Elektro-Automatik GmbH

高效电源供应器系列

High Efficiency Power Supply Series

PS 8000 3U

3,3kW - 15kW
40V - 1500V
30A - 510A

PS 8080-170 3U:	09 230 160	PS 8200-70 3U:	09 230 170
PS 8080-340 3U:	09 230 161	PS 8200-140 3U:	09 230 171
PS 8080-510 3U:	09 230 162	PS 8200-210 3U:	09 230 172
PS 8160-170 3U:	09 230 163	PS 8400-70 3U:	09 230 173
PS 8240-170 3U:	09 230 164	PS 8600-70 3U:	09 230 174
PS 8500-30 3U:	09 230 165	PS 8040-170 3U:	09 230 176
PS 8500-60 3U:	09 230 166	PS 8040-340 3U:	09 230 177
PS 8500-90 3U:	09 230 167	PS 8040-510 3U:	09 230 178
PS 81000-30 3U:	09 230 168	PS 8080-250 3U:	09 230 179
PS 81500-30 3U:	09 230 169		

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。

重要提示

- 产品老化以及超负荷使用都可能导致如按钮、旋钮类的产品控制件操作不稳定。

1. 简介

PS 8000 3U系列为高效电源供应器，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5组不同的预设值。

您可选择各种数字接口卡，这些接口卡通过电脑可执行更宽范围的控制和监控功能。根据接口卡类别，产品可支持的数量以及可操作功能会有所不同。

本系列所有型号都配有并联和共享总线操作用连接端子。

通过接口卡可方便地将产品融入现有系统，且完全不需配置卡或仅做少数几个设定。

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

本产品由微处理器控制，使得产品能准确、快速地测量和显示出各实际值。

主功能一览：

- 设置0...100%范围的设定电压和电流
- 0...110% U_{Nom}可调过压极限
- 可选拔插式接口卡 (CAN，USB，RS232，IEEE/GPIB，Ethernet/LAN，Profibus)
- 可选外控用模拟接口，0...5V或0...10V（可选）对应0...100%数值
- 功率级别分别为3.3kW, 5kW, 6.6kW, 10kW 或 15kW, 装进机柜内还可扩展至150kW功率
- 温控风扇
- 状态指示灯 (OT，OVP，CC，CV，CP)
- 5组可选内存集
- Share-Bus 共享总线操作（并联）

2. 技术规格

2. 1 控制面板和显示器

显示： 202 x 32点阵显示
分为三个区域

旋钮： 2个旋钮，9+2个按钮

额定值决定最大可调范围。

实际电压和电流同时显示，过压极限设定值，电压、电流和功率限定值则分开显示。

分辨率： 4位数
格式： 0.00V...99.99V
0.0V...99.9V
0V...9999V

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

分辨率： 4位数
格式： 0.000kW...9.999kW
0.00kW...99.99kW

2.2 各型号技术规格

	PS 8040-170 3U	PS 8080-170 3U	PS 8200-70 3U	PS 8500-30 3U	PS 8040-340 3U
电源输入					
输入电压	340…460V	340…460V	340…460V	340…460V	340…460V
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% $\triangle U_{IN}$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	最大2.5V	最大2.5V	最大6V	最大10V	最大2.5V
过压保护门限 (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% $\triangle U_{IN}$时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
带载0…100% $\triangle U_{OUT}$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
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	0.001kW	0.001kW	0.001kW	0.001kW	0.001kW
调节分辨率	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	不	不	不	不	是的
绝缘耐压输出对外壳	500V DC	500V DC	500V DC	1000V DC	500V 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				
标准	EN 60950, 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				
产品编号	09230176	09230160	09230170	09230165	09230177

* 与额定值有关，该精确度决定设定值与实际值间允许最大误差。

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

	PS 8040-510 3U	PS 8080-340 3U	PS 8160-170 3U	PS 8200-140 3U	PS 8400-70 3U
电源输入					
输入电压	340…460V	340…460V	340…460V	340…460V	340…460V
可选输入电压范围	588…796V+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	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% $\triangle U_{IN}$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% $\triangle U_{IN}$时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
带载0…100% $\triangle U_{OUT}$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
调节分辨率	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	是的	是的	不	是的	不
绝缘耐压输出对外壳	500V DC	500V DC	500V DC	500V DC	900V 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				
标准	EN 60950, 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				
产品编号	09230178	09230161	09230163	09230171	09230173

* 与额定值有关，该精确度决定设定值与实际值间允许最大误差。

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

	PS 8500-60 3U	PS 81000-30 3U	PS 8080-250 3U	PS 8080-510 3U	PS 8200-210 3U
电源输入					
输入电压	340…460V	340…460V	340…460V	340…460V	340…460V
可选输入电压范围	-	-	588…796V+MP	588…796V+MP	588…796V+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	80V	200V
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% $\triangle U_{IN}$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	< 150mVpp < 10mVrms	< 250mVpp < 25mVrms
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	100mV	1V	10mV	10mV	100mV
远程感测补偿	最大10V	最大20V	最大2.5V	最大2.5V	最大6V
过压保护门限 (可调)	0…550V	0…1100V	0…88V	0…88V	0…220V
输出 - 电流					
额定电流I_{Nom}	60A	30A	250A	510A	210A
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% $\triangle U_{IN}$时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
带载0…100% $\triangle U_{OUT}$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	< 900mApp < 120mArms	< 167mApp < 33mArms
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
调节分辨率	95.50%	95.50%	93%	93%	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	25.5kg	25.5kg	33kg	33kg	33kg
冗 餘	不	不	是的	是的	是的
绝缘耐压输出对外壳	1000V DC	1500V DC	500V DC	500V DC	500V 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				
标准	EN 60950, 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				
产品编号	09230166	09230168	09230179	09230162	09230172

* 与额定值有关，该精确度决定设定值与实际值间允许最大误差。

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

	PS 8240-170 3U	PS 8500-90 3U	PS 8600-70 3U	PS 81500-30 3U
电源输入				
输入电压	340…460V	340…460V	340…460V	340…460V
可选输入电压范围	588…796V+MP	588…796V+MP	588…796V+MP	588…796V+MP
要求相数	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
输入保险丝	6x T16A	6x T16A	6x T16A	6x T16A
输入电流	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
输出 - 电压				
额定电压U_{Nom}	240V	500V	600V	1500V
可调范围	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}	0V…U_{Nom}
市电波动范围在±10% $\triangle U_{IN}$时的稳定度	< 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%
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
纹波 @ BWL 20MHz	< 500mVpp < 20mVrms	< 300mVpp < 70mVrms	< 400mVpp < 80mVrms	< 1000mVpp < 350mVrms
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	100mV	100mV	100mV	1V
远程感测补偿	最大7.5V	最大10V	最大18V	最大30V
过压保护门限 (可调)	0…264V	0…550V	0…660V	0…1650V
输出 - 电流				
额定电流I_{Nom}	170A	90A	70A	30A
可调范围	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}	0…I_{Nom}
市电波动范围在±10% $\triangle U_{IN}$时的稳定度	< 0.05%	< 0.05%	< 0.05%	< 0.05%
带载0…100% $\triangle U_{OUT}$时的稳定度	< 0.15%	< 0.15%	< 0.15%	< 0.15%
纹波 @ BWL 20MHz	< 333mApp < 27mArms	< 50mApp < 23mArms	< 30mApp < 12mArms	< 19mApp < 13mArms
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	100mA	10mA	10mA	10mA
负载从10…90%瞬态恢复时间	< 2ms	< 2ms	< 2ms	< 2ms
输出 - 功率				
额定功率P_{Nom}	15000W	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}
精确度*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
显示器分辨率	0.01kW	0.01kW	0.01kW	0.01kW
调节分辨率	93%	95.50%	95.20%	95.50%
其它				
环境温度	0….50° C	0….50° C	0….50° C	0….50° C
储存温度	-20….70° C	-20….70° C	-20….70° C	-20….70° C
相对湿度	< 80%	< 80%	< 80%	< 80%
尺寸 (WxHxD)**	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm
重量	33kg	33kg	33kg	33kg
冗 餘	不	是的	不	不
绝缘耐压输出对外壳	500V DC	1000V DC	1000V DC	2000V 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			
标准	EN 60950, 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			
产品编号	09230164	09230167	09230174	09230169

* 与额定值有关，该精确度决定设定值与实际值间允许最大误差。

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

3. 产品描述

3.1 各面视图

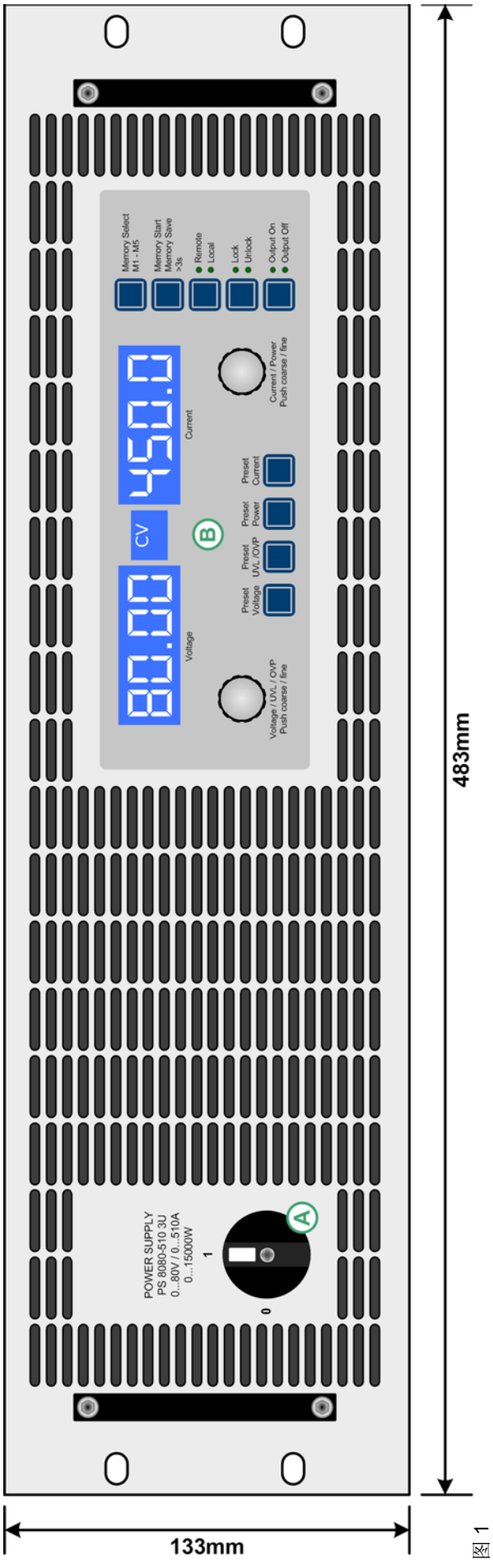


图 1

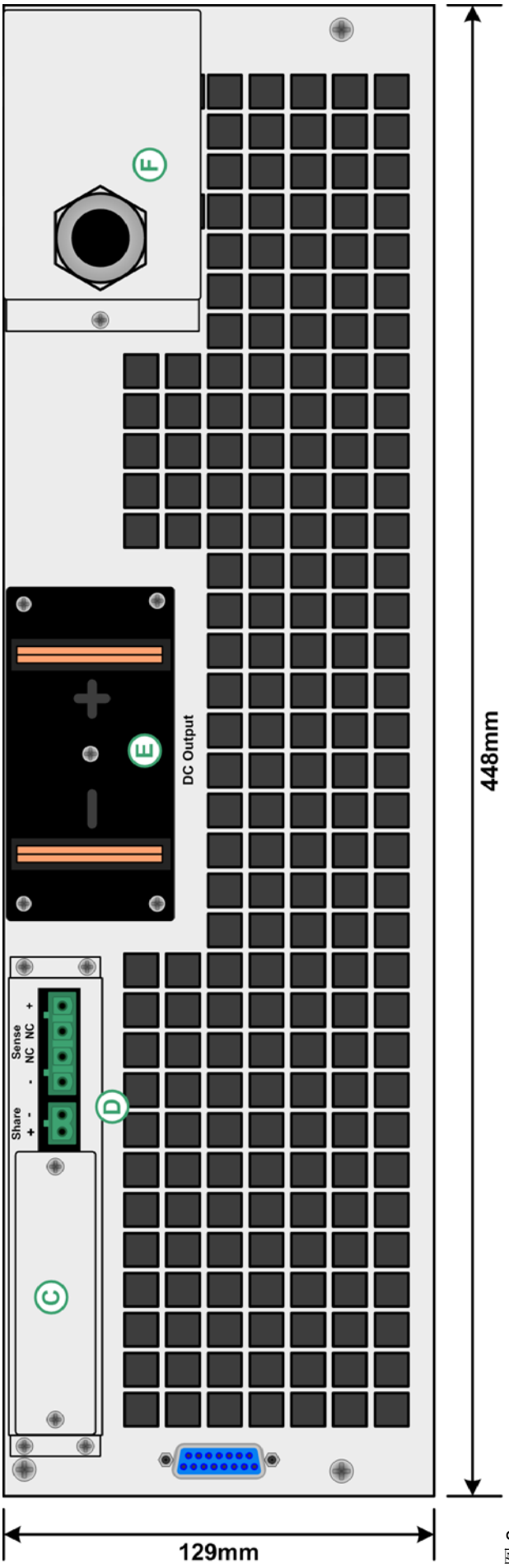


图 2

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（上图显示的输出端为80V型号的输出端类型）
F - 交流输入端

