have been configured in the function. The actual progression of the output values is however determined by the load and the output capacity of the device.

Explanation of the used terms:

Function = the function consists of up to 5 linked sequence headers (starts in menu at Setup function), which can consist of up to five differently configurable sequences.

Function layout = the configurations in the function layout are used by the function manager to set the operation (U/I/P or U/I/R) mode for the power supply. Furthermore, the repetition rate of the function and the arbitrary order of the sequences are set here. In dependency of the function layout the function manager processes the next sequence after the previous one has been processed and uses the settings from the sequence control of the next sequence.

Sequence = consists of the sequence control and 10 sequence points. If the function manager is going to process a sequence, it first of all sets the parameters given in the sequence control. The 10 sequence points are set consecutively and the whole process is repeated as often as the repetition rate for the particular sequence is set to.

Sequence control (Sequence control) = defines the repetition rate of the sequence and the maximum set value of power during the processing of the sequence, as well as internal resistance (optionally, has to be unlocked).

Sequence point = a sequence always consists of 10 sequence points. The points are processed (=set) consecutively by the function manager from point 0 to point 9. The definition of the sequence point determines, which set values for voltage and current have to be reached after the given time Δt. This enables the user to create step functions by setting the time to 0ms or 2ms, as well as ramps with times from 4ms to 99h99m. A time value of 0ms is settable, but results in a real time value of 2ms, because set values are only set in 2ms steps.

Additionally to the function itself you can set up and use the supervision circuits in the profiles. The function manager can also be controlled via the communication with the interface cards with one additional feature: you can set a stop point at which the function shall stop.

6.15.1 Configuring the function

M + Function + ↵

The menu page **Function** leads to the following menu selection:

- **Setup function**
- **Sequence 1**
- **Sequence 2**
- **Sequence 3**
- **Sequence 4**
- **Sequence 5**

Overview of the function manager display:

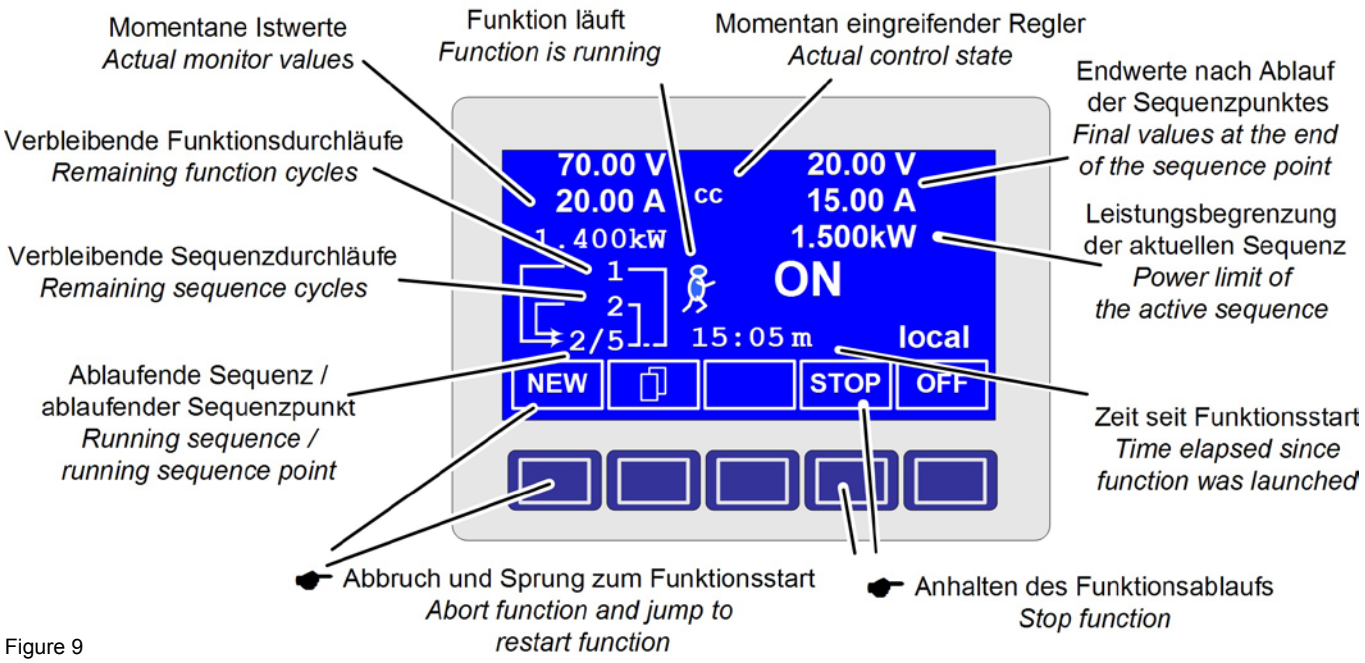


Figure 9

6.15.2 The function layout

Setup function + 

You can define the operation mode of the power supply and the repetition rate of the function here.

◆**Function mode**

= U/I/P Function uses U/I/P operation mode

= U/I/R Function uses U/I/R operation mode (only available if the option „internal resistance“ is unlocked)

Also see section „7.1 Defining operation parameters“)

◆**Funct.cycles**

= {1..254} it is repeated n times

= ∞ it is repeated infinitely

◆**Link sequences to one function**

Task: 1 2 3 4 5
Seq.: {-,1..5} {-,1..5} {-,1..5} {-,1..5} {-,1..5}

Beneath the particular tasks you can define of which sequences the function will consist and in which order the sequences are used. The symbol „-“ indicates, that the task is not defined and thus won't be processed.

6.15.3 Configuring sequences

The menu page **Sequence {1..5}** leads to the menu page where the sequences are edited.

Sequence {1..5} + 

It leads to the following menu selection:

Sequence {1..5} (number of the sequence to edit)

Sequence control

Sequence points 0-4

Sequence points 5-9

The repetition rate of the sequence, the maximum power and the internal resistance (optional, has to be unlocked) can be configured here, as well as the sequence points.

6.15.4 Sequence related parameters

Sequence control + 

Function mode : U/I/P {U/I/R}

Function mode of the power supply is displayed.

◆**Seq. cycles** {1..254, ∞ } Default: 1

= {1..254} it will be repeated n times
= ∞ it will be repeated infinitely

◆**P seq=** {0…P_{nom}} Default: P_{nom}

The maximum power given here is affecting the whole sequence.

This only with option „internal resistance“ (unlockable):

◆**R seq= {0Ω...20 * Ri_{nom}}** Default: R_{nom}

The maximum internal resistance given here is affecting the whole sequence.

6.15.5 Defining the sequence points

Sequence points 0-4 {5-9} + 

A sequence consists of 10 sequence points. A sequence point consists of three values: the set values for U and I together with the time Δt.

◆**Δt =** { 0…99:59h}

◆**U[V] =** { 0… U_{nom}}

◆**I[V] =** { 0… I_{nom}}

In order to understand how sequences are processed you need to consider the start condition of every sequence cycle:

Set values at the start of the function

The function always starts with
U_{set} = 0V and I_{set} = 0A

Set values at reentrance into the sequence

If the sequence is repeated, the last processed sequence point alters the start condition of the next sequence cycle.

Example: Sequence point 9 is set to the values 80V/50A/250ms and the sequence is repeated, then the sequence starts with 80V and 50A, but with the time that was set for sequence point 0, for instance 500ms. During that 500ms, the set values will approach linearly to the defined values of sequence point 0.

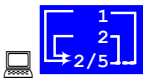
6.15.6 Display during the function run

Also see the overview on the previous page.

Display of the actual values

On the left side of the display the actual values are shown in small font. The status of the active control (CV/CC/CP) is displayed to the right of the corresponding value.

The set values of the sequence point, which will be reached after the sequence has been processed, are shown on the right side of the display



Status display of the function run. The remaining repetitions of the function (1) and of the sequence (2), as well as the current sequence (2/_) and the momentarily active sequence point (_/5) are displayed.


Function manager is halted or wasn't started yet


Function manager is running

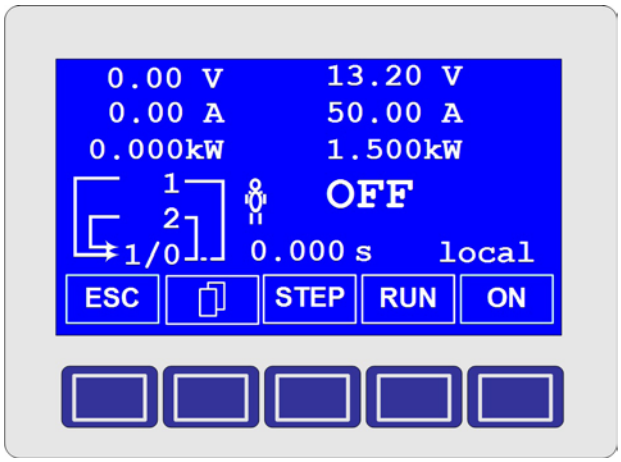
The elapsed time since the function generator was started is also displayed. The time display is stopped when the function manager stops. The **STEP**, **RUN** or **GO** keys are used to run the function manager in several ways. The time display will then continue to count.

