

**19“ / 1U – High Voltage Power Supplies  
HPS 300 W and 800 W series**

**19“ / 1U – C-Charger High Voltage Power Supplies  
LPS 300 W and 800 W series**

**Operator's manual**

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 **Attention!**

- The unit must not be operated with the cover removed to avoid the possibility of lethal shock to the operator!
- We decline all responsibility for damages and injuries caused by an improper use of the module. It is strongly recommended to read the operator's manual before operation!

**Note**

All information in this document is subject to change without notice. We take no responsibility for any error in this document. We reserve the right to make changes in the product design without any notification to the users.

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## 1 Safety instructions

This High Voltage Power Supply has to be installed by skilled personnel only.

Following instructions are made for the personal safety of the operator, the safe use of this product and the connected units.



### Caution



### Dangerous Voltage

This unit is supplied from line voltage of 85 to 260 V-AC and generates an output voltage of up to 30 kV.

The disregard of this voltage condition can cause death, heavy injuries or material damage.



### Danger in case of missing connector at the HV output

The **LEMO-HV** connector will be used for units which generate output voltages > 6kV. It is forbidden to switch on this unit without a suitable connector inclusive a cable which is connected to the output connector and the load.

Before connecting to the local mains it must be proofed that the nominal line voltage of this unit is equal to the local mains.

**Caution:** After system-assembly the guard connections have to be checked if they are connected correctly!

The guard connection has to be proofed through a correct mains cable. An additional guard connection is possible via the green-yellow guard connector next to the HV Output (  $\perp$ /PE-connector).

The shield of the HV output is always connected to the housing (  $\perp$ /PE-connector). If this shield is intended to use as "reverse line" , then a jumper has to be plugged between the "0 V" (reverse current) and the "  $\perp$ /PE" connector.

If this jumper has been removed an additional "reverse line" from the load to the "0 V" connector must be used and this connector close to ground can be float up to max.  $\pm$  300 V.

In this case the user is responsible that - due to the voltage between "0 V" and "  $\perp$ /PE" connector - no danger for the user may occur.

If the potential between "0 V" and "  $\perp$ /PE" connector is > |300|V then - in order to avoid damages for the unit - the connections are short circuited with help of electronically protection circuits.

The unit is prepared to be mounted into a 19"-cabinet. In this case the necessary air flow conditions through the according air input and output slots have to be guaranteed.

If the unit will be used as desk top instrument then the enclosed unit bases have to be glued on the bottom sheet in order to guarantee a certain distance to the desk.

Before the cover of the unit will be removed the mains connection has to be disconnected, the discharge time of at least (> 15 s) of the output capacitance has to be kept and the discharge status has to be checked afterwards.

Only skilled and authorised people are allowed to do any service, repair or maintenance for this unit.

## 2 Technical data

19" / 1U - series HPx <sup>1</sup> 300 W	HPx <sup>1</sup> 10 307	HPx <sup>1</sup> 20 157	HPx <sup>1</sup> 30 107	HPx <sup>1</sup> 40 756	HPx <sup>1</sup> 60 506	HPx <sup>1</sup> 80 356	HPx <sup>1</sup> 120 256	HPx <sup>1</sup> 150 206	HPx <sup>1</sup> 200 156	HPx <sup>1</sup> 300 106
Output voltage V <sub>NOM</sub> (kV)	1	2	3	4	6	8	12	15	20	30
Output current I <sub>NOM</sub> (mA)	300	150	100	75	50	35	25	20	15	10
HV connector	SHV front side (opt. rear side)						Lemo-HV-connector rear side			
	8 kV < V <sub>NOM</sub> ≤ 16kV: Lemo ERA.1Y.416.CLL V <sub>NOM</sub> > 16kV: Lemo ERA.3Y.425.CLL <b>Attention: Use with connected HV connector only !</b>									
Output power	max. 300 W									
Polarity	factory fixed ⇒ <sup>1</sup> x = p: positive ⇒ <sup>1</sup> x = n: negative									
Ripple & noise [V <sub>P-P</sub> ]	V <sub>NOM</sub> ≤ 8kV: < 1 • 10 <sup>-4</sup> • V <sub>NOM</sub>					V <sub>NOM</sub> > 8kV: < 5 • 10 <sup>-4</sup> • V <sub>NOM</sub>				
Voltage stability	< 1 • 10 <sup>-4</sup> • V <sub>NOM</sub> (load to no load, ΔV <sub>IN</sub> and repeatability) in the output voltage range: 1% • V <sub>NOM</sub> ≤ V <sub>OUT</sub> ≤ V <sub>NOM</sub>									
Current stability	< 2 • 10 <sup>-3</sup> • I <sub>NOM</sub> (R <sub>Lmin</sub> ≤ R <sub>L</sub> < no load and ΔV <sub>IN</sub> ) in the output voltage range: 1% • V <sub>NOM</sub> ≤ V <sub>OUT</sub> ≤ V <sub>NOM</sub>									