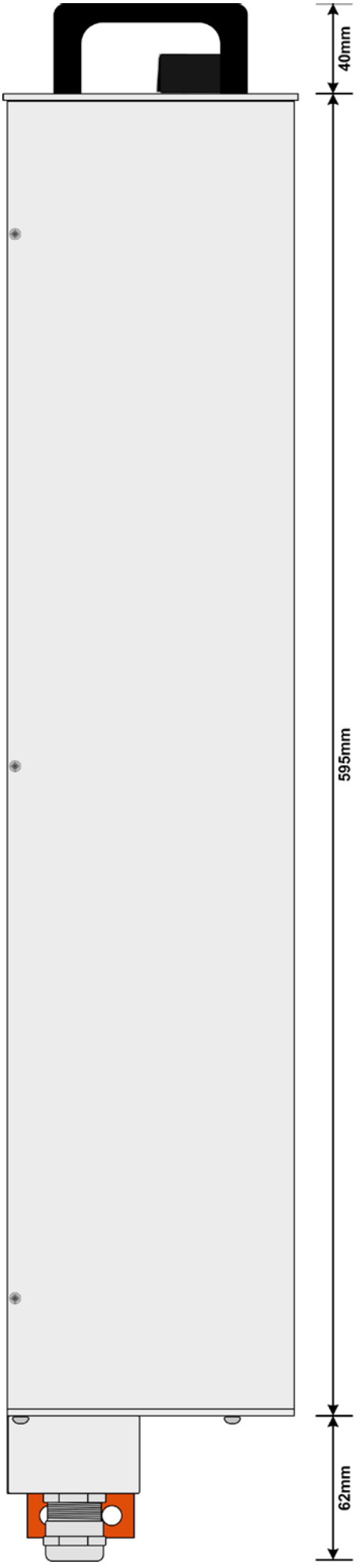


图 3

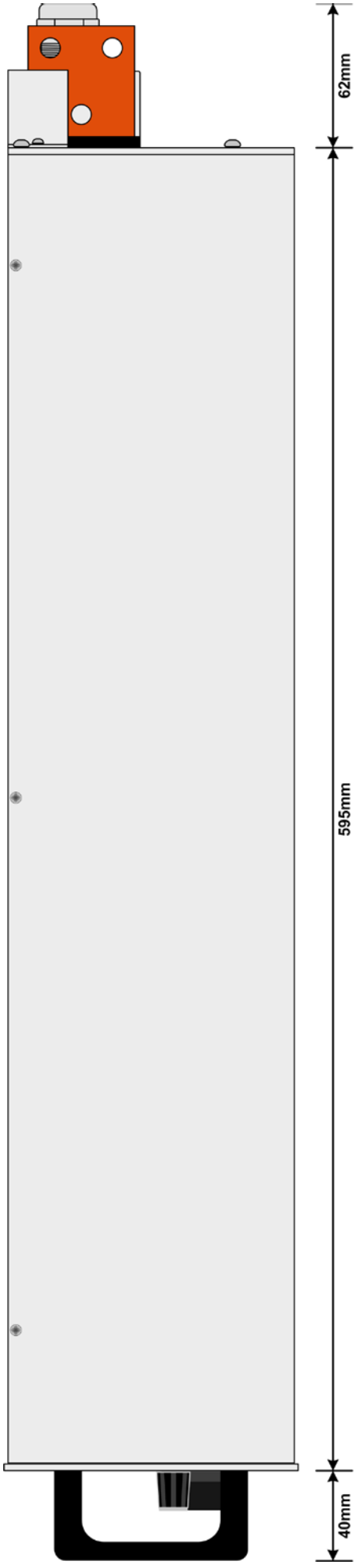


图 4

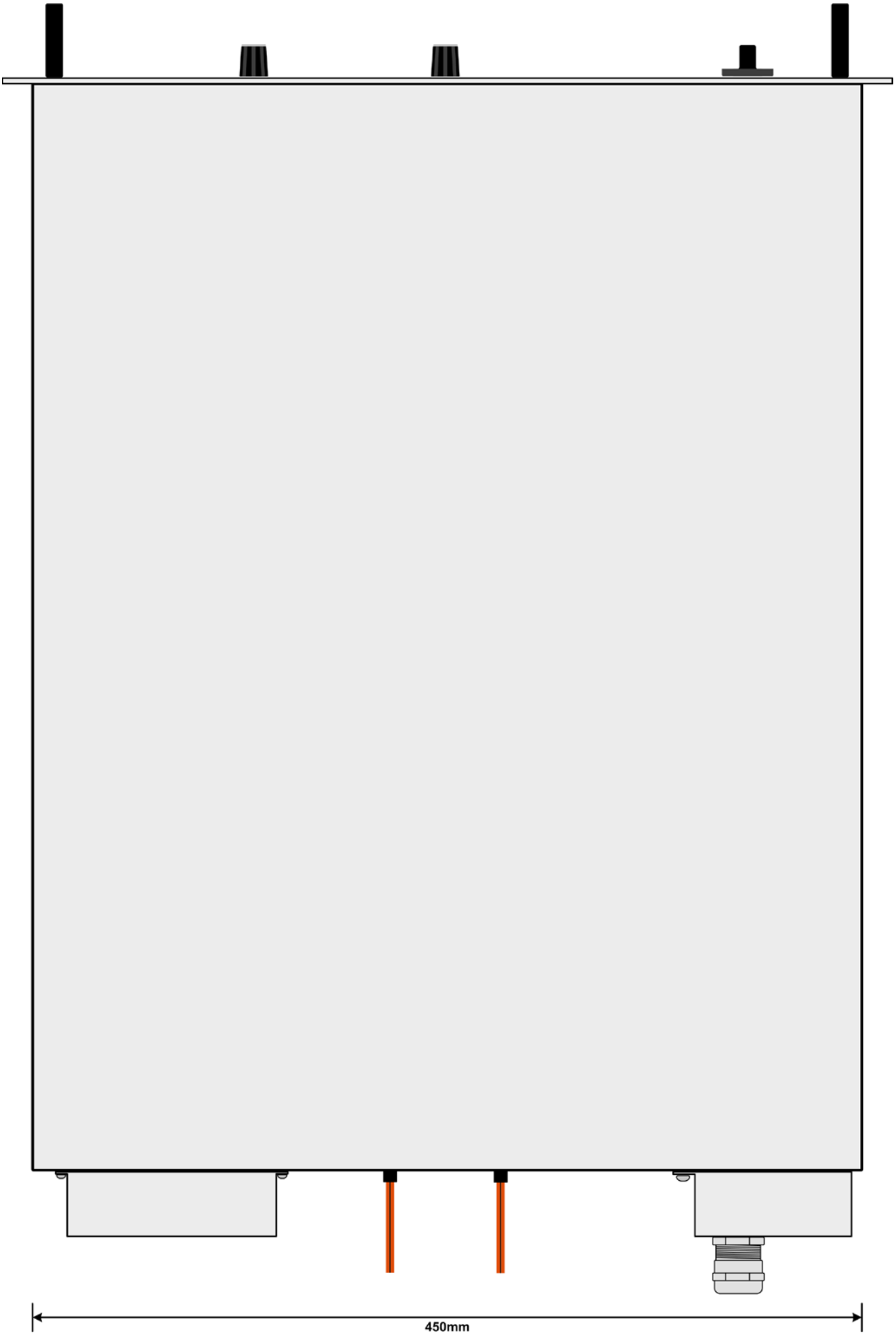


图 5

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 维修/服务

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 各型号技术规格“，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

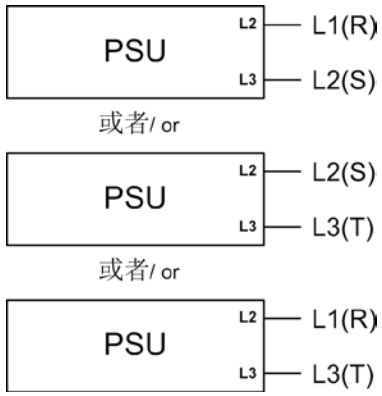
我们建议如下：

对于3.3kW/5kW/6.6kW型号： 至少为2,5mm²

对于10kW/15kW型号： 至少为4mm²

针对每相线以及地(PE)。

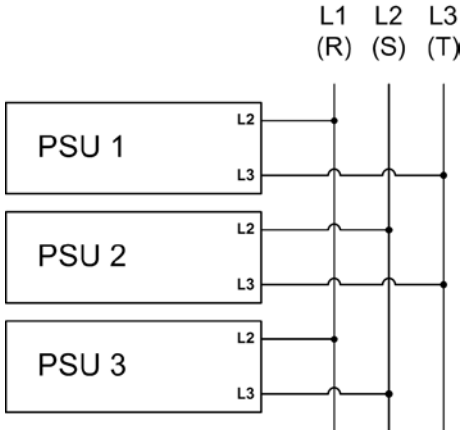
3.3kW或5kW单机使用的两相线可任意选择。意思是，不一定非为L2 (R)与L3 (S):



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：



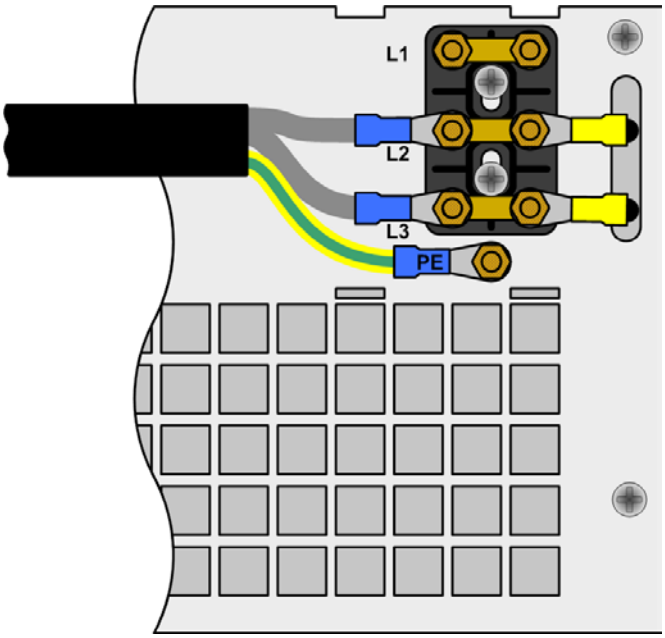


图6. 3.3kW/5kW产品输入端连接线图

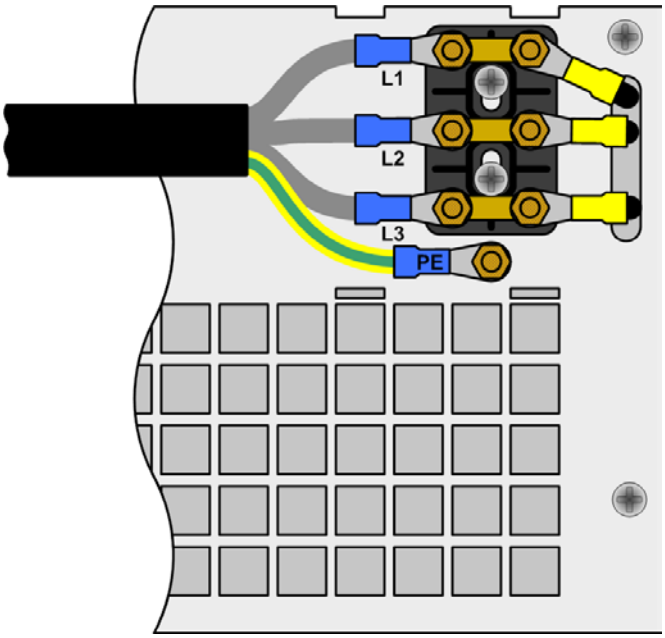
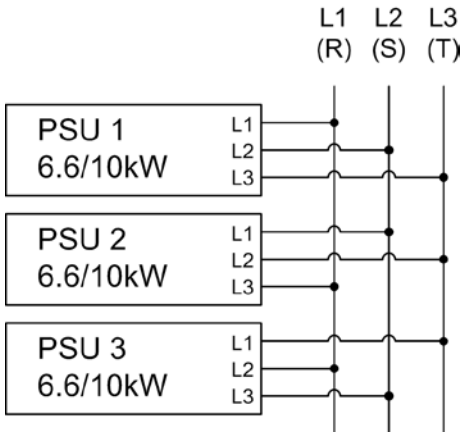


图7. 6.6kW/10kW/15kW产品输入端连线图

6.6kW/10kW型号的有所不同。在此情况下建议更改相位图。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

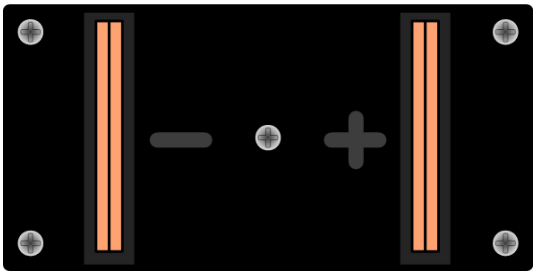
上面为每个直流输出端连线的最小直径（软性线）。

例如70mm²的单线，也可用2条35mm²的连线代替。

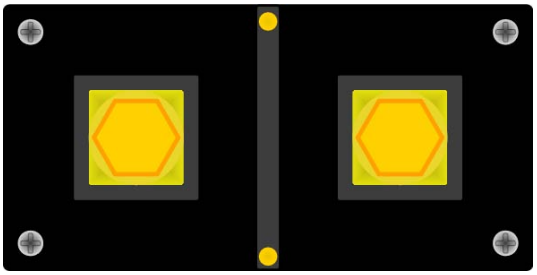
使用较长连线时，必须加大其直径，以免出现过大压降和发热过多。

5. 5. 1 输出端类型

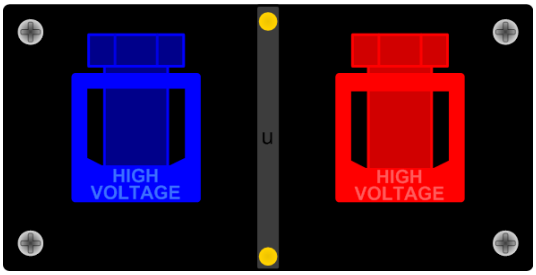
- **40V 或 80V** 型号：
  铜条上带有3个9mm配M8螺丝的螺丝孔
  建议：使用孔径为8mm的圆形接线片



- **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：
  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

为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 各型号技术规格“下的“远程感测补偿”。

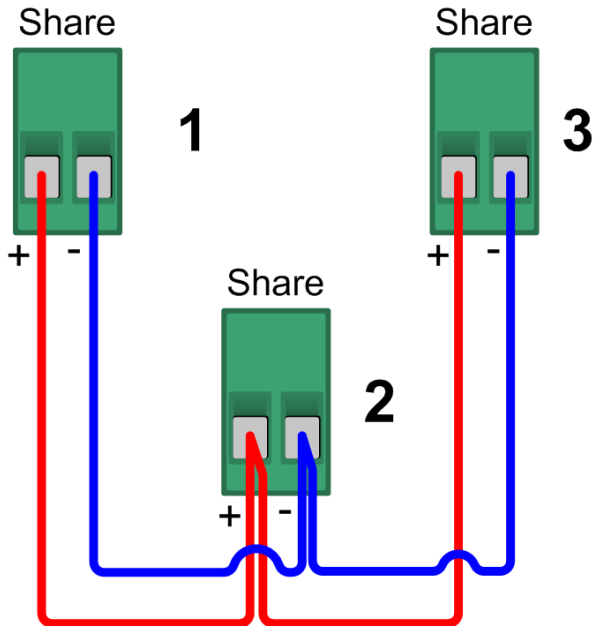
远程感测的连接点在产品后板“感测”端子上。也可见章节3.1。

(+)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7.7。

5.8 “Share”（共享）端

假如想使用共享总线操作，只要将相关产品的“Share”（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„11.2 串联“：