{ON,OFF} State of the power output

Besides the state of the power output an alarm, a warning or a signal can be displayed.

6.15.7 Controlling the function manager

The interactive control panel provides keys to control the function manager. You can halt, continue, reset it to the starting point or exit the function by using these keys.



Before the function manager is really setting the power supply you can simulate the function on the display. During this

- the output is not switched on and
- the sequence points are processed step by step and can be verified this way.

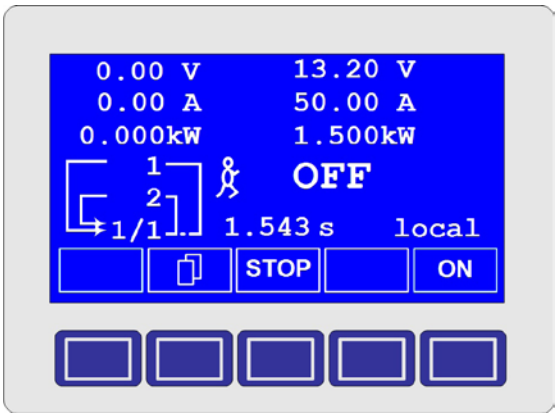
The execution is also controllable via communication with an interface card. Here you can additionally set one stop point at one of the 50 sequence points. This sequence point is processed and the sequence/function is then halted.

ESC The **ESC** button exits the function manager and returns to the former state of the power supply.

STEP The **STEP** button is used to run a sequence stepwise. The current sequence point is excuted after the button was pressed. After the „step“ has been executed, the set values, which are displayed in upper right corner of the display, are set.

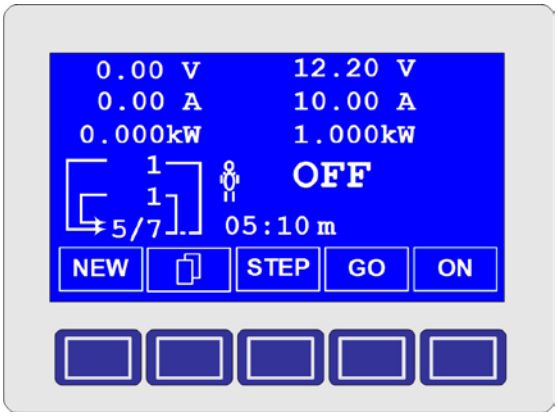
RUN The **RUN** button starts the function manager and the function is run as it was defined. The sequence points are then processed consecutively.

Example for a simulation during standby:



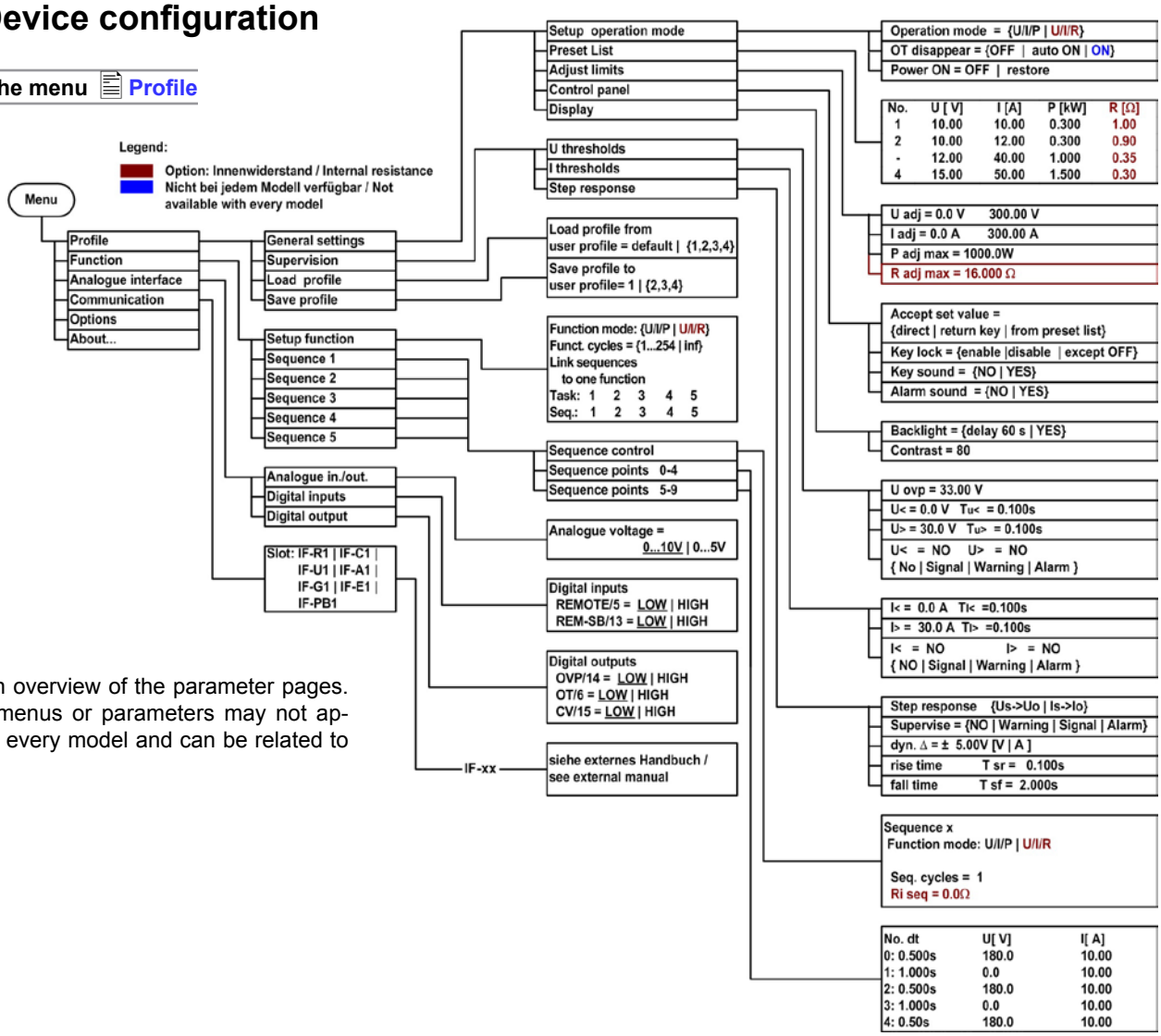
GO Use the **GO** button to continue the function after it was stopped.

NEW Alternatively, you can reset the function manager to the start of the current function with the **NEW** button.



7. Device configuration

Part 1: The menu Profile



This is an overview of the parameter pages. Colored menus or parameters may not appear with every model and can be related to options..

M + Profile +

The profiles are intended to minimize to time needed to set up the device at alternating users or to keep user defined settings for repeating applications. The last used profile is always loaded after the unit is switched on.

The menu entry Profile leads you to following selection:

- General settings
- Supervision
- Load profile
- Save profile

General settings +

The menu entry General settings leads to following selection where the operation mode, the display itself and the handling (adjustment) of the unit can be configured:

- Setup operation mode
- Preset list
- Adjust limits
- Control panel
- Display

Supervision +

The menu entry Supervision leads to following selection where alarms, warnings and signals, as well as the corresponding supervision limits and reaction times are set up.

- U thresholds
- I thresholds
- Step response

Load profile +

◆ Load profile from user profile = {default, 1..4}

The current profil is replaced by the selected one.

Save profile +

◆ Save profile to user profile = {1..4}

The current profile can be stored into one out of four profiles.

7.1 Defining operation parameters

Setup operation mode +

The way of adjusting the set values, which operation mode is used, how the unit shall react after the mains has restored or the behaviour of the unit after an overtemperature error can be configured here.

U/I/P or U/I/R operation mode

◆**Setup op. mode** Default: U/I/P

= U/I/P The power stage is controlled by voltage, current and power set values

= U/I/R The power stage is controlled by voltage,current and resistance set values and a settable, but not adjustable power set value (only with unlocked option „internal resistance control“)

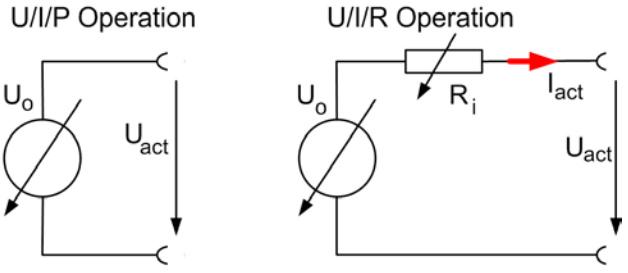
Note: the U/I/R operation mode can only be used after it has been unlocked in the **Options** menu. The unlock code can be purchased at the company where the power supply has also been purchased. The serial number of the unit is required to be told when purchasing the option, because the unlock code is related to it.