19" / 1U - series HPx <sup>1</sup> 800 W	HPx <sup>1</sup> 10 807	HPx <sup>1</sup> 20 407	HPx <sup>1</sup> 30 257	HPx <sup>1</sup> 40 207	HPx <sup>1</sup> 60 137	HPx <sup>1</sup> 80 107	HPx <sup>1</sup> 120 656	HPx <sup>1</sup> 150 506
Output voltage V <sub>NOM</sub> (kV)	1	2	3	4	6	8	12	15
Output current I <sub>NOM</sub> (mA)	800	400	250	200	130	100	65	50
HV connector	SHV front side (opt. rear side)						Lemo-HV-connector rear side	
	8 kV < V <sub>NOM</sub> ≤ 16kV: Lemo ERA.1Y.416.CLL <b>Attention: Use with connected HV connector only !</b>							
Output power	max. 800 W							
Polarity	factory fixed ⇒ <sup>1</sup> x = p: positive ⇒ <sup>1</sup> x = n: negative							
Ripple & noise [V <sub>P-P</sub> ]	V <sub>NOM</sub> ≤ 8kV: < 1 • 10 <sup>-4</sup> • V <sub>NOM</sub>				V <sub>NOM</sub> > 8kV: < 5 • 10 <sup>-4</sup> • V <sub>NOM</sub>			
Voltage stability	< 1 • 10 <sup>-4</sup> • V <sub>NOM</sub> (load to no load, ΔV <sub>IN</sub> and repeatability) in the output voltage range: 1% • V <sub>NOM</sub> ≤ V <sub>OUT</sub> ≤ V <sub>NOM</sub>							
Current stability	< 2 • 10 <sup>-3</sup> • I <sub>NOM</sub> (R <sub>Lmin</sub> ≤ R <sub>L</sub> < no load and ΔV <sub>IN</sub> ) in the output voltage range: 1% • V <sub>NOM</sub> ≤ V <sub>OUT</sub> ≤ V <sub>NOM</sub>							

19" / 1U - series LPx <sup>1</sup> 300 W	LPx <sup>1</sup> 10 307	LPx <sup>1</sup> 20 157	LPx <sup>1</sup> 30 107	LPx <sup>1</sup> 40 756	LPx <sup>1</sup> 60 506	LPx <sup>1</sup> 80 356	LPx <sup>1</sup> 120 256	LPx <sup>1</sup> 150 206	LPx <sup>1</sup> 200 156	LPx <sup>1</sup> 300 106
Output voltage V <sub>NOM</sub> (kV)	1	2	3	4	6	8	12	15	20	30
Output current I <sub>NOM</sub> (mA)	300	150	100	75	50	35	25	20	15	10
HV connector	SHV front side (opt. rear side)						Lemo-HV-connector rear side			
	8 kV < V <sub>NOM</sub> ≤ 16kV: Lemo ERA.1Y.416.CLL V <sub>NOM</sub> > 16kV: Lemo ERA.3Y.425.CLL <b>Attention: Use with connected HV connector only !</b>									
Output power	max. 300 W									
Discharge frequency	Max. one complete discharge per second, at discharging up to 2 kV against GND: up to 15 Hz at discharging up to 1 kV against GND: up to 60 Hz discharge current must be limited external to I <sub>NOM</sub> otherwise									
Polarity	factory fixed ⇒ <sup>1</sup> x = p: positive ⇒ <sup>1</sup> x = n: negative									
Voltage stability	$< 1 \cdot 10^{-3} \cdot V_{NOM}$ (load to no load, ΔV <sub>IN</sub> and repeatability) in the output voltage range: 5 V ≤ V <sub>OUT</sub> ≤ V <sub>NOM</sub>									
Current stability	$< 2 \cdot 10^{-3} \cdot I_{NOM}$ (R <sub>Lmin</sub> ≤ R <sub>L</sub> < no load and ΔV <sub>IN</sub> ) in the output voltage range: 5 V ≤ V <sub>OUT</sub> ≤ V <sub>NOM</sub>									