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。

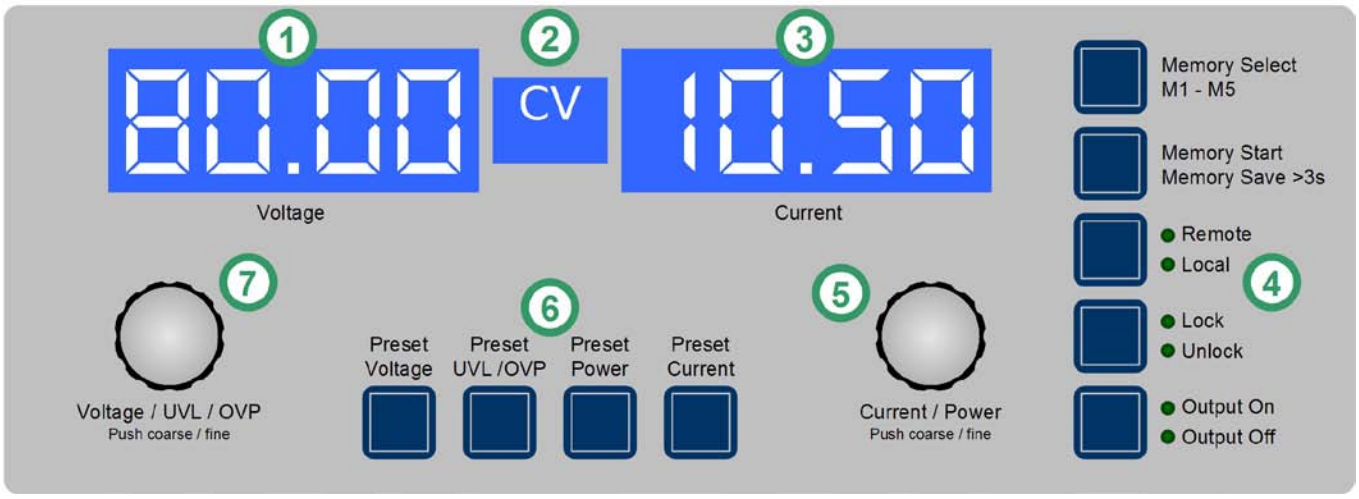


图 8. 控制面板

6. 操作

6. 1 显示

图8描述了点阵显示和控制面板总图。正常操作期间，显示区域展示实际电压（右边）和电流值（左边），以及产品状态（中间）。在预设模式下，左显示区域显示电压设定值（预设电压），过压保护阀值（预设OVP）欠压极限设定值（预设UVL）。右显示区域显示电流设定值（预设电流）或功率设定值（预设功率）。在产品设置模式下显示可调参数和设定。

中间区域显示的状态如下：

CV - 恒压调整（仅当输出为“on”时）

OT - 过温错误

OVP - 过压错误

CC - 恒流调整（仅当输出为“on”时）

CP - 恒功率调整（仅当输出为“on”时）

Fine - 两旋钮启用时作精调

图解：

1 - 左显示区域：实际电压或V, UVL, OVP的设定值。

2 - 状态区域：显示状态，如CC, CV等。

3 - 右显示区域：实际电流或I, P的设定值。

4 - 控制按钮：设定产品条件等。

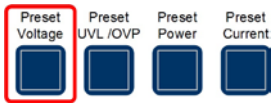
5 - 右旋钮：调节I和P设定值，以及在产品设定下的各项设定。

6 - 预设按钮：转为显示设定值。

7 - 左旋钮：调节V、UVL和OVP设定值，以及产品设定下的各参数。

6. 2 控制面板各按钮

Preset Voltage按钮



正常操作模式下，该按钮可将实际输出电压值的显示转为预设输出电压值的显示（预设模式）。

左显示区域将显示如下：

预设模式下，左旋钮(**Voltage / UVL / OVP**)以与正常操作方式下一样的方法，调节0...100% U_{Nom}范围内的电压设定值。调节值会立即传输到输出端！

注意！设定值的调节由欠压阀值UVL限制。见下面。

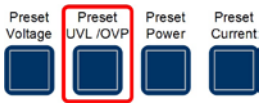
按两下该按钮立即退出预设模式，或者，如果没按预设按钮或有任一设定值被更改，则5s后自动退出。

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

用**LOCK**键可锁定该按钮。见后面详述。

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

Preset UVL / OVP按钮



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

--> 

--> 

预设模式下，左旋钮(**Voltage / UVL / OVP**)以与正常操作方式下一样的方法，调节0...100% U_{Nom}范围内的电压设定值。调节值会立即传输到输出端！

注意！设定值的调节由欠压阀值UVL限制。见下面。

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

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

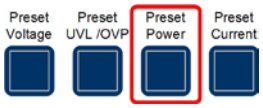
用**LOCK**键可锁定该按钮。见后面详述。

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

--> 

--> 

Preset Power按钮



在正常操作模式下，该按钮可将实际电流值的显示转为输出功率预设值（预设模式）。

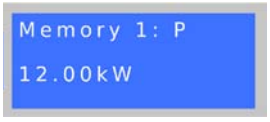
右显示区域将显示如下：

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

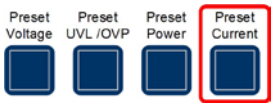
按两下该按钮立即退出预设模式，或者，如果没按预设按钮或有任一设定值被更改，则5s后自动退出。用**LOCK**键可锁定该按钮。见后面详述。

经模拟或数字接口卡控制的远程控制下，预设模式可用来检查远程指定的功率设定值。

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

--> 

Preset Current按钮



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

--> 

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

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

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

用**LOCK**键可锁定该按钮。见下面。

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

--> 

Memory Select M1-M5按钮

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

用该按钮用户可执行下列操作：

a) 调节数值

输出关闭，短按按钮，显示器变为第一个内存集，如上所示。

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

再按按钮，会循环显示至内存集5，然后退出内存模式。

调节后数值一直保留，直至产品关闭，但是不会提交到输出设定值，**也不保存！**

Memory Start / Memory Save >3s按钮

该按钮用来将之前由**Memory Select M1-M5**按钮选好的内存集值提交给输出，或将内存保存于内置存储卡上。该按钮只有当输出为***off***时才工作。

用该按钮用户可执行下列操作：

b) 仅提交

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

注意！内存集尚未保存！

c) 仅存储

输出关闭，选择一个或多个内存集，按需要调节数值，按住**Memory M1...M5**按钮不放，保持**3s**以上时间 --> 所有内存集被存储于内置存储卡，但不会被提交给输出。输出仍为关闭状态，保存内存集后退出内存模式。

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

用**LOCK**键可锁定该按钮，见后面详述。

Local按钮

本按钮激活/终止LOCAL模式。在LOCAL模式下不可进入远程控制模式。

注意！激活LOCAL模式将会即刻从远程控制模式退出（模拟或数字），并不再允许继续远程控制产品，除非再次退出LOCAL模式。

LOCAL模式由“**Local**”灯指示出来。只要LOCAL模式未被激活，“Remote”灯就显示产品通过模拟或数字接口处于远程控制模式。

用**LOCK**键可锁定该按钮，见后面详述。

Lock / Unlock按钮

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

***注意！**激活LOCK模式将会即刻从任何预设或内存模式退出，如果它们当前为激活状态。显示器会回到实际值的正常显示。*

Output On / Output Off按钮

只要产品未处于遥控模式，可用此按钮手动打开或关闭电源输。输出状态通过按钮上面的“Output On”或“Output Off”LED灯指示出来。输出打开时，在显示器中间状态区域显示当前工作中的调整模式 (CC、CV或CP)。

用**LOCK**键可锁定该按钮。见上述相关内容。

此按钮还可用来确认错误消息。详情请见7.4和7.5章节。

如果出现过温错误，„Output on“ LED灯会闪烁，指示即将自动打开产品输出，一旦过温错误消失。该运作可手动干扰，推动按钮可关闭输出。该LED灯停止闪烁，而„Output off“ LED灯会亮。

6.3 其它控制键

Rotary knob按钮

这两个旋转编码器有推动按钮功能。推动任何一个或两个会有下列作用：

a) 细调模式 (Fine)

短按任何一按钮可起用或停用细调模式。如果激活“Fine”，所有设定值、阀值和极限值都按最小的幅度调节，不管当前为何种模式（预设，内存等）。在状态显示区域以“Fine”文字显示出来。也可参考下面章节„6.4 调节设定值“。

b) 产品设置

当输出为**off**时，同时按住**两个**按钮，时间>3s，可将产品换到产品设置。按相同方式可退出。见章节„8. 产品设置“。

6.4 调节设定值

1. 手工操作

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

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

可通过细调或粗调手工完成设定值的设置，默认为粗调。需**Fine-**细调时按任一一个旋转编码器来激活，幅度为1。

coarse-粗调则按额定值的下列步宽来进行（也可参考技术规格）：

电压			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	100mV	70A	0.5A	10mA
200V	2V	100mV	90A	1A	10mA
240V	2V	100mV	120A	1A	100mA
400V	2V	100mV	140A	1A	100mA
500V	5V	100mV	210/250A	2A	100mA
600V	5V	100mV	340A	2A	100mA
1000V	10V	1V	510A	5A	100mA
1500V	10V	1V			

功率		
额定值	粗调	细调
3.3/5kW	0.050kW	1W
6.6/10kW	0.10kW	10W
15kW	0.10kW	10W

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。*

2. 通过模拟接口远程控制

经模拟接口(简称为AI)，可远程控制电流、电压和功率。这三个值是有要求的。即，用AI来调节电压的同时，不可用前板旋转编码器调节电流，反之亦然。因为AI极限不能用调节，而需在转换至模拟远程控制钱，在设备上手动设定。

在远程控制下，用预设按钮可转至预设模式，它将显示转化后的设定值，并输给AI的设定值引脚。为了设置合适的设定值，用户可借助外电压源，或18脚的参考输出电压。

如只要求通过外部手段调节电压，电流设定值(CSEL)或功率设定值(PSEL)可连到参考电压(VREF)。

AI能与普通的0…5V或0…10V范围工作，每个电压值对应0...100%的额定值。产品设置模式下可选择所需电压范围。

以下适用：

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

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

若选择的设定值超过极限，如 >5V，针对 0...5V 电压范围，该数值会被减至 100% 范围内。

请勿输入高于12V的设定输入值！

3. 通过数字接口卡远程控制

数字接口卡允许电脑设置电压、电流和功率，以及OVP阀值与欠压极限UVL。当转为远程控制模式时，产品保留最后的设定值，直至被更改。因此可发送任意设定值仅控制电压，而电流值保持不变。

数字接口（除GPIB和Ethernet外）传输的设定值永远为百分数，对应100% (hex: 0x6400)的额定值，或110%(hex: 0x6E00)的OVP门限。

使用GPIB时，给予的任何值都是真正的十进制值。

另外，数字接口卡允许查询和设定大量其它功能和数值。详情请参考章节„9. 数字接口卡“和IF卡的使用说明书。

7. 下列情形发生时的反应...

7. 1 用电源开关打开

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

7. 2 用电源开关关闭

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

7. 3 转至远程控制模式

a) *通过可选模拟接口*：如果产品未被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（引脚13）的设定值，将产品转为远程控制。输入到1，2，3和13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。从远程控制回到手控模式后，关闭输出，并保留最后远程调整的U、I和P设定值。

b) *通过可选数字接口*：如果产品未被LOCAL模式限制，或早已通过AI启动了远程控制模式，利用相关指令（这儿为：对象）可将产品转为远程控制，并保留输出状态和设定值，直至被更改。退出远程控制，则关闭输出，并保留最后远程调整的U、I、P、OVP和UVL设定值。

7.4 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“OVP”文字和AI上的“OVP”引脚8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！

如果清除过压原因，输出会再次打开，“OVP”状态文字清除。这被视为确认。在手工操作模式下，以推动**Output On**按钮为确认方式，在模拟遥控模式下是“REM-SB”引脚，而在数字遥控模式下为相关指令。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器。通过数字接口可读取该缓冲器。读缓冲器也表示确认。

注意：OV错误的状态优先于OT错误状态，当两个错误同时出现时会覆盖“OT”状态文字，且未经确认。

7.5 出现过温

一旦因内部过热而出现过温(OT)错误，则关断输出，显示器中间区域会出现 “OT”状态文字。

同时**Output On**按钮上的灯会闪烁，指示出产品一旦冷却后即自动重启。若不想这样，可手工关闭输出。LED灯停止闪烁，输出就不会自动启动。只有当内部所有功率级(3.3/5kW = 1级, 6.6/10kW = 2级, 15kW = 3级) 因过热而切断时输出电压才会为零。

OT错误要被确认。如果产品在冷却后还是关闭的，可使用**Output on**按钮或“REM-SB”触发引脚13或经数字接口利用相关指令来打开。如果输出为打开状态，可按一下**Output on**按钮，或触发一下“REM-SB”引脚，或经数字接口使用相关指令来关闭输出。

OT错误以报警声记录于内部警报器。通过数字接口可读取该缓冲器。读缓冲器也表示确认错误并清除缓冲器。

OT错误状态对于OV错误状态，具有较低的优先权。当两个错误同时出现时，“OVP”会覆盖“OT”状态文字。

7. 6 调整电压、电流和功率

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

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

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

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

例2：产品进入恒流模式，输出电压有负载阻值决定。于是限制了功率，根据P = U * I公式，输出电压和电流减少。一旦电流设定值减少，输出电流和电压也会减少。产品的两个值，实际功率将低到之前设定的功率极限以下，产品由恒功率调整(CP)转为恒流调整(CC)。

CC、CV和CP这三个条件也可显示于可选模拟接口卡的适当引脚上，或者经可选数字接口卡当状态位元读出来。

7.7 激活远程感测

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

感测输入端位于产品后板，即**Sense**端子上。按正确极性将导线连到负载上。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。