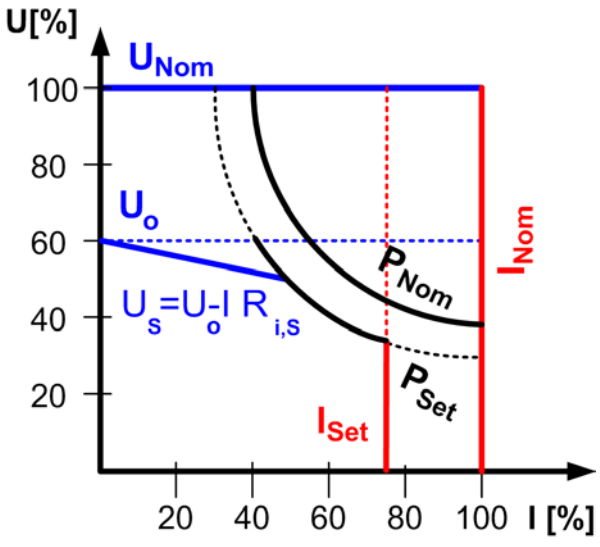
In U/I/R operation mode you can add an adjustable internal resistance to this voltage source.

The voltage set value is related to the off-load voltage U_0 of the power supply. The off-load voltage is reduced by the product of $I_{act} \bullet Ri_{set}$. The resulting voltage is calculated as follows:

$$U_{soll} = (U_0 - I_{ist} \bullet Ri) \Big|^{Isoll,\ Psoll}$$

Clarification:





CR This is shown in the display while the internal resi-stance control is active and U/I/R operation is set.

The internal resistance Ri_{set} is displayed instead of the power P_{set} while U/I/R mode is active. However, the actual value of the power is still displayed.

Reactivation after an overtemperature error

◆**Output on OT** Default: auto ON

=OFF The power supply output remains switched off, even if the unit has already cooled down.

The error OT (overtemperature) is displayed as an alarm.

= auto ON The power supply is automatically switched on after the unit has cooled down below the overtemperature shutdown limit. The error OT (overtemperature) is then displayed as a warning.

= ON The power supply output remains on and will provide voltage as long as at least one of the power stages keeps working.

Warnings as well as alarms are only deleted from the display after they have been acknowledged (see also „6.13 Alarms, warnings and signals“).

Output state after „power on“

◆**Power ON** Default: restore

= OFF The power supply output remains switched off after the mains voltage returns or after the unit was switched on.

= restore The power supply output is set to the state it had before a mains voltage loss occured or before the unit was switched off. In case it was ON when the unit was switched off, it will also be ON when the unit is switched on again.

7.2 Predefining preset lists

Preset List +

You can predefine up to four different presets.

No.	U[V]	I[A]	P[kW]	R[Ω]*
1:	0.00	0.00	1.500	20
2:	10.00	10.00	1.200	25
-:	0.00	0.00	1.500	50
-:	0.00	0.00	1.500	100

* Resistance values (red) only with unlocked option U/I/R.

With the parameter ◆**Accept set value** = from preset list you can switch from the normal set values (eg. adjusted by the rotary knob) to one of the predefined sets or switch between predefined sets. You can actually „jump“ between set values with this option.

7.3 Adjustment limits

Adjust limits +

The maximum and minimum adjustment limits can be defined here. These limits are always interfering, in **local** or **remote** mode, i.e. unit is controlled by a PC.

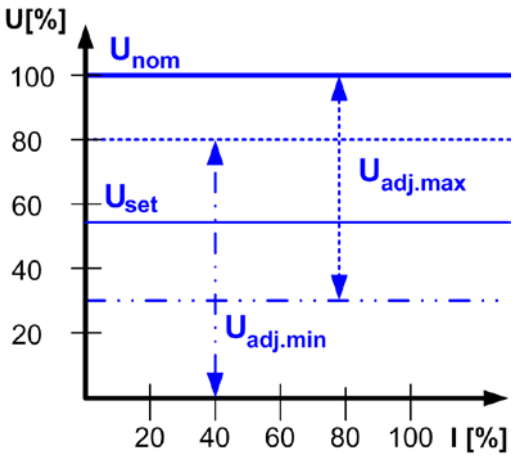
Limits of the set value of voltage

◆ **U adj** Default: 0V, U_{nom}

= {$U_{adj.min}$} {$U_{adj.max}$}

Whereas $U_{adj.min}$ = {0...$U_{adj.max}$} and $U_{adj.max}$ = {$U_{adj.min}$...U_{nenn}}

You can define the lower and upper limit of the adjustable voltage here. Set values which exceed these limits are not accepted, neither from the control panel nor from the remote control via a PC (communication with interface cards).



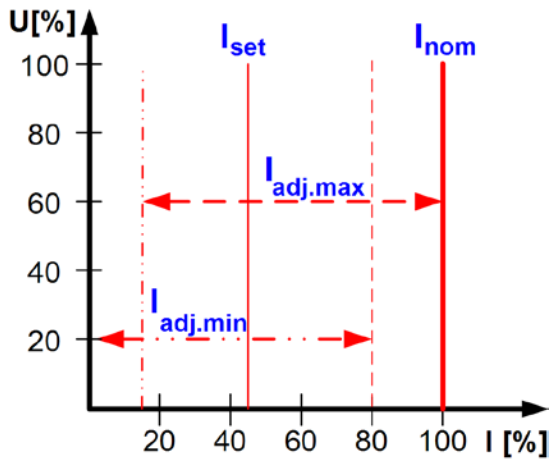
Limits of the set value of current

◆ **I adj** Default: 0A, I_{nom}

= {$I_{adj.min}$} {$I_{adj.max}$}

Whereas $I_{adj.min}$ = {0...$I_{adj.max}$} and $I_{adj.max}$ = {$I_{adj.min}$...I_{nom}}

You can define the lower and upper limit of the adjustable current here. Set values which exceed these limits are not accepted, neither from the control panel nor from the remote control via a PC (communication with interface cards).



Limit of the set value of power

◆ **P adj max** Default: P_{nom}

= {0kW… P_{nom}}

You can define the upper limit of the maximum adjustable power here. Set values which exceed these limits are not accepted, neither from the control panel nor from the remote control via a PC (communication with interface cards).

Limit of the set value of internal resistance

(Optional, only accessible with unlocked U/I/R mode)

◆ **R adj max** Default: 0Ω

= {0Ω…20 * Ri_{nom}}

If the U/I/R mode has been unlocked, you can set the upper limit of the maximum adjustable internal resistance. Set values which exceed these limits are not accepted, neither from the control panel nor from the remote control via a PC (communication with interface cards).

7.4 Configuring the control panel

Control panel +

The menu page Control panel lets you configure all parameters that are related to the graphical display and the control panel.

Configure how set values are manually adjusted

◆ **Accept set value** Default: direct

= direct	The set values are directly submitted to the power stage when changed with the rotary knobs
= return key	The changed set values are only set if submitted with the button.
= from preset list	You can choose sets from the Preset List with the rotary knobs and submit them with the button

Control panel lock

The control panel lock is only configured here.

◆ **Key lock** Default: except OFF

= except OFF	The control panel (buttons and rotary knobs) will be locked, except for the OFF button
= enable	The rotary knobs and most buttons will be locked
= disable	No lock

The control panel lock is used to prevent from unwanted changes to the set values or to the settings.

Note: this setting is only temporary. It is reset (=disable) after the device is switched on again or returns from mains blackout.

Sounds

◆ **Key sound** Default: NO

= YES A short beep signalises a button press
= NO No signal if keys are pressed

◆ **Alarm sound** Default: YES

= YES If an alarm or warning occurs an acoustic signal is emitted (beep) in short intervals

= NO No acoustic signal for alarms/warnings

7.5 Configuring the graphic display

Display + 

The menu page **Display** lets you configure all parameters related to the graphic display.

◆ **Backlight** Default: YES

= YES The backlight is permanently on

= delay 60s The backlight will be switched off with a delay of 60s after a button or a rotary knob has been used the last time

◆ **Contrast** Default: 70

= { 40...100 }

The contrast can be adjusted to suit the needs of the location where the unit is installed and for a clearer view at the values.

