

The Main Catalogue 2002  
is an update of the  
Catalogue 2000 and  
not available in printed form.

DIN EN ISO 9001



F.u.G. Elektronik GmbH

# Main Catalogue 2002

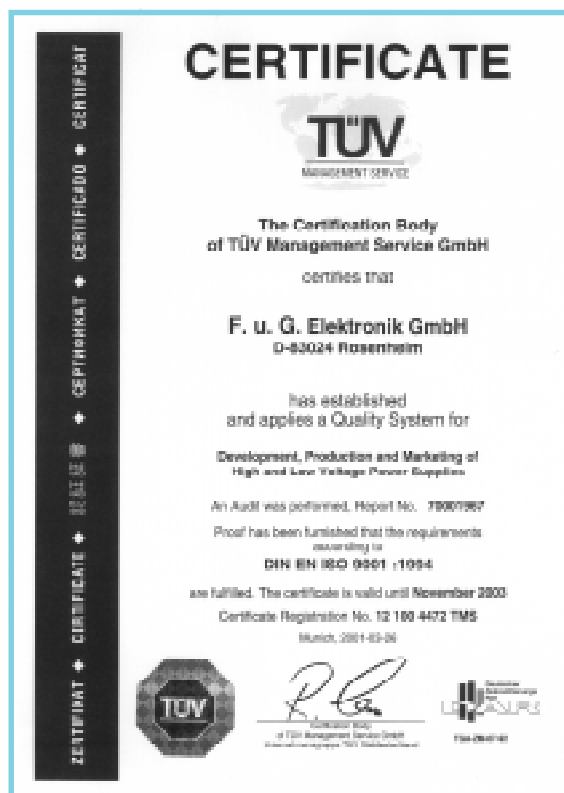


## DC Power Supplies High and Low Voltage

for

Reserch - Development - Industry

The **Main Catalogue 2002** is an update of the Catalogue 2000 and not available in printed form.



All Units



Since 1994  
**DIN EN ISO 9001**

This catalogue contains approx. 650 models,  
please take from the price list,  
which models are available from stock, there are about 100 !

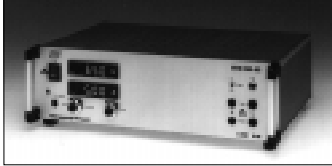
F.u.G. Elektronik GmbH , Florianstr. 2 , D - 83024 Rosenheim  
Telefon: +49(0)8031 / 2851-0 ; Telefax: +49(0)8031 / 81099  
GERMANY  
eMail: info@fug-elektronik.de  
Internet: http://www.fug-elektronik.de

F.u.G. Elektronik GmbH - Florianstr. 2 - D 83024 Rosenheim - GERMANY

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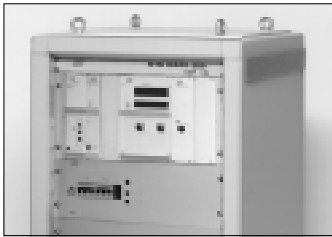
# Product Summary



**Low voltage power supplies  
Series NTN**  
Thyristor and transistor controlled  
6,5 V to 350 V  
35 W to 100 kW



**High voltage cassettes  
IMS-size  
Series HCN 7E**  
125 V to 35000 V / 7 W  
from page 24 on



higher power in racks  
from page 6 on



**High voltage cassettes  
EURO-size  
Series HCE**  
125 V to 35000 V / 7 W and 35 W  
from page 26 on



**Low voltage power supplies  
with high power  
Series NYN**  
Thyristor controlled  
6,5 V to 350 V  
7 kW to 100 kW



**Autorangig power supplies  
Series NCA / MCA**  
50 V to 3000 V  
750 W to 3000 W  
from page 28 on

**Medium voltage power supplies  
with high power  
Series MYN**  
Thyristor controlled  
650 V to 2000 V  
7 kW to 70 kW



**Medium voltage power supplies  
Series MCL and MCN**  
125 V to 2000 V  
14 W to 4200 W  
from page 30 and 32 on

**High voltage power supplies  
with high power  
Series HYN**  
Thyristor controlled  
3500 V to 20000 V  
7 kW to 70 kW



**High voltage power supplies  
Series HCL and HCN**  
3500 V to 150000 V  
14 W to 4200 W  
from page 36 and 38 on

from page 12 on



**Linear regulated power supplies  
Series NLN**  
6,5 V to 500 V  
35 W to 1400 W

from page 18 on



**Bipolar power supplies  
Series NLB**  
 $\pm 6,5$  V to  $\pm 350$  V  
35 W to 1400 W

from page 18 on



**High power supplies  
Series HCH**  
650 V to 200000 V  
350 W to 50 kW

from page 42 on

# 25 Years

## DC Power Supplies for Research

## Development

## and Industry



### Bipolar high voltage power supplies Series HCB

1250 V to 20000 V  
1,4 W to 200 W

from page 46 on



### Capacitor charging power supplies Series HCK

2000 V to 65000 V  
100 J/s to 20000 J/s

from page 48 on



### Current sources for super conducting coils / magnets Series NTS

up to 10000 A  
up to 250 kW

from page 52 on



Modules for power supplies with analog programming  
0 - 10 V DC  
IMS size and EURO size

### Computer interfaces Probus IV

IEEE 488 and RS 232

from page 54 on



### High voltage isolation transformers Series HTS

50 kV isolation  
up to 3000 VA

from page 56 on



On request we deliver also many special power supplies.