最大补偿值：见技术参数表，不同型号有不同。

也可参考图9。

7. 8 市电欠压或过压

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！

7. 9 连接不同类型的负载

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

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

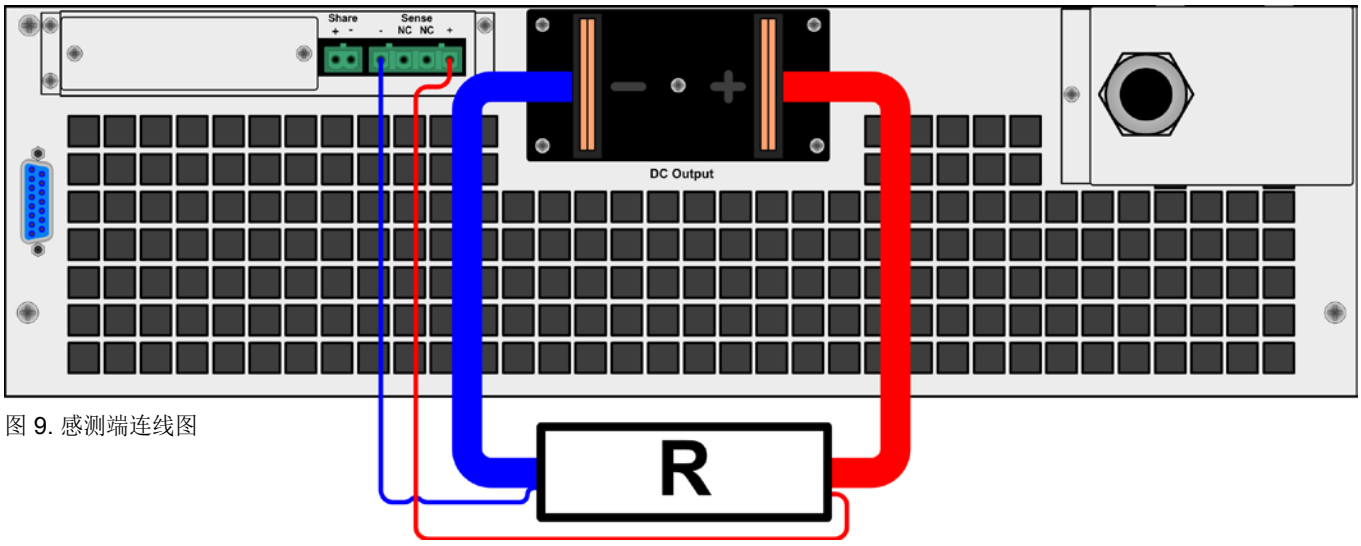


图 9. 感测端连线图

8. 产品设置

产品设置目的在于设定非常变参数。通常有两个基本设置，其它设定仅在配上数字接口卡时才需要。

当输出关闭，长按旋钮超过2s，可进入产品设置（见章节„6.3 其它控制键“）。

更换不同接口卡时，所有接口卡的具体设置都是一样的。故用户不必每次更换接口卡类型时都设置一次。

具体有下列**基本设置**：

名称：AutoPwrOn 默认：on

设置：on, off

解释：“Auto Power-on”为“on”时，在产品关闭或停电前恢复最后输出状态。这可保证产品在恢复电源后可继续按最后的设定操作。

名称：AI range 默认：0-10

设置：0-5, 0-10

解释：通过模拟接口选择使用的电压范围。

名称：Contrast 默认：70

设置：50...100

解释：调整LCD显示器的对比度。

下列设置适用于<u>所有</u>接口卡：

名称：Device node 默认：1

设置：1...30

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

利用**CAN接口卡-IF-C1**才可进行下列设置：

名称：Baud 默认：100k

设置：10k,25k,50k,100k,125k,250k,500k,1M

解释：选择CAN传输波特率。

名称：RID 默认：0

设置：0...31

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

名称：Bus term 默认：on

设置：on, off

解释：启用/停用CAN接口卡的总线终止电阻。这只在产品位于产品终端时才需要。

利用**RS232接口卡-IF-R1**才可进行下列设置：

名称：Baud 默认：57600

设置：9600, 19200, 38400, 57600

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

奇偶性 = 奇数

停止位 = 1

数据位 = 8

必须设置成相同于电脑的配置。

下列设置适用于**Profibus接口卡IF-PB1**：

名称：Profibus 默认：1

设置：1...125

解释：定义产品的Profibus现场总线地址。该地址与产品节点分开使用，用来将产品应用到现场总线系统内，或者访问该系统下的产品。

9. 数字接口卡

本系列产品支持下列插拔式数字接口卡：

IF-U1 (USB)

IF-R1 (RS232)

IF-C1 (CAN)

IF-G1 (GPIB/IEEE)

IF-E1 (Ethernet)

IF-PB1 (Profibus)

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

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

重点！仅能在产品被完全关闭（用电源开关）后才可插入或取出接口卡！

关于插拔式接口卡的配置请看章节„8. 产品设置“。

10. 模拟接口

10.1 一般信息

内置15脚模拟接口位于产品前端，此外具有下列功能：

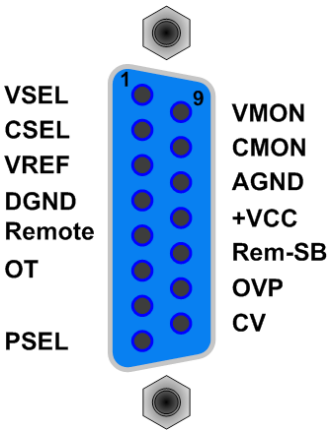
- 远程控制电流、电压和功率
- 远程监控(OT，OVP，CC，CV)状态
- 远程监控实际值
- 远程打开/关闭输出

产品设置菜单下选择即将使用的控制电压范围。请参考章节„8. 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：

- 用模拟电压控制产品需先用“REMOTE”(5)引脚将产品转为远程控制模式。
- 连接控制电源的应用设备前，要保证所有连线正确，并检查应用设备不会输入高于指定电压的电压（最大12V）。
- REM-SB (远程待机，13引脚)引脚要优先于**Output On**按钮。意思是，如果该引脚定义输出状态为“off”，就不能用**Output On**按钮打开输出。
- VREF输出引脚给设定值输入脚VSEL、CSEL和CSEL创建设定值，如仅需电流控制，可将VSEL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和地之间的电位器来给CSEL供电。也可参考下一章节。
- 如选择了0...5V电压范围，想输入高达10V的设定值，则高于5V以上的电压会被忽略（被限制），以保证100%的设定值。
- 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！

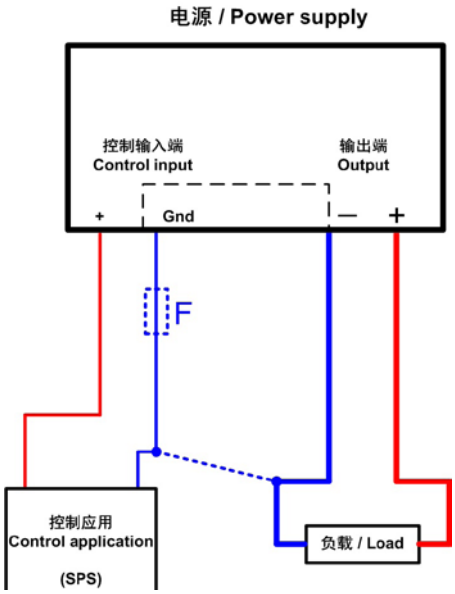


图 10

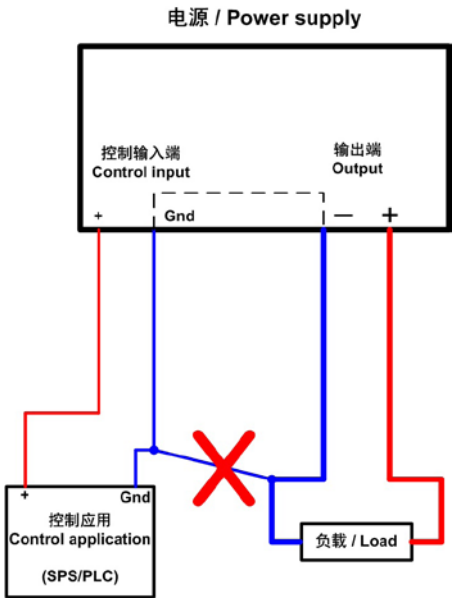


图 11

10.3 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 Ri >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 Ri >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 如果输出关= HIGH	

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

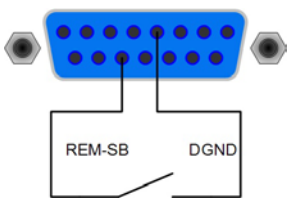
** 内控 Vcc = 13.8V

10.4 应用举例

输出关闭

“REM-SB”引脚一直处于工作状态，因此它不依靠远程模式。在不利用外部手段的条件下用它可关闭输出。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。

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。

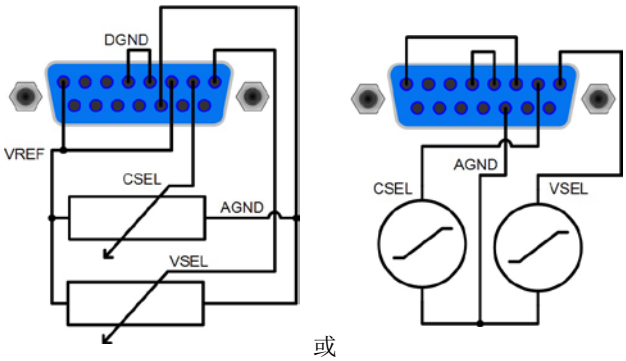


远程控制电流和电压

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。

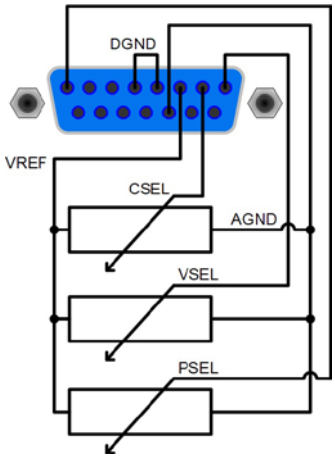
或者，可用外部电压源控制设定输入脚（见例二）。



或

远程控制功率

与上述例子相似，但用可调功率极限来完成。



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。也可参考下图12。

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

可将输出电压相同或不同，但最好输出电流相同的多台单机串联在一起。如果单机的输出电压不同，则输出电流最低的产品决定串联连接的最大电流。

注意！使用可选模拟接口卡时，切勿将接口卡的地连到产品的直流负（-）输出端。

注意！无主从连接功能。每台机都单独受控。

注意！若有一直流输出极接地了，为安全起见，仅允许将带最低电位的输出端接地，此时为直流负（-）输出端。

图13为一串联范例。

> ***注意！串联连接下允许总直流输出电压为600V，切不可超过该值！***

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。

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。

11.4 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。

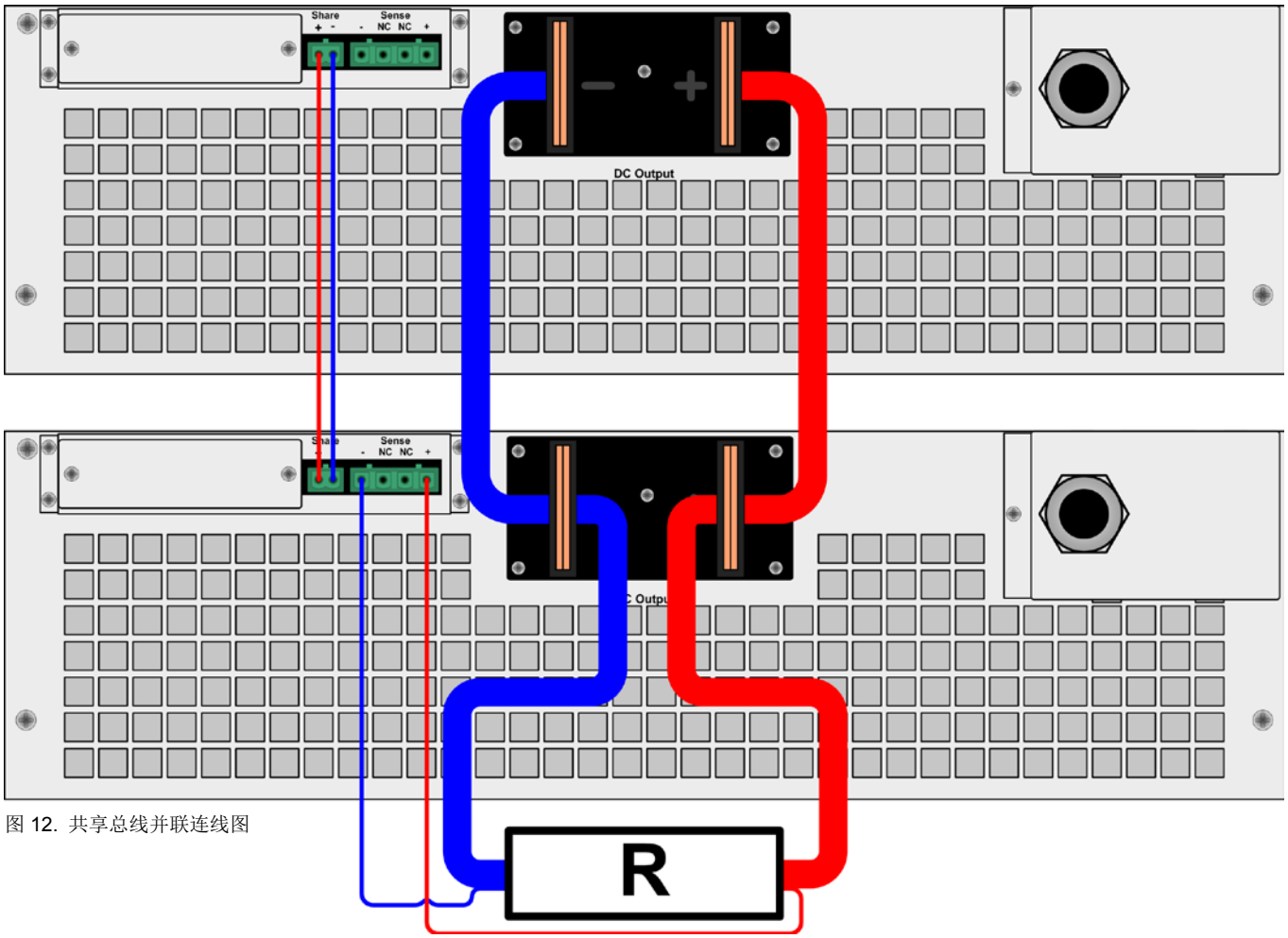


图 12. 共享总线并联连线图

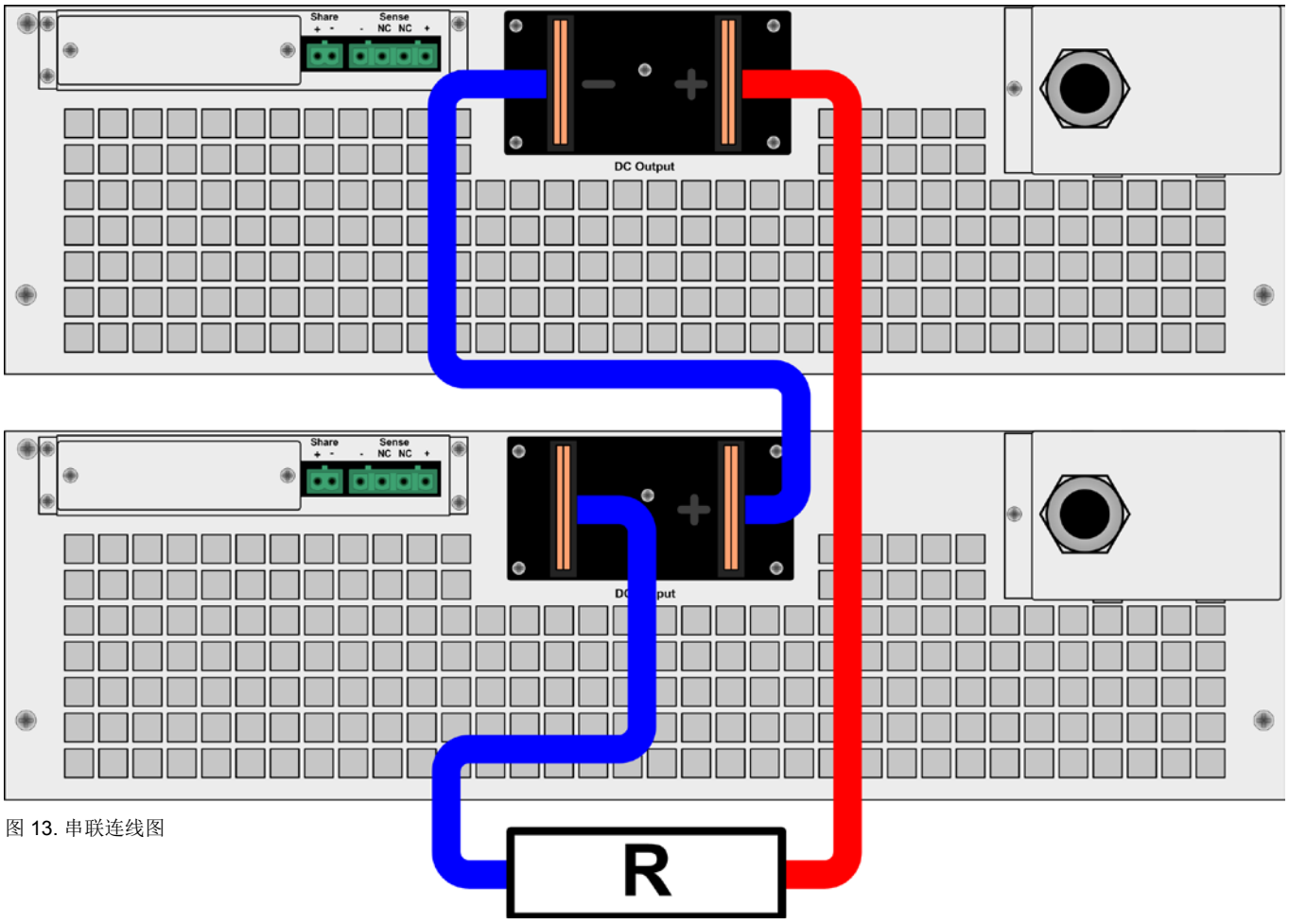


图 13. 串联连线图

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.