7.6 Supervision

Supervision + 

The **Supervision** menu lets you configure the supervision of output voltage, output current and output power. You can also supervise a step function. The menu **Supervision** leads you to following menu selection:

U thresholds

I thresholds

Step response

7.6.1 Voltage supervision

U thresholds + 

The menu page **U thresholds** lets you configure the over-voltage threshold OVP) as well as the supervision circuits for over- and undervoltage.

Overvoltage protection (OVP)

◆ **U ovp** Default: $1,1*U_{nom}$

= {U>... $1,1*U_{nom}$}

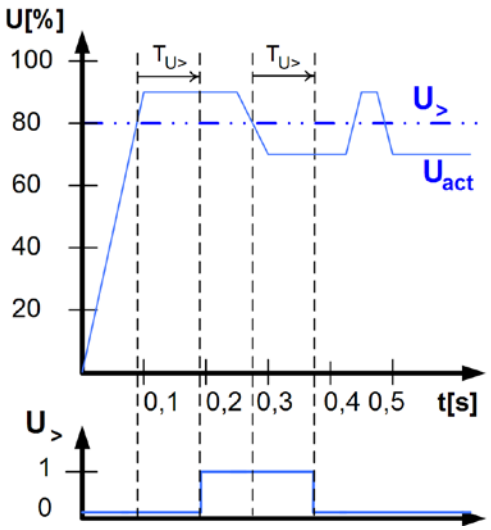
The overvoltage protection is intended to protect the connected load. This threshold should always be adjusted to the maximum voltage the load can take without damage. The output is instantly shut down if this threshold is exceeded.

Example: an 80V unit can be adjusted up to 88V for U_{ovp}

OV It is displayed as an alarm.

(also see „6.13 Alarms, warnings and signals“)

Overvoltage supervision



◆**U>** Default: U_{Nom}

= { U<… U_{ovp}}

◆**Tu>** Default: 100ms

= { 0…99:59h}

This is slightly different from the OVP (see above). Here the voltage is also supervised, but it is notified with either an alarm, a warning or a signal and after a definable delay ◆Tu>. The signal vanishes if the voltage is under the thre-shold for the time ◆Tu>. Hence you can supervise overvoltages without getting an OVP error every time or if you only want to get an alarm if the overvoltage is persistent longer than defined by ◆Tu>.

U> Alarm: Overvoltage

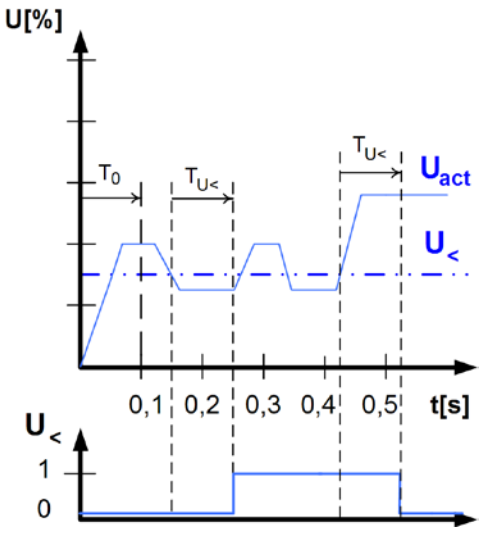
This error shuts down the power output. An alarm has to be acknowledged, before the power output can be switched on again.

U> Warning: Overvoltage

The error is notified and remains until it is acknowledged and not persistent anymore.

U> Signal: Overvoltage

Undervoltage supervision



◆**U<** Default: 0V

= { 0… U>}

◆**Tu<** Default: 100ms

= { 0…99:59h}

As soon as the voltage falls below the undervoltage threshold, the undervoltage is notified after the response time ◆Tu<. The notification vanishes, if the undervoltage limit is exceeded for the time ◆Tu<. This undervoltage error is suppressed for T_0=100ms after the power output was switched on.

U< Alarm: Undervoltage

This error shuts down the power output. An alarm has to be acknowledged, before the power output can be switched on again.

U< Warning: Undervoltage

The error is notified and remains until it is acknowledged and not persistent anymore.

U< Signal: Undervoltage

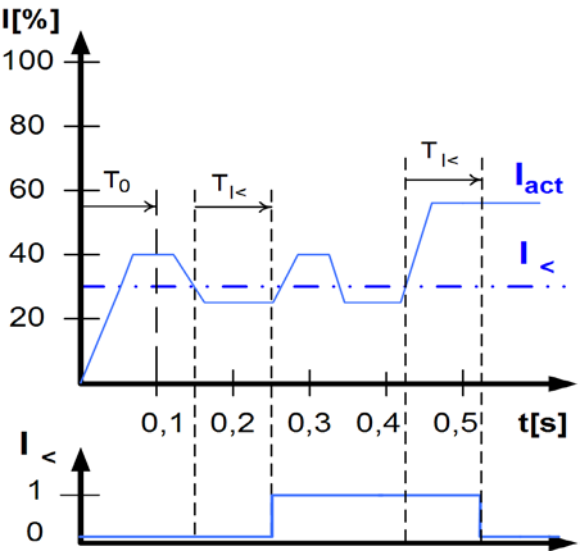
The analogue interface (IF-A1, optional) can signalise an undervoltage at one of the digital outputs.

7.6.2 Current supervision

I thresholds +

The menu page **I thresholds** lets you configure the supervision circuits for under- and overcurrent.

Undercurrent supervision



◆**I<** Default: 0A

= { 0… I>}

◆**Ti<** Default: 100ms

= { 0…99:59h}

The undercurrent error is signalised after the response time ◆Ti<, if the actual value of the current falls below the adjusted undercurrent limit. The error notification vanishes if the actual current has exceeded the threshold again for the time ◆Ti<. This undercurrent error is suppressed for T_0=100ms after the power output was switched on.

I< Alarm: Undercurrent

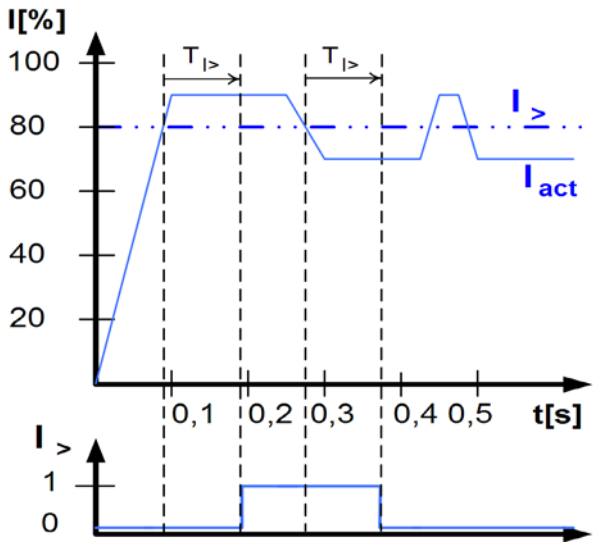
This error shuts down the power output. An alarm has to be acknowledged, before the power output can be switched on again.

I< Warning: Undercurrent

The error is notified and remains until it is acknowledged and not persistent anymore.

I< Signal: Undercurrent

Overcurrent supervision



◆**I>** Default: I_{Nom}

= { I<… I_{nom} }

◆**Ti>** Default: 100ms

= { 0…99:59h}

The overcurrent error is signalised after the response time ◆Ti>, if the actual value of the current falls below the adjusted overcurrent limit. The error notification vanishes if the actual current has exceeded the threshold again for the time ◆Ti>. This overcurrent error is suppressed for T_0 = 100ms after the output was switched on.

I> Alarm: Overcurrent

This error shuts down the power output. An alarm has to be acknowledged, before the power output can be switched on again.

I> Warning: Overcurrent

The error is notified and remains until it is acknowledged and not persistent anymore.

I> Signal: Overcurrent

The analogue interface (IF-A1, optional) can signalise an overcurrent or undercurrent at one of the digital outputs.

7.6.3 Step response supervision

Step response +

The menu page **Step response** lets you configure the supervision circuits for the dynamic and static comparison of actual value and set value.

◆Step response Default: Us→Uo

Us→Uo	Supervision of the deviance between set value and actual value of voltage
Is→Io	Supervision of the deviance between set value and actual value of current

◆Supervise Default: NO

NO	Supervision is inactive
Signal	Supervision reports a signal
Warning	Supervision reports a warning
Alarm	Supervision reports a alarm

◆ dyn. Δ Default: 10% I_{nom} resp. U_{nom}

= ± {0...1,1*U_{nom}}	Allowed tolerance for the voltage
= ± {0...I_{nom}}	Allowed tolerance for the current

Note: The settling process of the power supply is determined by the load. After a set value has changed, a certain time elapses until the desired value is put to the power output. For instance, it can last some seconds for the voltage to go down from 100% to 0V at no or small load, because the output capacitors need a time to discharge.