19" / 1U - series LPx <sup>1</sup> 800 W	LPx <sup>1</sup> 10 807	LPx <sup>1</sup> 20 407	LPx <sup>1</sup> 30 257	LPx <sup>1</sup> 40 207	LPx <sup>1</sup> 60 137	LPx <sup>1</sup> 80 107	LPx <sup>1</sup> 120 656	LPx <sup>1</sup> 150 506
Output voltage V <sub>NOM</sub> (kV)	1	2	3	4	6	8	12	15
Output current I <sub>NOM</sub> (mA)	800	400	250	200	130	100	65	50
HV connector	SHV front side (opt. rear side)						Lemo-HV-connector rear side ERA.1Y.416.CLL	
	<b>Attention: Use with connected HV connector only !</b>							
Output power	max. 800 W							
Discharge frequency	Max. one complete discharge per second, at discharging up to 2 kV against GND: up to 15 Hz at discharging up to 1 kV against GND: up to 60 Hz discharge current must be limited external to I <sub>NOM</sub> otherwise							
Polarity	factory fixed ⇒ <sup>1</sup> x = p: positive ⇒ <sup>1</sup> x = n: negative							
Voltage stability	$< 1 \cdot 10^{-3} \cdot V_{NOM}$ (load to no load, ΔV <sub>IN</sub> and repeatability) in the output voltage range: 5 V ≤ V <sub>OUT</sub> ≤ V <sub>NOM</sub>							
Current stability	$< 2 \cdot 10^{-3} \cdot I_{NOM}$ (R <sub>Lmin</sub> ≤ R <sub>L</sub> < no load and ΔV <sub>IN</sub> ) in the output voltage range: 5 V ≤ V <sub>OUT</sub> ≤ V <sub>NOM</sub>							

## 2.1 General technical data

19" / 1U - series HPx <sup>1</sup> 300 W		19" / 1U - series HPx <sup>1</sup> 800 W		19" / 1U – series LPx <sup>1</sup> 300 W		19" / 1U – series LPx <sup>1</sup> 800 W	
Accuracy	voltage measurement	$\pm (0,5\% \cdot V_{OUT} + 0,3\% \cdot V_{NOM} + 1 \text{ digit})$		for one year			
	current measurement	$\pm (0,1\% \cdot I_{OUT} + 0,05\% \cdot I_{NOM} + 1 \text{ digit})$		for one year			
Temperature coefficient		$< 2 \cdot 10^{-4}/K$					
Display		8-digit LCD-Display for current and voltage					
Resolution of voltage and current measurement		4-digit					
Resolution of settings		LOCAL	4-digit				
Voltage / Current		REMOte	4-digit				
Switching of output voltage		with button "ON/OFF" or via remote control					
Control		LOCAL	rotary encoders for voltage and current				
	(REMOte)	CAN	via CAN-Interface e				
		RS-232	via RS232-Interface				
	optional:	AIF	via indirect coupled analogue I/O additionally (male SUB-D-9)				
	optional:	IEEE-488	via IEEE-Interface additionally (male Micro D25)				
Efficiency		up to 95%					
Supply		$V_{IN} = 85$ up to 260 V AC with PFC $I_{IN} = 1,7$ A at 230V-AC / 3,5 A at 115 V-AC (300 W series), $I_{IN} = 4,5$ A at 230 V AC / 9 A at 115 V AC (600 W series) via mains connector and switch "POWER", isolated from HV-output, fused with 2 • 6,3 A / slow (300 W series) 2 • 10 A / slow (800 W series).					
Dimension		1U -19" compatible / depth: 450 mm					
Weight		ca. 5,7 kg (300 W series) / ca. 6,5 kg (800 W series)					
Cooling		Internal fan					
Protection		Over load and short circuit , voltage supply and temperature					
Environment conditions		Operating temperature: 5 up to 35 °C Humidity: 30% up to 80 %, no condensation					
Storage temperature		0 up to 60 °C					

### 3 Functional description

The High Voltage PS of the HPx<sup>1</sup> - 300 W series provide an output voltage of 0 up to 30 kV-DC at max. 300 W output power.