Table of contents

EN

1. Introduction

The high efficiency power supplies of the series PS 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 5 different presets of set values.

The optionally available, digital interface cards provide an even wider spectrum of control and monitoring functions by means of a PC. The supported number and kind of features varies from card to card.

All models also offer integrated terminals for parallel connection as share bus operation by default.

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

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

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

The main functions at a glance:

- Set voltage, current and power, each with 0...100%
- Adjustable overvoltage threshold 0...110% U_{Nom}
- Optional, pluggable digital interface cards (CAN, USB, RS232, IEEE/GPIB, Ethernet/LAN, Profibus)
- Optional, analogue interface for external control and monitoring with 0...5V or 0...10V (selectable) for 0...100%
- Power ratings of 3.3kW, 5kW, 6.6kW, 10kW or 15kW; expandable in cabinets with up to 150kW
- Temperature controlled fans
- Status indication (OT, OVP, CC, CV, CP)
- 5 selectable memory sets
- Share-Bus operation (parallel connection)

2. Technical specifications

2.1 Control panel and display

Type

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

Display formats

The nominal values define the maximum adjustable range.

Actual values of voltage and current are displayed simultaneously, the set values of the overvoltage threshold, the undervoltage limit, voltage, current and power are displayed seperately.

Display of voltage values

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

2.2 Device specifications

	PS 8040-170 3U	PS 8080-170 3U	PS 8200-70 3U	PS 8500-30 3U	PS 8040-340 3U
Mains input					
Input voltage range	340…460V	340…460V	340…460V	340…460V	340…460V
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 input to output	4200V DC				
Cooling	by fans, air inlet on the front, air exhaust on the rear				
Standards	EN 60950, EN 61326, EN 55022 Class B				
Overvoltage class	2				
Protection class	1				
Pollution degree	2				
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	09230176	09230160	09230170	09230165	09230177

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

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

	PS 8040-510 3U	PS 8080-340 3U	PS 8160-170 3U	PS 8200-140 3U	PS 8400-70 3U
Mains input					
Input voltage range	340…460V	340…460V	340…460V	340…460V	340…460V
Input voltage range optional	588…796V+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	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 input to output	4200V DC				
Cooling	by fans, air inlet on the front, air exhaust on the rear				
Standards	EN 60950, EN 61326, EN 55022 Class B				
Overvoltage class	2				
Protection class	1				
Pollution degree	2				
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	09230178	09230161	09230163	09230171	09230173

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

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

	PS 8500-60 3U	PS 81000-30 3U	PS 8080-250 3U	PS 8080-510 3U	PS 8200-210 3U
Mains input					
Input voltage range	340…460V	340…460V	340…460V	340…460V	340…460V
Input voltage range optional	-	-	588…796V+MP	588…796V+MP	588…796V+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	80V	200V
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	< 150mVpp < 10mVrms	< 250mVpp < 25mVrms
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	100mV	1V	10mV	10mV	100mV
Remote sense compensation	max. 10V	max. 20V	max. 2.5V	max. 2.5V	max. 6V
Overvoltage protection threshold (adjustable)	0…550V	0…1100V	0…88V	0…88V	0…220V
Output - Current					
Nominal current I_{Nom}	60A	30A	250A	510A	210A
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	< 900mApp < 120mArms	< 167mApp < 33mArms
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%	93%	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	25.5kg	25.5kg	33kg	33kg	33kg
Redundancy	no	no	yes	yes	yes
Isolation output to enclosure	1000V DC	1500V DC	500V DC	500V DC	500V DC
Isolation input to output	4200V DC				
Cooling	by fans, air inlet on the front, air exhaust on the rear				
Standards	EN 60950, EN 61326, EN 55022 Class B				
Overvoltage class	2				
Protection class	1				
Pollution degree	2				
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	09230166	09230168	09230179	09230162	09230172

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

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

	PS 8240-170 3U	PS 8500-90 3U	PS 8600-70 3U	PS 81500-30 3U
Mains input				
Input voltage range	340…460V	340…460V	340…460V	340…460V
Input voltage range optional	588…796V+MP	588…796V+MP	588…796V+MP	588…796V+MP
Required phases	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
Input fuse	6x T16A	6x T16A	6x T16A	6x T16A
Input current	max. 28A	max. 28A	max. 28A	max. 28A
Power factor	> 0.99	> 0.99	> 0.99	> 0.99
Output - Voltage				
Nominal voltage U_{Nom}	240V	500V	600V	1500V
Adjustable range	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%
Stability at 0…100% load	< 0.05%	< 0.05%	< 0.05%	< 0.05%
Ramp-up time 10...90% at 100% load	max. 30ms	max. 30ms	max. 30ms	max. 30ms
Ripple @ BWL 20MHz	< 500mVpp < 20mVrms	< 300mVpp < 70mVrms	< 400mVpp < 80mVrms	< 1000mVpp < 350mVrms
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	100mV	100mV	100mV	1V
Remote sense compensation	max. 7.5V	max. 10V	max. 18V	max. 30V
Overvoltage protection threshold (adjustable)	0…264V	0…550V	0…660V	0…1650V
Output - Current				
Nominal current I_{Nom}	170A	90A	70A	30A
Adjustable range	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%
Stability at 0…100% ΔU_{OUT}	< 0.15%	< 0.15%	< 0.15%	< 0.15%
Ripple @ BWL 20MHz	< 333mApp < 27mArms	< 50mApp < 23mArms	< 30mApp < 12mArms	< 19mApp < 13mArms
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	100mA	10mA	10mA	10mA
Transient recovery time 10….90% load	< 2ms	< 2ms	< 2ms	< 2ms
Output - Power				
Nominal power P_{Nom}	15000W	15000W	15000W	15000W
Nominal power at derating	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}	0...P_{Nom}
Accuracy*	≤ 0.2%	≤ 0.2%	≤ 0.2%	≤ 0.2%
Resolution of display	0.01kW	0.01kW	0.01kW	0.01kW
Efficiency	93%	95.50%	95.20%	95.50%
Miscellaneous				
Ambient temperature	0….50°C	0….50°C	0….50°C	0….50°C
Storage temperature	-20….70°C	-20….70°C	-20….70°C	-20….70°C
Humidity rel.	< 80%	< 80%	< 80%	< 80%
Dimensions (WxHxD) **	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm	19" 3U 595mm
Weight	33kg	33kg	33kg	33kg
Redundancy	no	yes	no	no
Isolation output to enclosure	500V DC	1000V DC	1000V DC	2000V DC
Isolation input to output	4200V DC			
Cooling	by fans, air inlet on the front, air exhaust on the rear			
Standards	EN 60950, EN 61326, EN 55022 Class B			
Overvoltage class	2			
Protection class	1			
Pollution degree	2			
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	09230164	09230167	09230174	09230169