Supervision of a step response

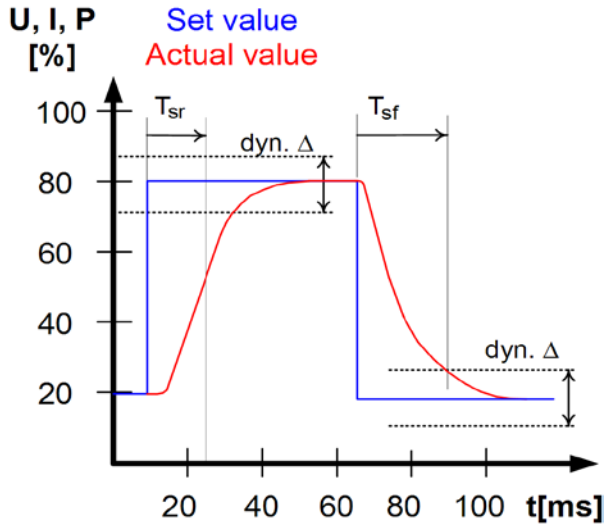
The adjusted set value is compared with the measured actual value. If there is a difference between them and this difference is greater than the tolerance, the supervision will initiate an error after the settling time ◆Tsr. See figure below.

◆rise time

Tsr = {0…99:59h} Default: 100ms

◆fall time

Tsf = {0…99:59h} Default: 2s



Notifications of the set/actual comparison

Example: The step from a lower set value to a higher set value was not performed within the settling time ◆Tsr. The supervision error is then notified as alarm, warning or signal.

U or U or U

Depending on the configuration of Step response, the I condition is alternatively notified.

Example: The step from a higher set value to a lower set value was not performed within the settling time ◆Tsf. The supervision error is then notified as alarm, warning or signal.

U or U or U

Depending on the configuration of Step response, the I condition is alternatively notified.

Part 2: The menu Options

Options +

The menu entry **Options** leads you to following menu selection:

Reset configuration
Enable R mode
Setup lock

7.7 Reset to default configuration

You can reset all modifications of the setup to the default setup (the state the unit had when it was delivered).

After selecting the corresponding menu entry you will be prompted again to submit the choice to reset your current, personal configuration.

Attention! *Even if the device configuration has been locked by a PIN it will be unlocked and overwritten!*

Reset configuration +

◆**Are you sure ?** Default: NO
= YES All modifications of the default setup are reset
= NO No change

7.8 Unlocking the U/I/R mode

R mode available:
YES The U/I/R operation is unlocked and can be used
NO U/I/R operation not enabled yet

The U/I/R operation mode can only be used after it was unlocked with a PIN code. This mode also has to be configured in the profile (see also „7.1 Defining operation parameters“).

In order to unlock the feature, a PIN code is required, which can purchased optionally. Please contact your supplier. The device's serial number, which can be found on the type label, is required to be told, because the code is related to it.

Enable R mode +

◆**Activate R mode via pin code: 0 0 0 0**

Use the code you got from your supplier. It consists of 4 numbers of 0...15.

7.9 Locking the device configuration

Setup lock +

It can be necessary, for security reasons, to lock the device configuration from access. You can enter a PIN code here, consisting of 4 numbers, each from 0 to 15.

Attention! *This only effects the user profile of the device, not the set values or the rotary knobs on the front panel!*

◆**Lock setup via pin code:** Enter the PIN code {0..15} {0..15} {0..15} {0..15}

The lock can only be disabled with the same PIN code or by resetting the configuration with

Reset configuration.

This will reset the configuration to factory setting. It also deletes the custom setup and can be used in case the PIN code for setup lock has been lost.

If you activate the setup lock with a code you can only change the configuration again after the code was entered anew.

8. Behaviour of the device when...

8.1 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 „7. Device configuration") there is an option „Power On" that determines the output condition after the device is switched on. Default is „OFF". It means, that the set values of U, I, P and the output condition are not 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% and the output is switched on after every start. With setting „restore", the set values and the output condition will be restored when switching the unit on.

8.2 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.

8.3 Switching to remote control

a) *Built-in analogue interface*: Pin 5 „Remote" switches the device to remote control via the set values pins VSEL (pin 1), CSEL (pin 2) and PSEL (pin 8), as well as the status input REM-SB (pin 13), if not inhibited by **local** mode or **remote** control by digital interface already being active. The output condition and the set values which are put into pins 1, 2, 8 and 13 (also see section „10. Analogue interface") are immediately set. After return from remote control, the output will be switched off and the last, remotely adjusted set values of U, I and P are kept.

Note: there are settings in the device setup for the built-in analogue interface, regarding the logical levels of the digital pins etc., which are described in section 10.3.

b) *Optional, analogue interface IF-A1*: Pin 22 „SEL-enable" switches the device to remote control via the set values pins VSEL (pin 3), CSEL (pin 2) and PSEL (pin 1), as well as the status input REM-SB (pin 23), if not inhibited by **local** mode or remote control by digital interface already being active. The output condition and the set values which are put into pins 1, 2, 3 and 23 (also see section „10. Analogue interface") are immediately set. After return from remote control, the output will be switched off and the last, remotely adjusted set values of U, I and P are kept.

Note: there are settings for the optional analogue interface in the device setup, regarding the logical levels of the digital pins etc., which are described in the external interface cards manual. The examples as depicted in section 10.5 can also be used for 25pole analogue connector of the IF-A1, but the pin numbers and some pin names differ.

c) *Optional, digital interface*: Switching to remote control by the corresponding command (here: object), if not inhibited by **local** mode or remote control via an analogue interface already being active, keeps output state and set values until altered.

8.4 Overvoltage occurs

An overvoltage error 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 error on the display by the status text „OV" and an alarm symbol and on the pin 14 „OVP" of the built-in analogue interface and on pin 8 „OVP" of the optional, analogue interface IF-A1, if equipped.

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

If the cause of the overvoltage is removed, the output can be switched on again and status text „OV" will disappear. Before this, the alarm has to be acknowledged by button  or by a command via digital interface. If the error is still present, the output is not switched on.

OV errors are recorded as alarm into the internal alarm buffer. This buffer can be read out via a digital interface. Flushing the buffer is initiated by another command.

8.5 Overtemperature occurs

As soon as an overtemperature (OT) error occurs by internal overheating of one or multiple power stages, the status is indicated in the display by a text „OT" and an alarm symbol and on the pin 6 „OT" of the built-in analogue interface, as well as on pin 9 „OT" of the optional, analogue interface IF-A1, if equipped. The output is not always switched off, depending on the settings (see „7.1 Defining operation parameters"), and continues to provide voltage. The output voltage only will only be zero if all internal power stages (3.3/5kW models = 1 stage, 6.6/10kW models = 2 stages, 15kW models = 3 stages) have shut down because of overheat.

OT errors have to be acknowledged with pushbutton  or by sending the corresponding command via an optional, digital interface.

OT errors are recorded as alarm into the internal alarm buffer. This buffer can be read out via the digital interface. Flushing the buffer is initiated by another command.

8.6 Voltage, current and power are regulated

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".

All models feature an adjustable power limitation for 0...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. The power limitation primarily affects the output voltage. Because voltage, current and power limitation affect each other, various situations like these may occur:

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

Example 2: the device is in constant current regulation, the output voltage is defined by the resistance of the load. Then the power is limited down. Output voltage and current are decreasing to values according to the formula P = U * I. Once the current set value is 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).

Those three conditions CC, CV and CP are also indicated on the appropriate pins of the optional, analogue interface cards or can be read out as status bits via an optional, digital interface card.

8.7 Remote sense is active

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

The sense input is located on the rear at terminal **Sense**, where the sense conductors are connected to the load with correct polarity. The power supply will detect the external sense automatically and compensate the output voltage by the actual voltage at the load instead of the output. The output voltage will be raised by the value of the voltage drop between power supply and load.

Maximum compensation: see technical specifications, will vary from model to model.

Also see figure 10 below.

8.8 Mains undervoltage or overvoltage occurs

The units require two or three phases of a three-phase supply with 400V phase conductor voltage and tolerate max. ±15%. This results in an input voltage range of 340...460V AC. Within this range, the units can be operated without any restrictions. Input voltages below 340V AC are considered as supply undervoltage and will store the last condition, as well as switch the power output off. Same happens at overvoltage above 460V AC.

Permanent input undervoltage or overvoltage must be avoided!

8.9 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.