The High Voltage PS of the HPx<sup>1</sup> - 800 W series provide an output voltage of 0 up to 15 kV-DC at max. 800 W output power.

The control loop is designed to provide a constant voltage or current.

The High Voltage PS of the LPx<sup>1</sup> - 300 W series provide an output voltage of 0 up to 30 kV-DC at max. 300 W output power.

The High Voltage PS of the LPx<sup>1</sup> - 800 W series provide an output voltage of 0 up to 15 kV-DC at max. 800 W output power. Mains voltage is 85 - 264 V -AC 50/60 Hz (PFC is standard).

The control loop is designed to charge a capacity in constant current control mode. This capacity will discharge with the user circuit. You will find information to the discharge frequency dependence on the discharge level in chapter 2.

On LPS devices, the Software voltage ramp (0...3000V/s) can be disabled. The device then ramps to the chosen set voltages as fast as possible (see chapter 4 "Front panel operation" and 6 "Command sets").

Mains voltage is 85 to 260 V-AC 50/60 Hz.

The output voltage and current are limited due to the hardware circuitry. The polarity is factory fixed ( <sup>1</sup>x=p: positive; <sup>1</sup>x=n: negative).

The shield of the HV output is always connected to the housing (  $\perp$ /PE-connector).

If this shield is intended to use as "reverse line", then a jumper has to be plugged between the "0 V" (reverse current) and the " $\perp$ /PE" connector.

If this jumper has been removed an additional "reverse line" from the load to the "0 V" connector must be used and this connector close to ground can be float up to max.  $\pm$  300 V.

**Attention: In this case the user is responsible that – due to the voltage between "0 V" and " $\perp$ /PE" connector – no danger for the user may occur.**

If the potential between "0 V" and " $\perp$ /PE" connector is  $> |300|$  V then – in order to avoid damages for the unit – the connections are short circuited with help of internal electronically protection circuits.

### 3.1 Operation states

The device has the following operation states:

- POWER-ON Device initialises the connected Hardware (Booting)
- LOCAL Device is controlled with buttons and rotary encoders at the front panel
- REMOTE Device is remote controlled via interface (CAN, RS-232, IEEE-488)

The states LOCAL and REMOTE are further divided into:

- HV-OFF No high voltage is produced
- HV-ON High voltage according to Set values is produced

In the HV-ON state there are two modes for high voltage creation:

1. Voltage control CV:  
Control of output voltage according to set value  $V_{SET}$   
(Output current  $I_{OUT} < I_{SET}$ ), LED „CV“ lighting.
2. Current control CC (only with “Kill disable”):  
Control of output current according to set value  $I_{SET}$   
(Output current  $I_{OUT} > I_{SET}$ ), LED „CC“ lighting.

The KILL function is be set with the KILL/ESC button:

- Disable: The output voltage will be limited after reaching  $I_{SET}$
- Enable: The yellow LED „KILL ENABLE“ is lighting.  
The output voltage will be shut off permanently without ramp, if  $I_{OUT} \geq I_{SET}$ .  
The re-setting of the output voltage is possible after pushing button HV ON again.

### 3.2 Safety loop (Interlock)

The unit is equipped with a connector for a hardware safety loop (interlock) on the rear.

If the loop is closed an internal current source (open circuit voltage 15 V / short circuit current max. 40 mA) will drive a current of ca. 12 mA through the built-in safety relay.

That will work if the impedance of the closed loop is less than 200 Ohm.

If the safety loop is opened, the relay will be drop-out and the generation of high voltage will be stopped without any semiconductor by the contacts of the safety relay only.

**Caution: The internal and external capacities must be discharge about the load before the output will be volt-free. The internal load is very high, so a very long discharging time is possible according to the connected load.  
The unit is not equipped with an active discharging circuit!**

The safety loop is closed ex works with help of a wire strap.

It is not possible to switch on the high voltage generation if the loop is open.

If the loop will be closed again high voltage will be switch on with HV-ON on front panel or via the digital interfaces only.

If chosen **AIF ON** in the menu F06 „Control with analogue I/O automatically“ it is able to switch on high voltage with **Low to High** on the **INHIBIT** pin of the analogue I/O too.