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

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

3. Device description

3.1 Views

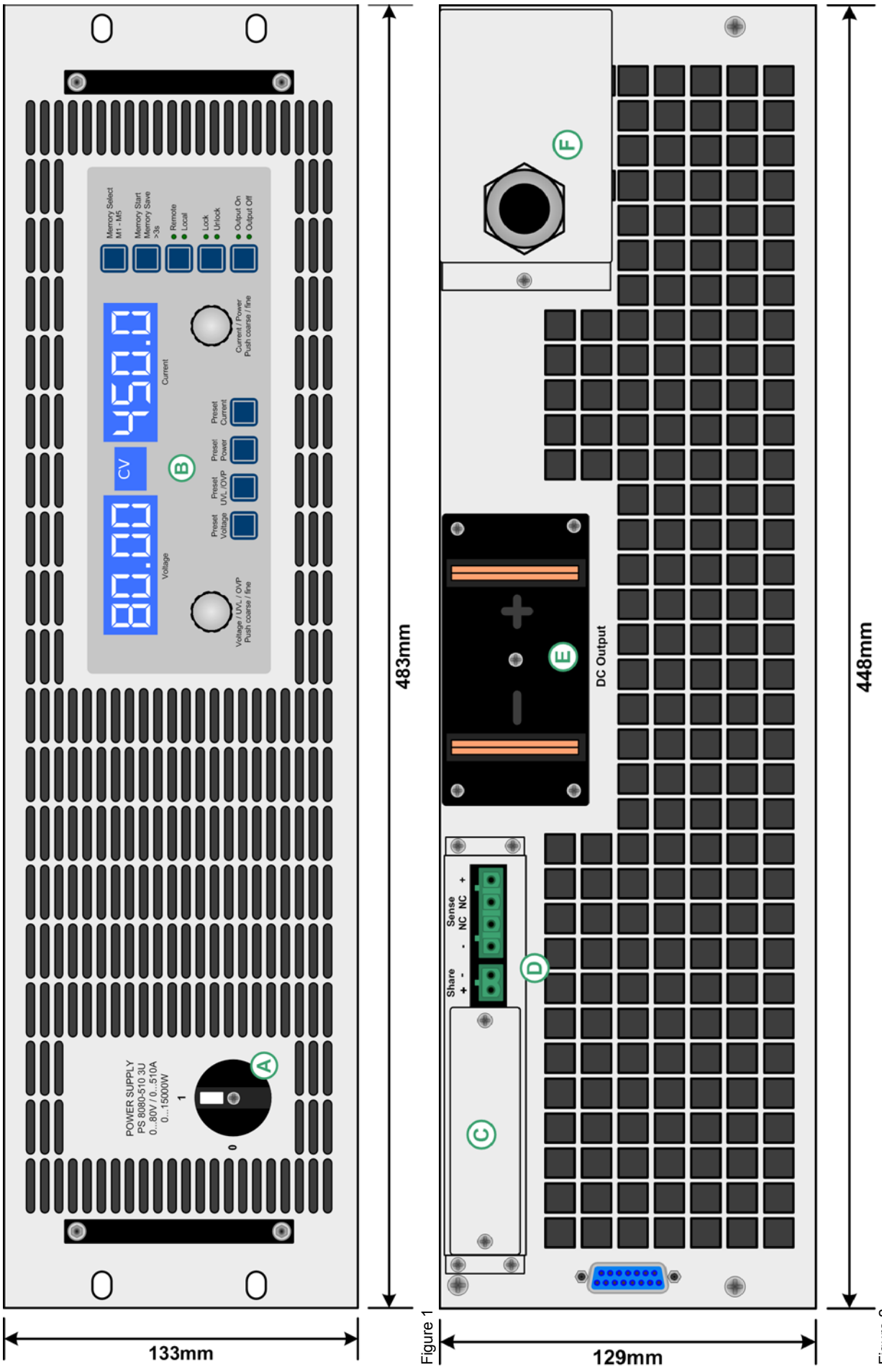


Figure 1

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 2

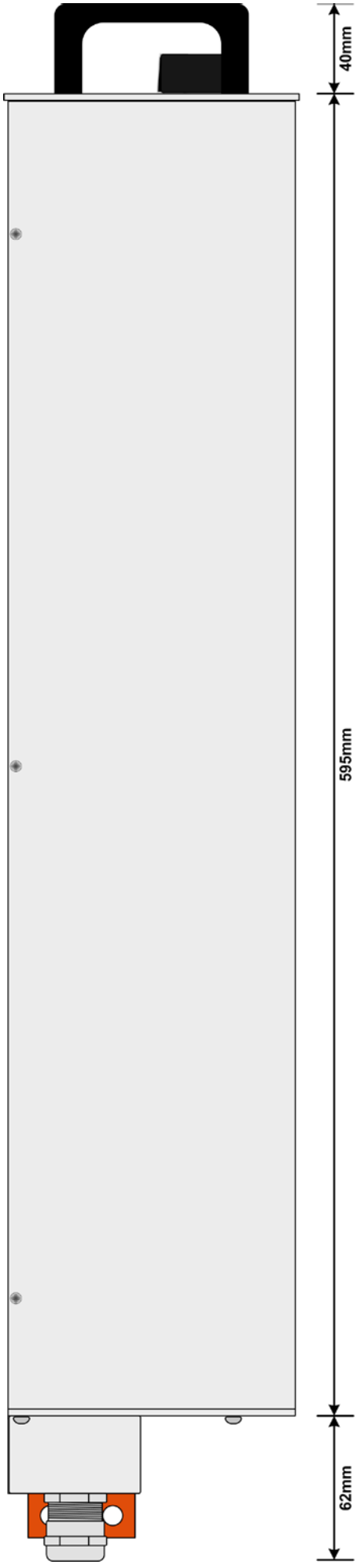


Figure 3

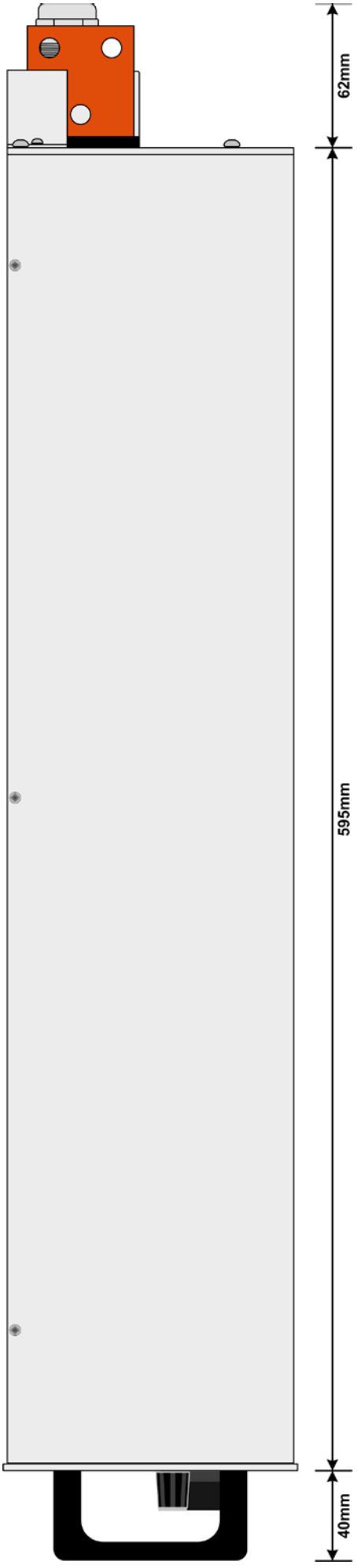


Figure 4

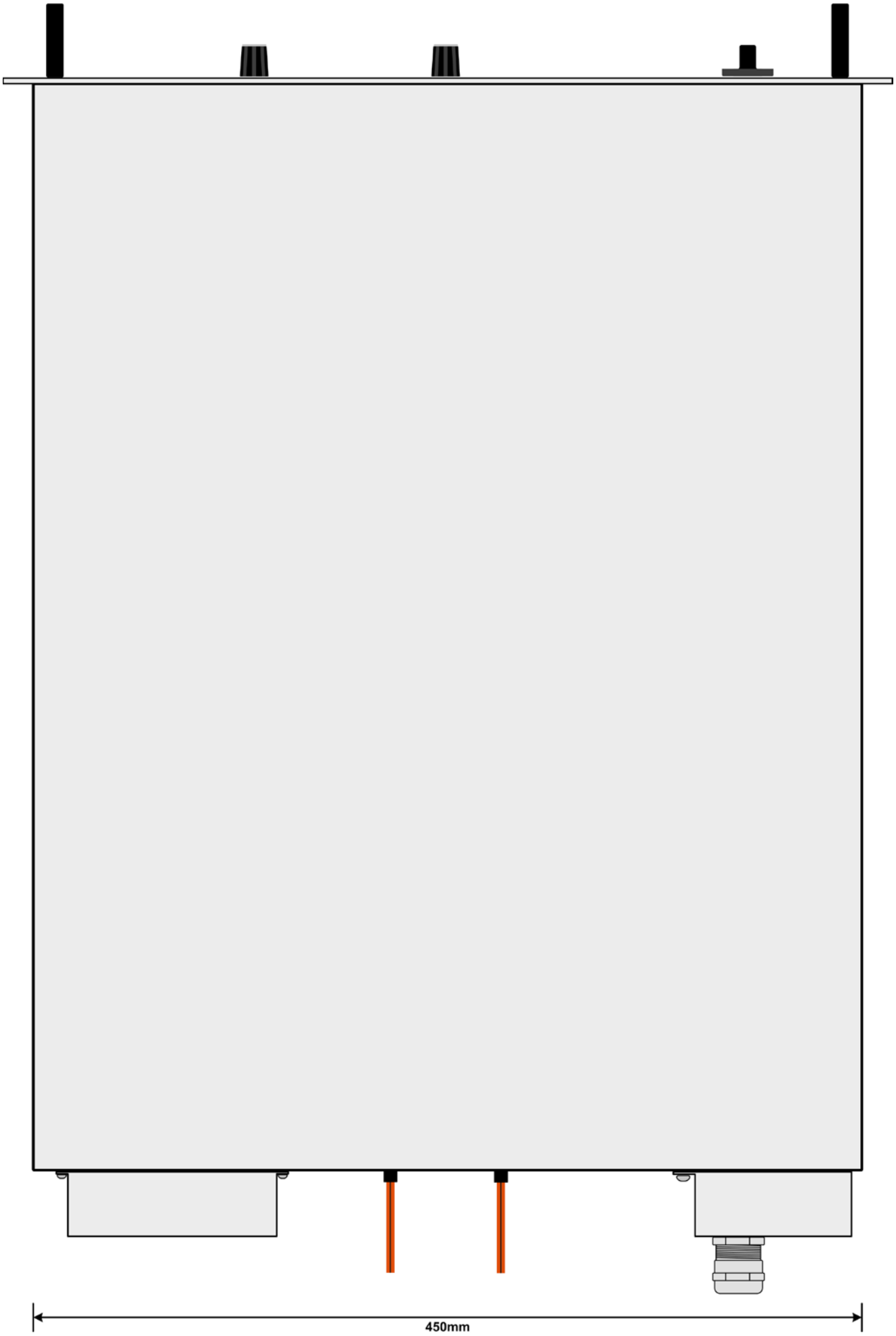


Figure 5

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

4.2 Cooling

The air inlets on the front and the air outlets at the rear have to be kept clean to ensure proper cooling. Take care of at least 20cm distance at the rear to any surrounding objects in order to guarantee unimpeded air flow.

4.3 Repairs / Service

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	16A	4mm²	28A	4mm²	16A
15kW	4mm²	28A	4mm²	28A	4mm²	28A

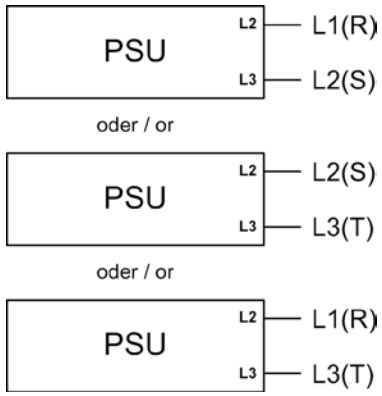
We recommend to use

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

for 10kW/15kW models at least 4mm²

for every phase and ground (PE).

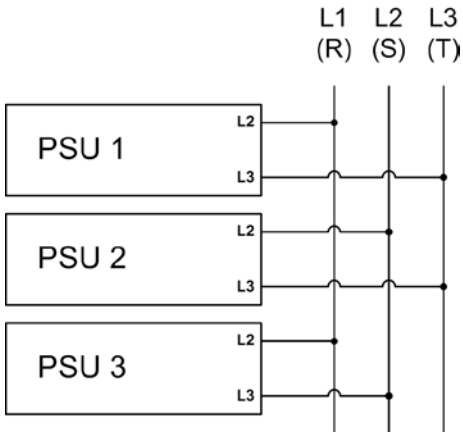
The selection of the phase pair to use for a 3.3kW or 5kW model is arbitrary for one unit. Means, it does not necessarily has to be L2(R) and L3(S):



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:



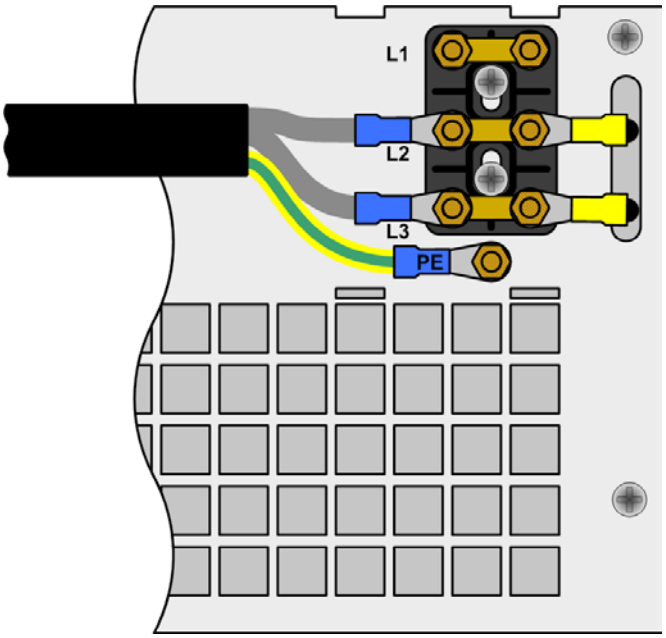


Figure 6. Input connection 3.3kW/5kW

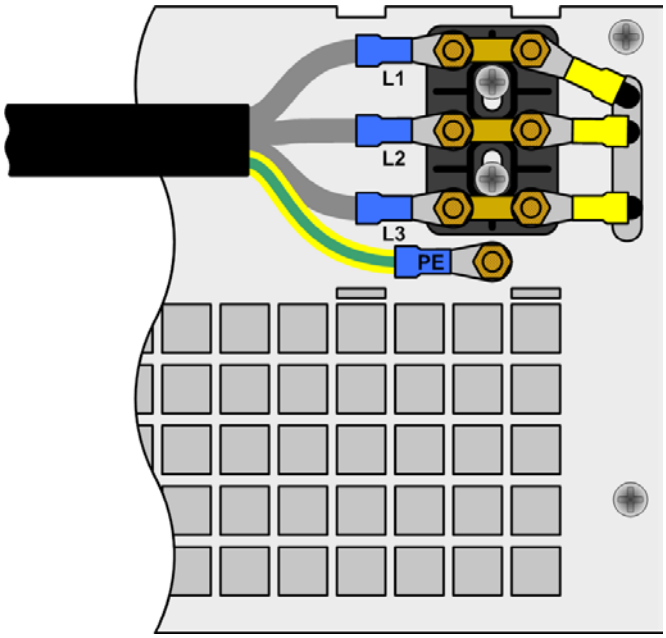
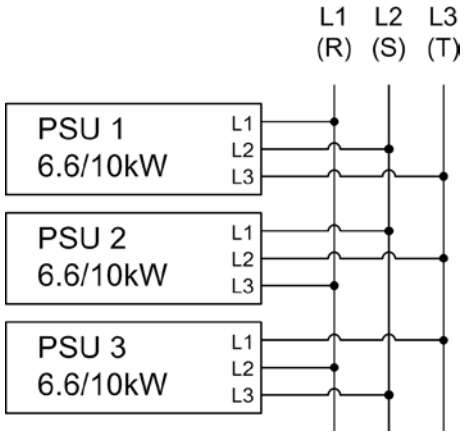


Figure 7. Input connection 6.6kW/10kW/15kW

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 a 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

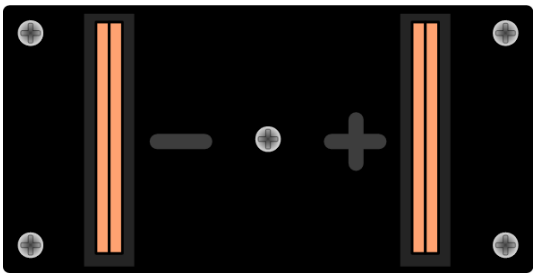
at least per DC output pole (flexible wire).

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

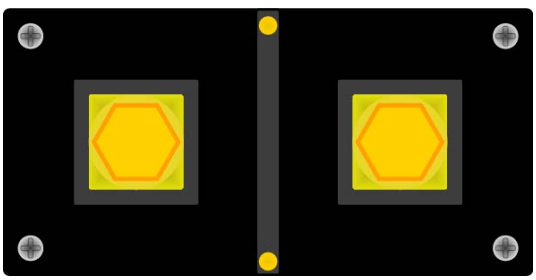
When using longer cables it is required to increase cross section in order to avoid voltage drops and unwanted heating.g.

5.5.1 Terminal types

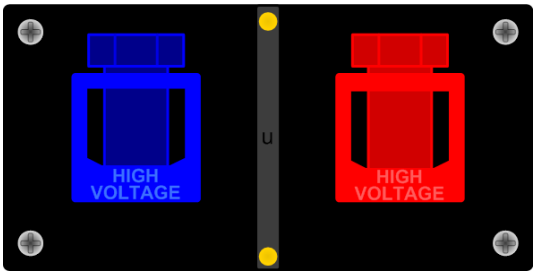
- **40V or 80V** models:
  Copper bars with 3x drilling holes 9mm for M8 screws
  Recommendation: ring cable lugs 8mm



- **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“.

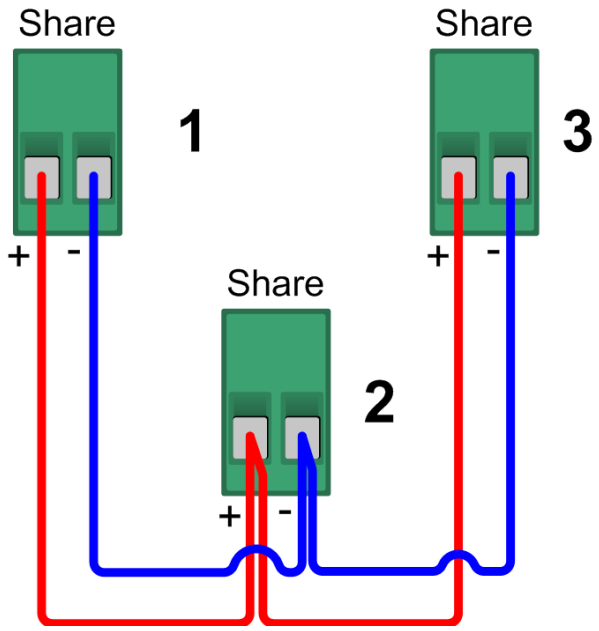
The connection for remote sense is done at the terminal „Sense“ on the rear side. Also see section 3.1.

(+) 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 7.7.

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“.

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 user guide for the interface cards and on the quick installation guide for the interface cards.