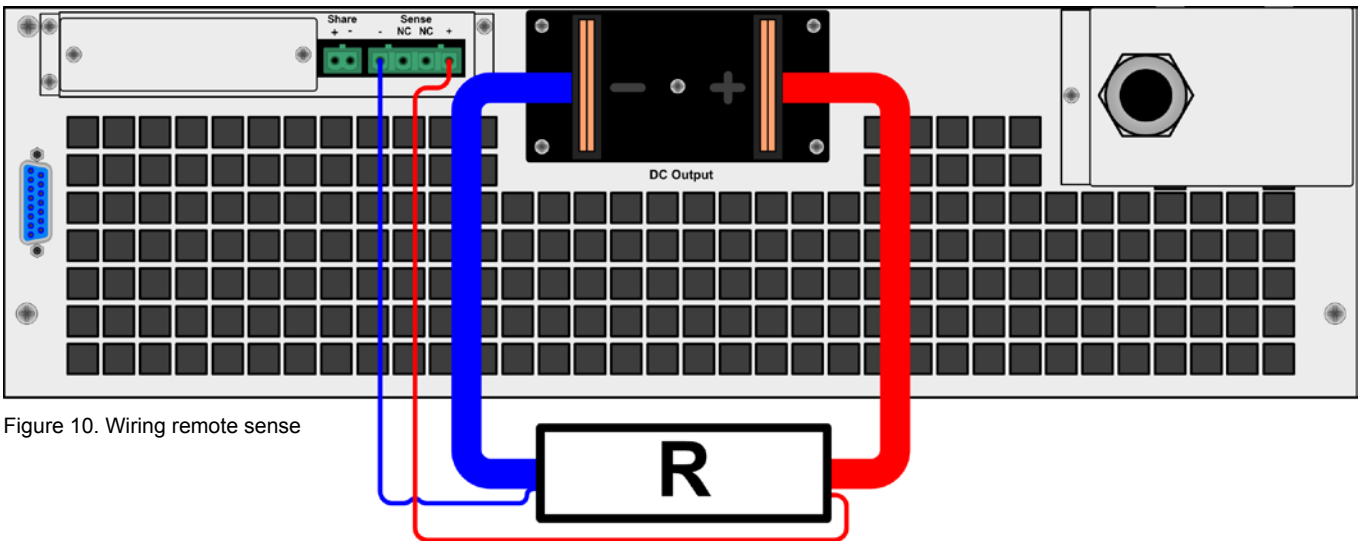


Figure 10. Wiring remote sense

9. Digital interfaces

9.1 General

The power supply supports various interface cards for communication or analogue control. All cards, except Profibus card IF-PB1, are galvanically isolated up to 2000V. The Profibus card is isolated up to 1000V.

The digital interface cards IF-R1 (RS232), IF-C1(CAN) and IF-U1(USB) use a uniform communication protocol. Up to 30 units can be controlled from a PC at once with these cards.

The GPIB interface IF-G1 (IEEE 488) offers a SCPI command structure for up to 15 units per bus. The analogue card IF-A1 is a galvanically isolated, analogue interface with configurable in- and outputs.

The new Ethernet/LAN interface IF-E1 also provides SCPI command set, as well as a browser surface. It features an additional USB port which makes the device accessible like with the IF-U1 card.

The Profibus card IF-PB1 is designed to be used on a field bus. It offers DPV0 and DPV1 functionality at bus speeds of up to 12MBit/s, 125 Profibus addresses, 32 units per bus segment and simple integration via a generic station description file (GSD). An additional USB port includes complete functionality of a USB interface card type IF-U1. It offers monitoring and controlling of the unit with our custom, binary communication protocol. The port only works alternatively to the Profibus port.

9.2 Configuring the interface cards

The interface cards have to be configured at least once.

This is done using the menu **Communication.**

M + **Communication** + ↵

◆**Device node** Default: 1

= {1..30} Up to 30 device nodes (addresses) can be assigned to devices, one per unit. A device node must only be assigned once if multiple units are controlled.

Except for the analogue interface it is necessary to set the unit's address (◆Device node) when using interface cards. Only then the unit can be identified correctly.

Slot A: { IF-… } depends on what is equipped

An equipped interface card is automatically recognized by the unit. The menu selection displays the equipped card with its product code.

Configuring the various cards

All cards have different parameters to configure. These are explained in detail in the corresponding user instruction manual. Please refer to it.

10. Analogue interface

10.1 General

The integrated, 15 pole analogue interface is located on the front and offers, amongst others, following possibilities:

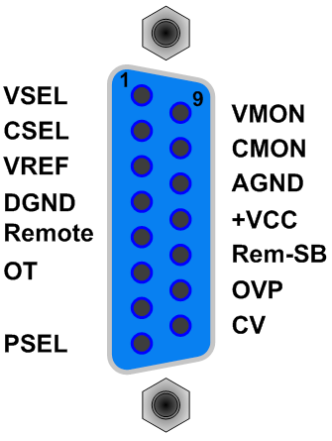
- Remote control of output current, voltage and power
- Remote monitoring of status (OT, OVP, CC, CV)
- Remote monitoring of actual values
- Remotely switching the output on/off

The set value inputs can be operated with either 0...5V or 0...10V. The proper voltage range is selected in the device setup. See section „7. Device configuration“. The reference voltage at output pin 3 is tied to the chosen setting and will be either 5V or 10V.

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 **ON**. It means, the output can not be switched on by the button if the pin defines the output state as „off“ So it can be as emergency power off. This does not apply, if the control location was set to **local**. Also see section 6.9.
- The output VREF can be used to build set values for the set value inputs VSEL, CSEL and PSEL. For example, if only current control is required, pin VSEL and PSEL can be bridged to VREF. CSEL is then either fed by an external voltage (0...5V or 0...10V) or via a potentiometer between VREF and ground. Also see next section.
- Putting in set values up to 10V while the 0...5V range is selected will ignore any voltage above 5V (clipping) and keep the output value at 100%.
- **The grounds of the analogue interface are related to minus output**.

10.2 Pin overview



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

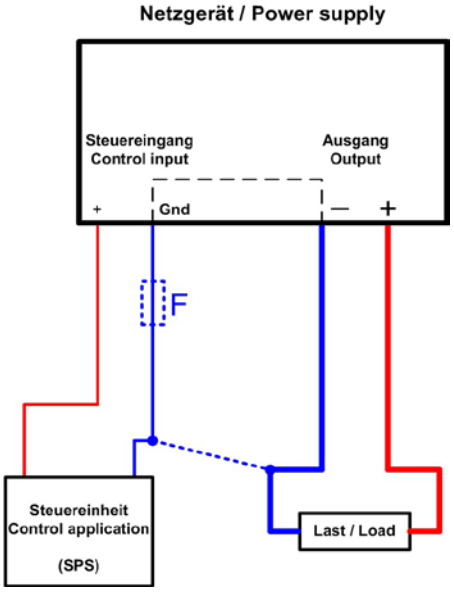


Figure 11

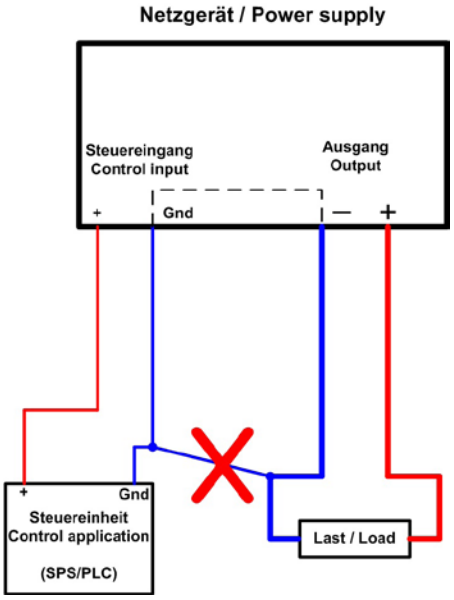
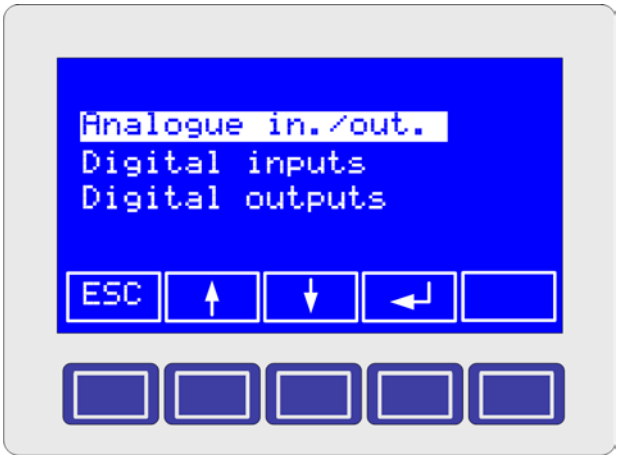


Figure 12

10.3 Settings in the device setup

M + Analogue interface + ↵

The setup menu gives access to some settings for the built-in analogue interface:



◆ **Analogue voltage** Default: 0...10V

= { 0...5V | 0...10V } Selects the voltage range for the analogue in- and outputs, which corresponds to 0...100% set/actual value

◆ **REMOTE /5** Default: LOW

◆ **REM-SB /13** Default: LOW

= { LOW | HIGH} Defines, if the digital inputs will react their dedicated function with either LOW or HIGH level. For the levels of LOW and HIGH see section 10.4.