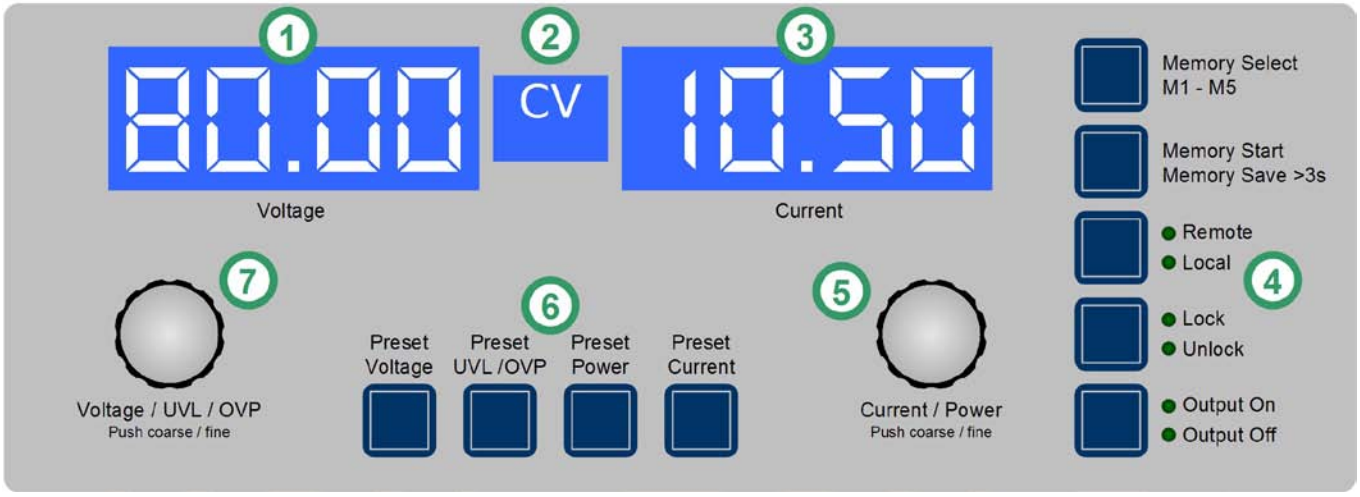


Figure 8. Control panel

6. Handling

6.1 The display

Figure 8 depicts an overview of the dot matrix display and the control panel. During normal operation, the display shows the actual values of voltage (left side) and current (right side) and device status (middle). In preset mode, the left display area shows the set value of voltage (Preset Voltage) or of the over-voltage protection threshold (Preset OVP) or the undervoltage limit (Preset UVL). The right display area shows the set values of current (Preset Current) or power (Preset Power). In the device setup the display is used to show adjustable parameters and settings.

The status area in the middle can show following status:

CV - Constant voltage regulation (only when output is „on“)

OT - Overtemperature error

OVP - Overvoltage error

CC - Constant current regulation (only when output is „on“)

CP - Constant power regulation (only when output is „on“)

Fine - Fine adjustment for both rotary knobs active

Legend:

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

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

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

4 - Control buttons: Setting the device condition etc.

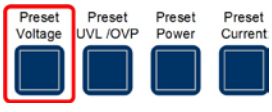
5 - Rotary knob right: Set value adjustment of I and P, as well as settings in the device setup

6 - Preset buttons: Switching to set value display

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

6.2 Pushbuttons on the control panel

Pushbutton **Preset Voltage**



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

The left display area will then show like this:

In preset mode, the left rotary knob (**Voltage / UVL / OVP**) is used to adjust the voltage set value the same way as during normal operation from 0...100% U_{Nom}. The adjusted value is instantly transferred to the output!

Attention! *The set value adjustment can be limited by the undervoltage threshold UVL. See below.*

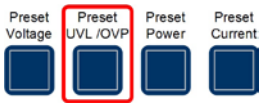
A second push exits the preset mode instantly or it is exited automatically after 5s, if no preset button is pushed or any set value is altered.

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

The button may be locked by the condition **LOCK.** See below.

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

Pushbutton **Preset UVL / OVP**



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

--> 

--> 

.

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

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

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

A third push exits the preset mode instantly or it is exited automatically after 5s, if no preset button is pushed or any set value is altered.

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

The button may be locked by the condition **LOCK.** See below.

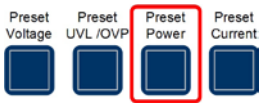
In memory selection mode the button is also used to switch to the UVL or OVP value of the selected memory set, but in this mode the values are not valid yet. The left display area will then show like this:

--> 

--> 

.

Pushbutton **Preset Power**



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

The right display area will switch to:

--> 

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

A second push exits the preset mode instantly or it is exited automatically after 5s, if no preset button is pushed or any set value is altered. The button may be locked by the condition **LOCK.** See below.

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

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

--> 

Pushbutton **Preset Current**

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

The display then changes to:

--> 

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

A second push exits the preset mode instantly or it is exited automatically after 5s, if no preset button is pushed or any set value is altered.

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

The button may be locked by the condition **LOCK.** See below.

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

--> 

Pushbutton **Memory Select M1-M5**

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

By using the button the user can:

a) Adjust values

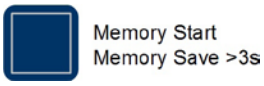
Output off, short push of the button, the display changes to the first memory set as displayed above.

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

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

The adjusted values remain as long the device is powered, but are not submitted to the output set values **and are not saved yet!**

Pushbutton **Memory Start / Memory Save >3s**



This pushbutton is either used to submit the values of the memory set that has been selected before by button **Memory Select M1-M5** to the output or to save the memory to internal flash. The button only works if the output is ***off***.

By using the button the user can:

b) Submit only

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

Attention! Submitting the values does not save them!

c) Save only

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

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

The button may be locked by the condition **LOCK.** See below.

Pushbutton **Local**

This pushbutton activates or deactivate the LOCAL mode. In LOCAL mode not remote control of the device is possible.

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

LOCAL mode is indicated by LED „Local“. As long as LOCAL is not active, the LED „Remote“ indicates an active remote control by analogue or digital interface.

The button may be locked by the condition **LOCK.** See below.

Pushbutton **Lock / Unlock**

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

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

Pushbutton **Output On / Output Off**

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

The button may be locked by the condition **LOCK.** See above.

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

If an overtemperature error occurs, the LED „Output on“ will flash to indicate that the device output will automatically switch on, once the OT condition is gone. This can be interrrupted by manually switching the output off with the pushbutton. The LED will stop flashing and LED „Output off“ will be lit.

6.3 Further control elements

Pushbuttons **Rotary knob**

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

a) Fine adjustment mode (Fine)

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

b) Device setup

Pushing **both** buttons together for >3s while the output is **off** changes to device setup. It is exited the same way. See section „8. Device setup“ about the device setup.

6.4 Adjusting set values

1. Manual operation

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

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

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

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

Voltage			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	100mV	70A	0.5A	10mA
200V	2V	100mV	90A	1A	10mA
240V	2V	100mV	120A	1A	100mA
400V	2V	100mV	140A	1A	100mA
500V	5V	100mV	210/250A	2A	100mA
600V	5V	100mV	340A	2A	100mA
1000V	10V	1V	510A	5A	100mA
1500V	10V	1V			

Power		
Nom. val.	**Coarse**	**Fine**
3.3/5kW	0.050kW	1W
6.6/10kW	0.10kW	10W
15kW	0.10kW	10W

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.*

2. Remote control by analogue interface

Via an optional analogue interface (short: AI) it is possible to remotely control current, voltage and power. All three values are required. It means, it‘s not possible to adjust voltage via the AI and the current with the rotary knob on the front at the same time or vice versa. Because the OVP threshold can not be adjusted via the AI, it is required to set it manually on the device before switching to analogue remote control.

In remote control, switching to preset mode with the preset buttons shows the translated set values which are put into the set value pins of the AI. In order to put in appropriate set values, the user can either use an external voltage source or the reference output voltage on pin 18.

In case it is, for example, only required to adjust voltage by external means, the current set value (CSEL) resp. power set value (PSEL) can be bridged to the reference voltage (VREF).

The AI can be operated with the common 0...5V or 0...10V ranges, each corresponding to 0...100% nominal values. The desired control voltage range is selected in the device setup.

Following applies:

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

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

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

Never input voltages higher than 12V to the set value inputs!

3. Remote control by digital interface card

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

Set values given by the digital interface (except GPIB and Ethernet) are always percentage and correspond, at 100% (hex: 0x6400) or 110% (hex: 0x6E00) for the OVP threshold, to the nominal values of the device.

Using GPIB or Ethernet (via SCPI language), any value is given as real decimal value.

Furthermore, the digital interfaces allow to query and set a lot of other features and values. For details refer to section „9. Digital interface cards“ and the user guide of the interface cards.

7. Behaviour of the device when...

7.1 Switching on by power switch

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

7.2 Switching off by power switch

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

7.3 Switching to remote control

a) *By the optional, analogue interface*: Pin 22 „SEL-enable" switches the device to remote control via the set values pins VSEL (pin 3), CSEL (pin2) and PSEL (pin 1), 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, 3 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.

b) *By an optional, digital interface*: Switching to remote control by the corresponding command (here: object), if not inhibited by LOCAL mode or remote control via AI already being active, keeps output state and set values until altered. Returning from remote control switches the output off and the last, remotely adjusted set values of U, I P, OVP and UVL are kept.

7.4 Overvoltage occurs

An overvoltage error can occur due to an internal defect (output voltage rises uncontrolled) or by a too high voltage from external. The overvoltage protection (OVP) will switch off the output and indicate the error on the display by the status text „OVP" and on the pin 8 „OVP" of the analogue interface.

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 „OVP" will disappear. This is considered as acknowledgement. In manual operation, it is done by pushing button **Output,** in analogue remote control with pin „REM-SB" and in digital remote control by the corresponding command. If the error is still present, the output is not switched on.

OVP errors are recorded as alarm into the internal alarm buffer. This buffer can be read out via the digital interface. Reading the buffer will also acknowledge.

Note: The status of an OV error has priority over the status of an OT error and will overwrite the status text „OT" in case both errors occured the same time and are not acknowledged yet.

7.5 Overtemperature occurs

As soon as an overtemperature (OT) error occurs by internal overheating, the output is switched off and the status text „OT" is displayed in the middle status field of the display.

Simultaneously, the LED „Output On**"** will flash, indicating that the output will automatically switch on again as soon as the device has cooled down. In case this is not wanted, the output can be manually switched off. Then the LED stops flashing and the output won't switch automatically on. The output voltage only will only be zero if all internal power stages (3.3/5kW = 1 stage, 6.6/10kW = 2 stages, 15kW = 3 stages) have shut down because of overheat.

OT errors have to be acknowledged. If the output is off after the device has cooled down, this is done by switching the output on using button **Output** or toggling pin 13 „REM-SB" or a corresponding command via digital interface. If the output is on, acknowledgement is done by pushing the button **Output** once or giving pin „REM-SB" a toggle or, via digital interface, by sending the corresponding command to switch the output off.

OT errors are recorded as alarm into the internal alarm buffer. This buffer can be read out via the digital interface. Reading the buffer will acknowledge the error and flush the buffer.

OT error status has lower priority than OV error status. In case an OV error occurs while an OT error is present and indicated, the status text „OT" will be overwritten by „OVP".

7.6 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.

7.7 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 conducsctors 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 9 below.

7.8 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. Withing this range, the units can be operated without any restrictions regarding power. 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!

7.9 Connecting different types of loads

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

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

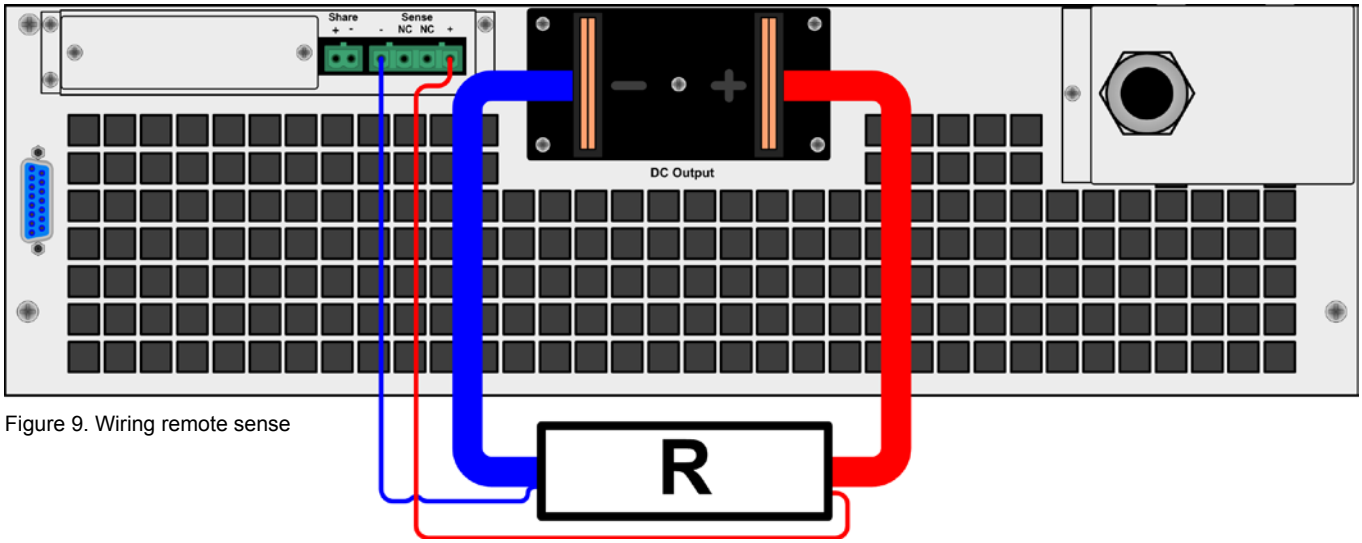


Figure 9. Wiring remote sense

8. Device setup

The device setup is intended to set parameters that are not constantly altered. Three elementary settings are always available, other settings only if a digital interface card is equipped.

The device setup can be accessed by pressing both pushbuttons of the rotary knobs simultaneously for >2s while the output is switched off (see section „6.3 Further control elements“) .

All interface specific settings remain unmodified when inserting a different card. Thereby, the user don‘t has to setup the interface card everytime the card type changes.

Following **elementary settings** are available:

Name: AutoPwrOn Default: on

Settings: on, off

Meaning: Auto power-on, if set to „on“ it activates the restoration of the last output state when the device was switched off or when a blackout occured. This is intended to be used in case the power supply is supposed to continue working as soon as it is powered again.

Name: AI range Default: 0-10

Settings: 0-5, 0-10

Meaning: selects the control voltage range to use with the analogue interface.

Name: Contrast Default: 70

Settings: 50...100

Adjusts the contrast of the LCD display.

For **all** interface cards this setting applies:

Name: Device node Default: 1

Settings: 1...30

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

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

Name: Baud Default: 100k

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

Meaning: Selects the CAN transmission baud rate.

Name: RID Default: 0

Settings: 0...31

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

Name: Bus term Default: on

Settings: on, off

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

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

Name: Baud Default: 57600

Settings: 9600, 19200, 38400, 57600

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

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

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

Name: Profibus Default: 1

Settings: 1-126

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

9. Digital interface cards

The device supports following retrofittable, pluggable, digital interface cards:

IF-U1 (USB)

IF-R1 (RS232)

IF-C1 (CAN)

IF-G1 (GPIB/IEEE)

IF-E1 (Ethernet/LAN)

IF-PB1 (Profibus)

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

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

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

About configuration of the plugged cards see section „8. Device setup“.

10. Analogue interface

10.1 General

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

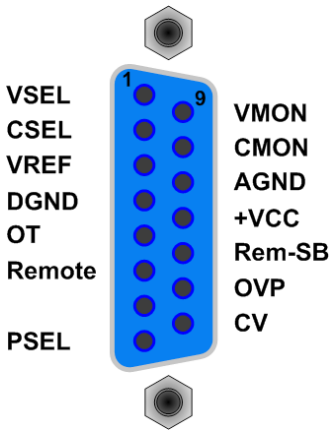
- Remote control of output current, voltage and power
- Remote monitoring of status (OT, OVP, CC, CV)
- Remote monitoring of actual values
- Remotely switching the output on/off

The control voltage range that is going to be used is selected in the device setup. See section „8. Device setup“. The reference voltage at output pin 3 is related to the chosen setting and will be either 5V or 10V.

Usage instructions:

- Controlling the device with analogue voltages requires to switch it to remote control before with pin „REMOTE“ (5).
- Before connecting the application that is used to control the power supply, make sure to wire all leads correctly and check if the application is unable to put in voltages higher than specified (max. 12V).
- The input REM-SB (remote standby, pin 13) overrides the pushbutton **Output On**. It means, the output can not be switched on by the button if the pin defines the output state as „off“. So it can be used as emergency power off.
- 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 applied 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!

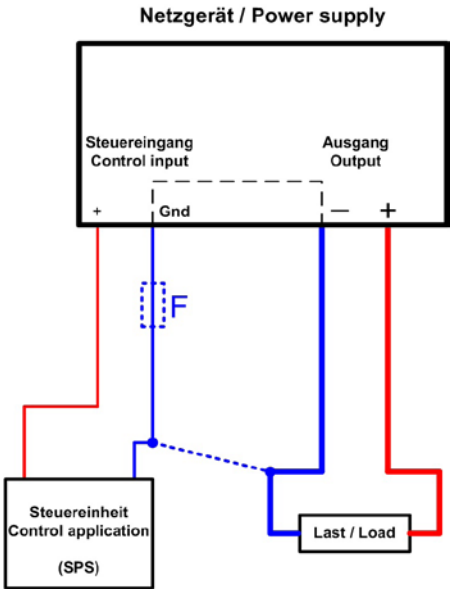


Figure 10

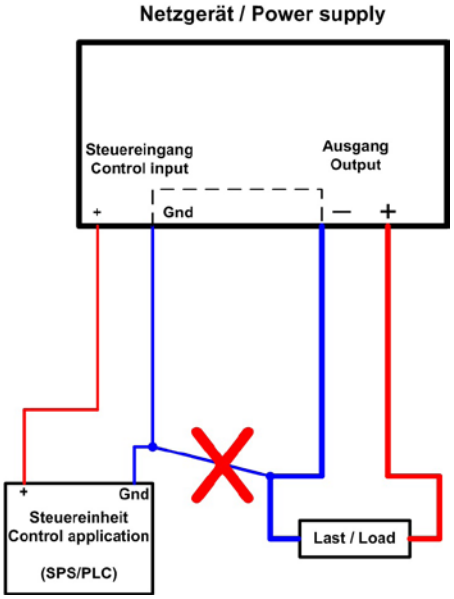


Figure 11

10.3 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 Ri >100K
2	CSEL	AI	Set value: current	0…10V or 0...5V correspond to 0..100% of I_{Nom}	
3	VREF	AO	Reference voltage	10V or 5V	Accuracy < 0.2% at I_{Max} = +5mA Short-circuit-proof against AGND
4	DGND	POT	Reference potential for digital control signals		For +Vcc, control and status signals
5	REMOTE	DI	Toggle between internal or external control	External = LOW, U_{Low} <1V Internal = HIGH, U_{High} > 4V Internal = open	U range = 0 …30V I_{Max} = +1mA at 5V Sender: Open collector against DGND
6	OT	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 Ri >100K
9	VMON	AO	Actual value: voltage	0…10V or 0...5V correspond to 0..100% of U_{Nom}	Accuracy < 0.2% at I_{Max} = +2mA Short-circuit-proof against AGND
10	CMON	AO	Actual voltage: current	0…10V or 0...5V correspond to 0..100% of I_{Nom}	
11	AGND	POT	Reference potential for analogue signals		For -SEL, -MON, VREF signals
12	+Vcc	AO	Auxiliary voltage output (Ref: DGND)	11...13V	I_{Max} = 20mA Short-circuit-proof against DGND
13	REM-SB	DI	Output off	off = LOW, U_{Low} <1V on = HIGH, U_{High} > 4V on = OPEN	U range = 0…30V I_{Max} = +1mA at 5V Sender: Open-Collector against DGND
14	OVP	DO	Overvoltage error	OVP = HIGH, U_{High} > 4V no OVP = LOW, U_{Low} <1V	Quasi open collector with pull-up to 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

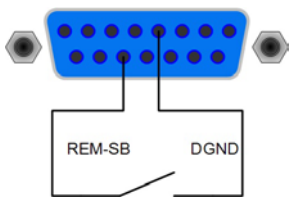
** Internal Vcc = 13.8V

10.4 Example applications

Output off

Pin „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. Switching the output off is done by connecting the pin to ground (DGND) via a low-resistive contact like a switch, open collector transistor or relay.

Note: a didital 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.

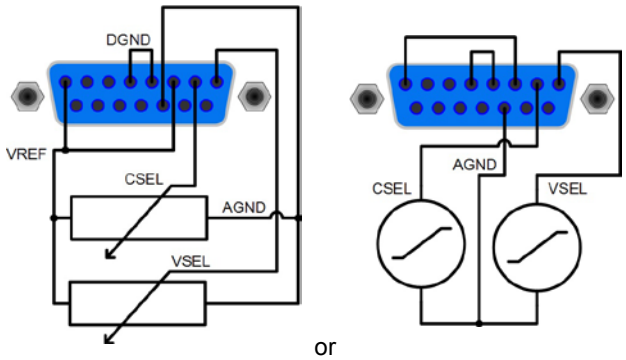


Remote control of current and voltage

*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 a total of 4.7kOhm should be used.

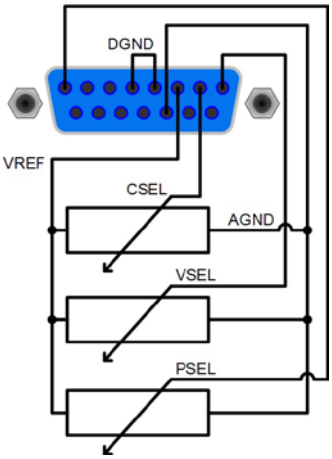
Alternatively, external voltages sources can be used to control the set value input (second example).



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 also 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 the terminal „Share“, which is required for Share bus operation, is explained in section „5.8 Terminal „Share““. Also see figure 12 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.

11.2 Series connection

It is possible to connect multiple units of same or different output voltage and, preferably, identical output current in series. If the output current of the units is different, the unit with the lowest output current defines the max. current of the series connection.

Attention! When using the optionally available, analogue interface card, never connect the grounds of the card to DC minus (-) output.

Attention! No master-slave connection possible. Every unit has to be controlled seperately.

Attention! In case one of the DC output poles is grounded, it is for safety reasons only allowed to ground the output with the lowest potential against ground, in this case DC minus (-).

An example of a series connection is depicted in figure 13.

> ***Caution! The total allowed DC output voltage of a series connection is 600V and must not be exceeded!***

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 avaibale with every device model.

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.

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.

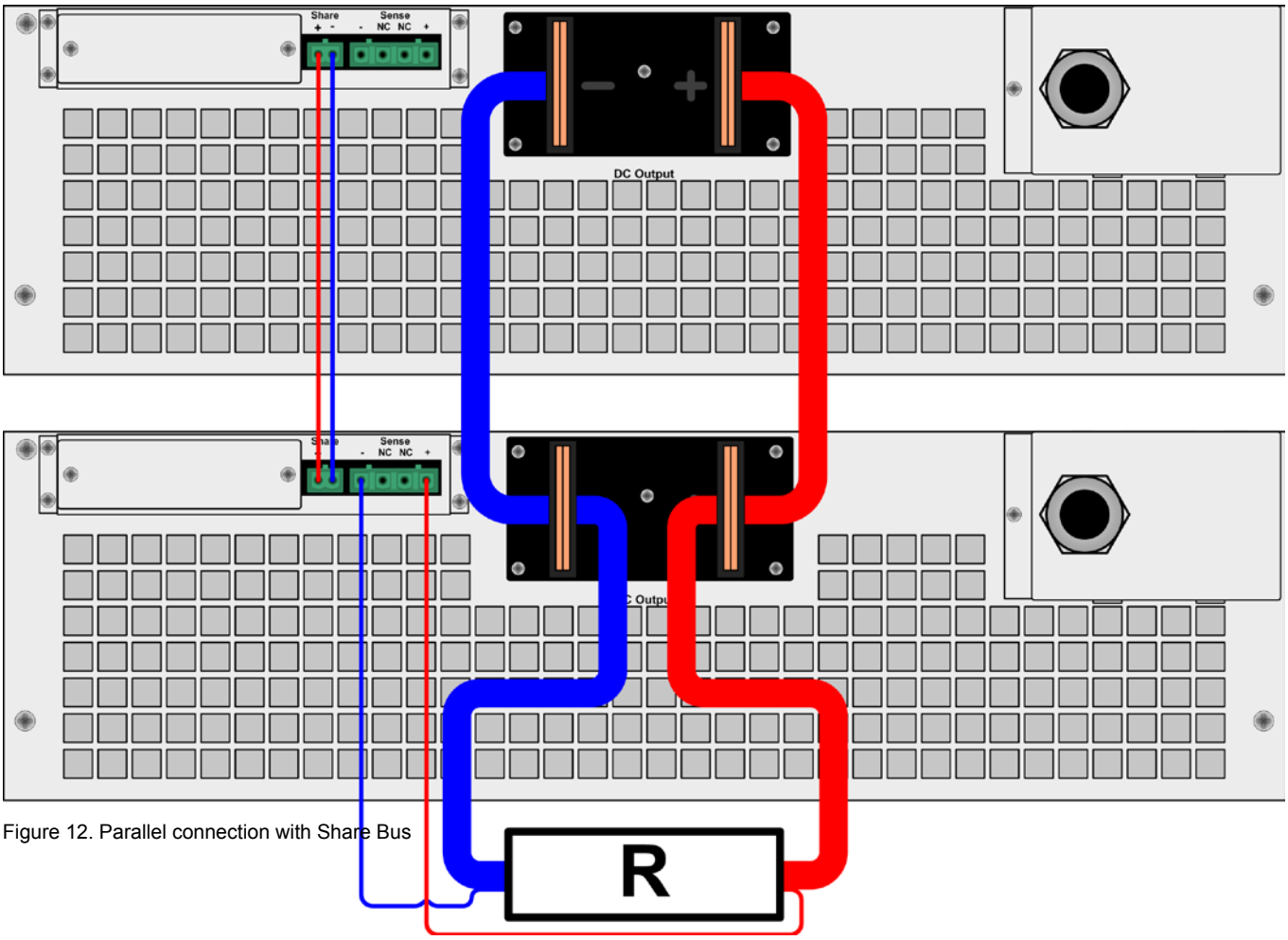


Figure 12. Parallel connection with Share Bus

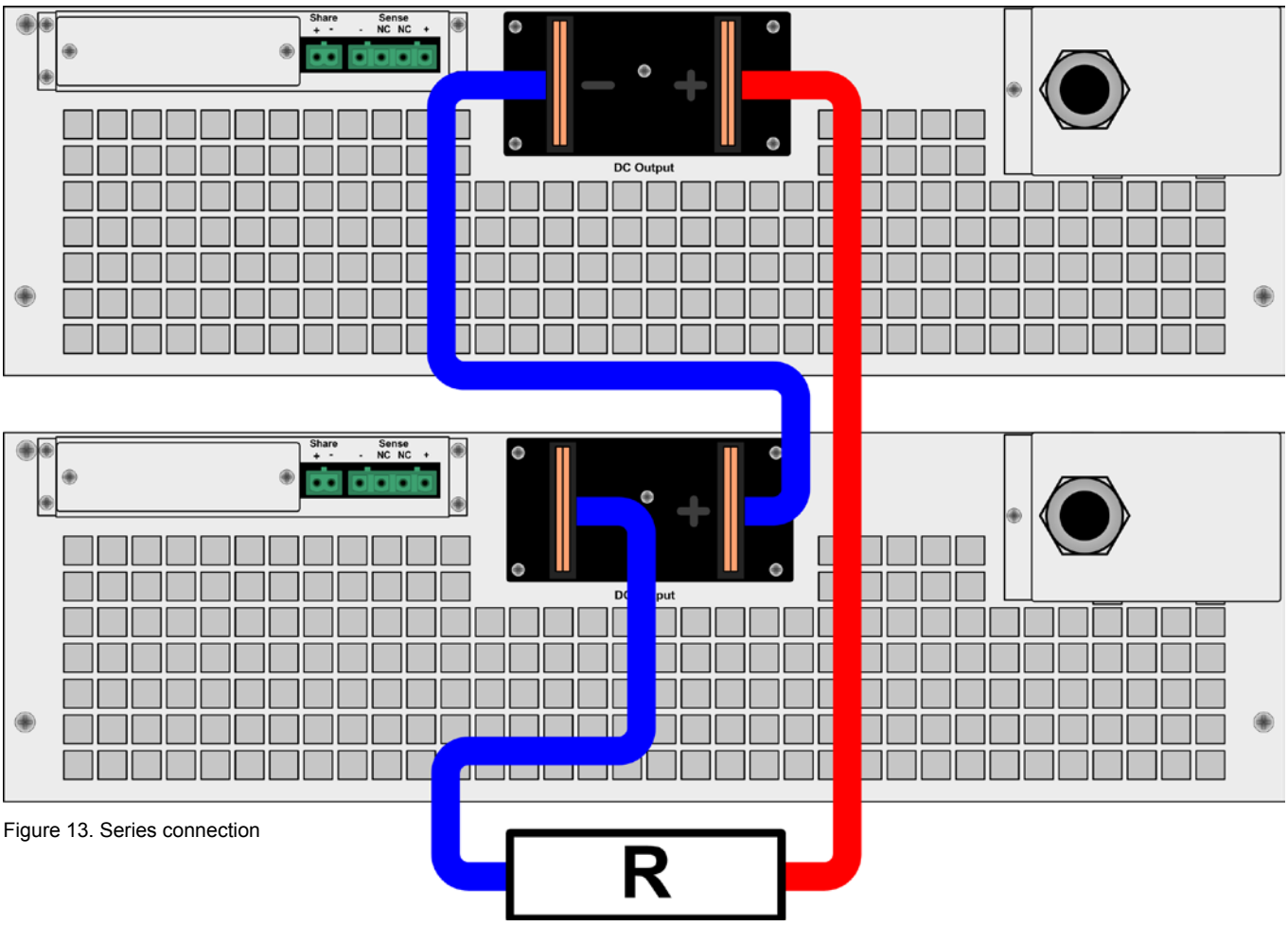


Figure 13. Series connection