Note: both pins are internally pulled-up to HIGH. It means, that if setting HIGH is selected and nothing is connected to the analogue interface, pin REMOTE would instantly switch to permanent remote control and pin REM-SB would switch the output permanently off.

◆ **OVP /14** Default: LOW

◆ **OT /6** Default: LOW

◆ **CV /6** Default: LOW

= { LOW | HIGH} Defines, if the digital outputs will report their dedicated status with either LOW or HIGH level. For the levels of LOW and HIGH see section 10.4.

10.4 Pin specifications

Pin	Name	Type*	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	U range = 0 …30V I_{Max} = +1mA at 5V Sender: Open collector against DGND
6	OT	DO	Overtemperature error	OT = HIGH, U_{High} > 4V no OT = LOW, U_{Low} <1V ***	Quasi open collector with pull-up to Vcc ** 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	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	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 Vcc ** 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
15	CV	DO	Indication of voltage regulation active	CV = LOW, U_{Low} <1V *** CC = HIGH, U_{High} >4V	

* AI = Analogue input, AO = Analogue output, DI = Digital input, DO = Digital output, POT = Potential

** Internal Vcc = 13.8V *** Default setting, can be modified in the setup menu

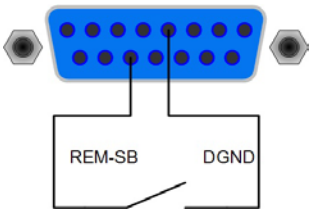
10.5 Example applications

Output off

Pin 13 „REM-SB“ is always operative and does not depend on the remote mode . It can thus be used to switch off the output without extra means, except the device was set to mode **local.** Then the pin has no function. 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, if setting „LOW“ was selected for the pin REM-SB (see section 10.3). If HIGH is set, it is vice versa and the contact has to opened in order to shut the output down (emergency off principle).

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

Clarification:

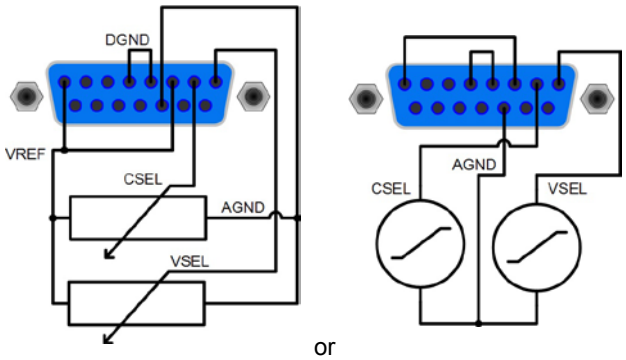


Remote control of current and voltage

*Note: Remote control via analogue interface always requires to put all **three** set values.*

Two potentiometers between VREF and ground, sliders at the inputs VSEL and CSEL. Power set value PSEL is tied to VREF and thus set to 100%. 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. 5mA for the VREF output, potentiometers with at least 4.7kOhm should be used.

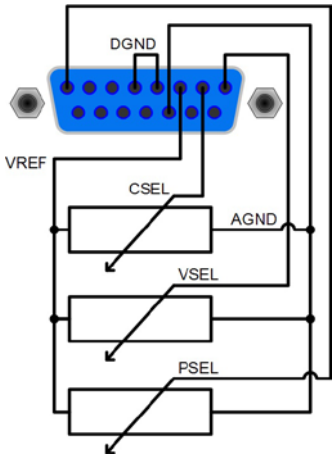
Alternatively, external voltage sources can be used to control the set value input (second example).



or

Remote control with power

Similiar to the example above, but with adjustable power limit.



11. Miscellaneous

11.1 Parallel connection in Share bus mode

Share bus operation is used to gain a symmetric load current distribution when running multiple units in parallel connection.

Important: in this operation mode, the unit with the highest output voltage controls and defines the output voltage of the whole parallel connection. It means, any unit of the system could be in charge. Thus it recommended to pick a unit that is used to control the whole system, while the set value of voltage for the remaining units is set to the required minimum. Voltage and power set value could be set to 100% or, if not desired, set to equal values on every unit so that the total results in what's required.

In case a unit is broken and will completely shut off, the parallel connection will continue to work without interruption. This is called redundancy.

For a device error like overtemperature (OT) or overvoltage, the output voltage will rise or fall to the highest value that was adjusted on any of the remaining units.

The wiring of terminal „Share", which is required for Share bus operation, is explained in section „5.8 Terminal „Share"". Also see figure 13 below.

Note: if remote sense is going to be used, it is recommended only to connect the „Sense" input of the main unit that determines the system voltage.

Attention! This is a purely analogue connection. No totals formation of actual values on any of the units.

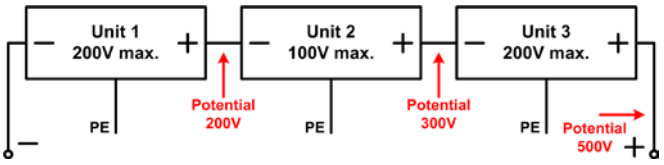
Attention! Share bus connection with units different to 3U series, which also feature a Share bus, is not allowed!

11.2 Series connection

Series connection of two or more units is generally allowed. But there are some restrictions and rules to consider because of safety and isolation reasons:

- **No negative DC output pole of a unit in the series connection may be raised to a potential >300V against ground (PE)!**
- Every unit is adjusted seperately, there is no master-slave connection.
- **The Share bus must not be wired!**
- **The grounds (AGND, DGND) of the analogue interfaces of the units in series connection must not be wired to each other!**
- **Remote sense must not be wired!**
- It is recommended to build a series connection only with unit of same model.

Example: Three identical units with 200V nominal voltage, for example PSI 8200-70 3U, shall be connected in series. When calculating, the total voltage of that series connection could go up to 600V. Looking at the resulting potentials on the negative outputs of the units, the 3rd unit negative DC pole could be raised to 400V if all units put out maximum voltage. This is not permitted! So one of the lower units has to be limited to a certain maximum. The figure below clarifies that the resulting total voltage would only be 500V:



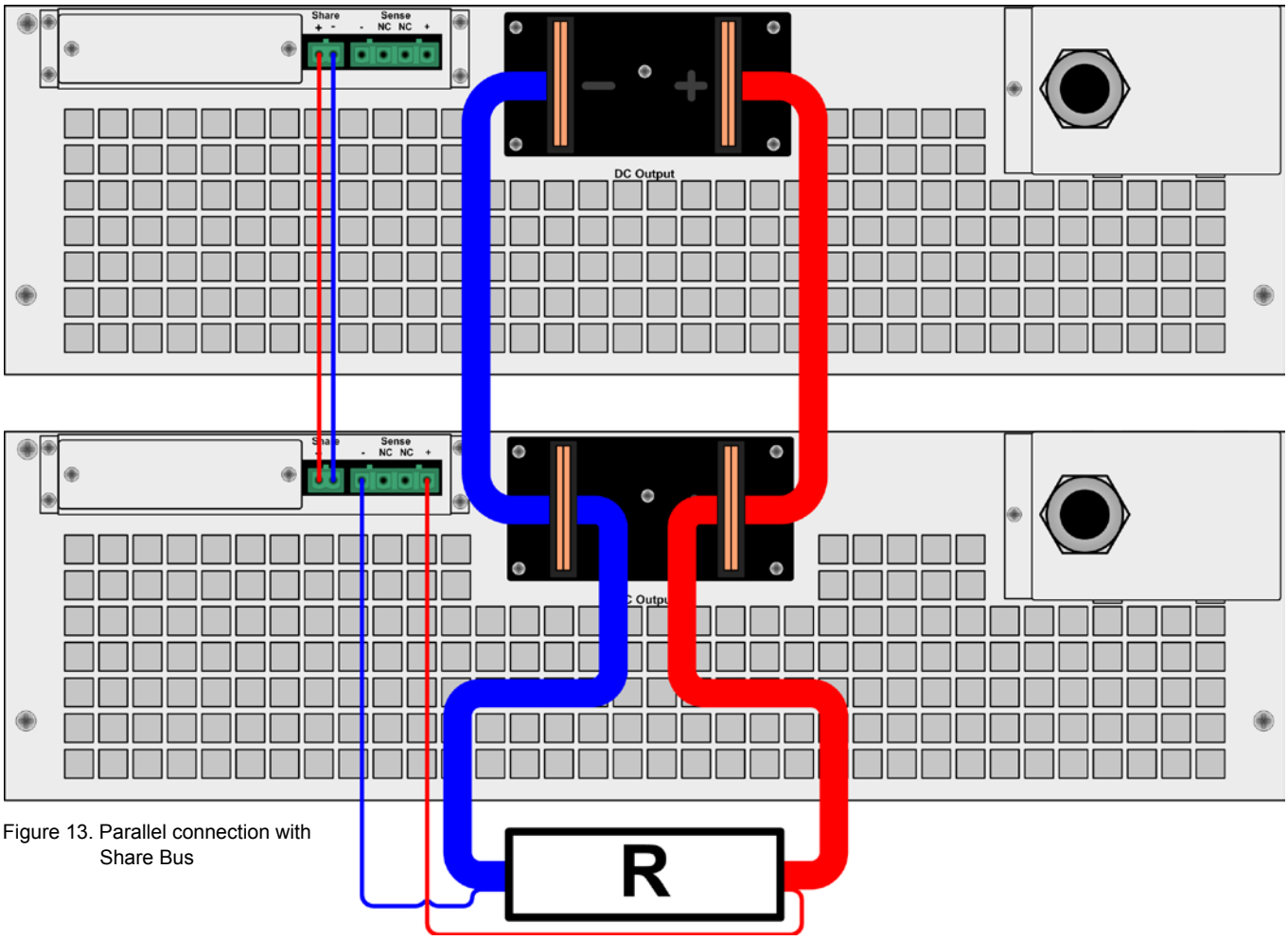


Figure 13. Parallel connection with Share Bus

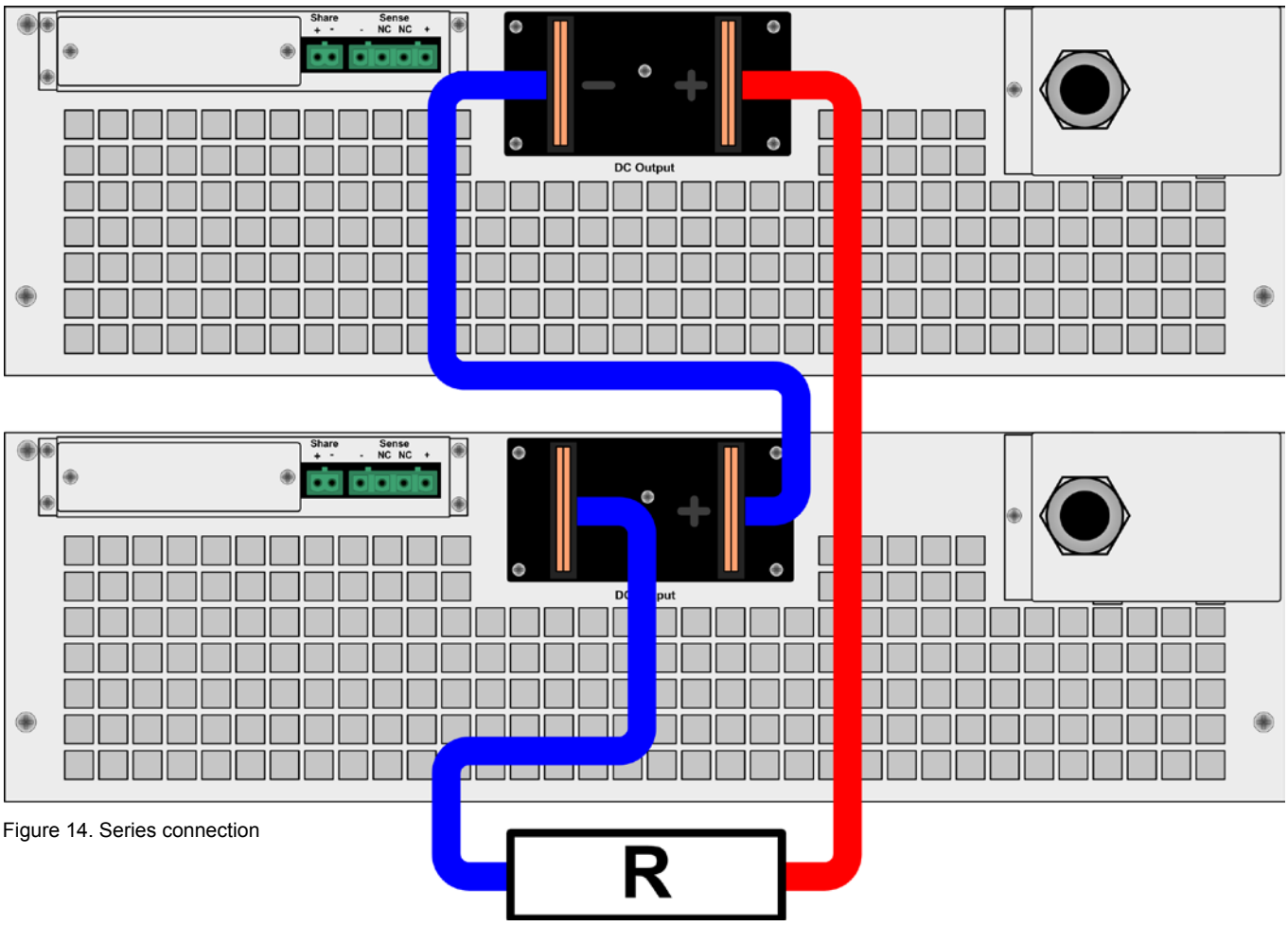


Figure 14. Series connection

11.3 Accessories and options

Following accessories are optionally available:

a) Digital interface cards

Pluggable and retrofitable, digital interface cards for USB, RS232, CAN, GPIB/IEEE (SCPI only), Ethernet/LAN (SCPI only) or Profibus are available. There is one interface card slot available with every device model.

b) Extended analogue interface

Pluggable and retrofitable, galvanically isolated, 25 pole analogue card. For details refer to the seperate interface cards instruction 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!

Note: this is a permanent modification which is not switchable.

b) Watercooling

Internally integrated water cooling block. The watercooling is used prevent premature shutdown of the power output because of overheating.

c) Internal resistance regulation

This option can be purchased subsequently and is unlocked with a code number in the device‘s setup menu.

After it is unlocked, the user can choose between U/I/P or U/I/R operation. The power set value will not be adjustable in U/I/R mode, it is then only defined as a limit in the device settings.

Note: it will eventually be required to update the device firmware before the option can be unlocked. Ask your supplier.

11.4 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 upod request. The update too will guide the user through the semi-automatic update process.

11.5 Networking

The figures below depict networking examples for the digital control of multiple devices in star-shaped (USB, RS232, Ethernet) or bus-like (CAN, GPIB, Profibus) 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 (see „7. Device configuration“).

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.

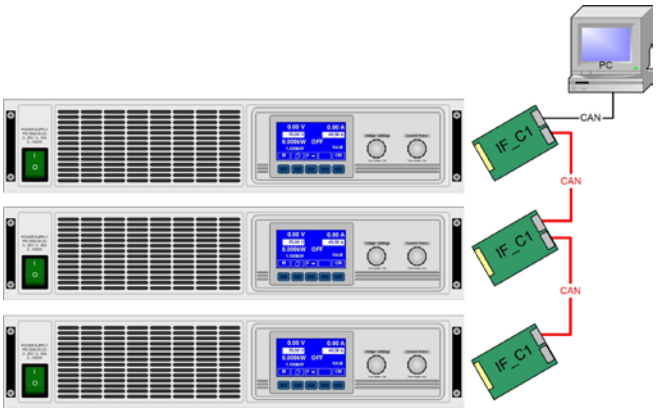


Figure 15. USB or RS232 networking

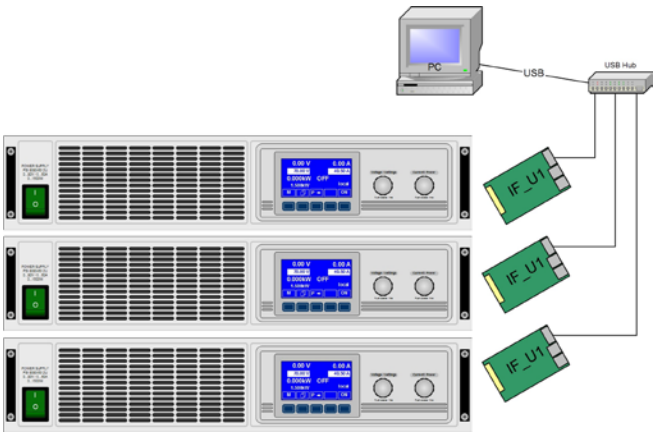


Figure 16. CAN networking example, also applies to GPIB