Examples you will find from page 62 on.

## 1978

In former carpenter's rooms  
F.u.G. develops and produces power supplies.



## 1988

F.u.G. moves into a new company building with 2000 square meters area.



## Today

F.u.G. develops and produces with 70 employees high precision power supplies for customers all over the world.



Development  
Design  
Production  
Final Test



Everything under one roof



# Low voltage power supplies transistor regulated with thyristor prestabilisation

## Design examples



**NTN 140 - 12,5**  
12,5 V / 8 A



**NTN 700 - 125**  
125 V / 5 A



**NTN 4200M - 20**  
20 V / 200 A

On request these models are  
available as 19" plug-in unit



**NTN 10500 - 200**  
200 V / 50 A

# Low voltage power supplies

## Series NTN from 6,5 V to 350 V / 35 W to 100 kW

### Function

Series regulated with a set of parallel transistors and a preregulation with phase controlled thyristors. The power lost on the transistors is kept as low as possible

### Features

- High efficiency
- Short circuit proof and unlimited operation with full current in short circuit condition
- Voltage and current regulation with automatic and sharp transition
- Control mode indicated by LEDs
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- 3½ digit DVM for voltage and current (at ½19" units, switch-selected)
- Sensor terminals for the compensation of voltage drop on the load lines. The nominal voltage always refers to the output terminals, see also technical appendix page 65.
- Parallel and series connection possible
- Suitable for inductive and capacitive loads
- Standard starting current limitation from 700 W nominal power on
- Standard interlock control loop for three-phase units
- Standard elapsed-hour meter for three-phase units

### Design

- Up to 140 W nominal power ½19" table-top case,  
For 350 W nominal power or higher 19" table-top case
- 19" rack-adapters see page 56  
For 7 kW nominal power or higher 19" rack. Height depending on type. The side walls can be removed, the rear door can be locked.
- All cabinets have removable crane-eyes.
- Racks are equipped with castors.
- Racks 37 HU are also equipped for fork lift transport.
- Cooling: Convection or built-in fan with air outlet on the rear or the top, (depending on type).

### Outputs

- 4 mm safety connectors, up to 20 A on the front panel. For higher currents, the output is on the rear. Up to 300 A - clamps, for higher currents - copper bars.

### Technical Data

- Mains connection:  
Up to 1400 W nominal power 230 V ±10% 47 Hz to 53 Hz  
From 2800 W nominal power on 400 V ±10% 47 Hz to 53 Hz two-phase (depending on type it can be three-phase)  
from 7000 W nominal power on 400 V ±10% 47 Hz to 53 Hz three-phase
- Ambient temperature: 0°C to +40°C
- Output isolation:  
The output is floating. Operating voltage with respect to earth: ±500 V, either the positive or the negative terminal may be connected to earth.

All further data apply, if not otherwise stated, for voltage and current regulation and refer to the rated value.

- Setting range:  
from appr. 0,1% to 100%
- Setting resolution:  
 $\pm 1 \times 10^{-4}$
- Reproducibility:  
 $\pm 1 \times 10^{-3}$
- Residual ripple:  
 $< 1 \times 10^{-4} \text{pp} + 10 \text{ mVpp}$
- Deviation:  
for ±10% mains voltage variation:  
 $< \pm 1 \times 10^{-5}$   
for no load / full load:  
 $< \pm 2 \times 10^{-4}$   
over 8 hours under constant conditions:  
 $< \pm 1 \times 10^{-4}$   
within the temperature range:  
 $< \pm 1 \times 10^{-4} / \text{K}$
- Recovery time for voltage control:  
<50 µs for load changes from 10% to 100% or from 100% to 10%.
- Recovery time for current control:  
<50 ms for load changes causing an output voltage change of less than 10% of the rated voltage.  
Units with an output voltage  $\geq 65 \text{ V}$  switch off for a short time at higher load changes.
- Setting time at nominal load:  
100 ms to 500 ms (depending on type) for changes of the output voltage from 10% to 90% or 90% to 10%.
- Discharging time constant for output without load:  
appr. 2 sec to 60 sec (depending on type).

### Options

- Analog programming
  - Analog programming, floating
- More informations about the output isolation you will find on page 58
- IEEE 488 / RS232 interface
  - DVM with higher resolution
  - Higher stability
  - Units with 2800 W and 4200 W are also available for three-phase connection.
  - Water cooling

Further informations about options you will find on pages 60 and 61. Please note, that certain options contain changes of the description of the unit.

Types see next pages

# Low voltage power supplies

## Series NTN from 6,5 V to 12,5 V / 35 W to 50 kW

Type	Voltage	Current	Width	Height	Depth	Weight
NTN 35 - 6,5	0 - 6,5 V	0 - 5 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NTN 140 - 6,5	0 - 6,5 V	0 - 10 A	½19" / 222 mm	3 HU / 133 mm	350 mm	8 kg
NTN 350 - 6,5	0 - 6,5 V	0 - 30 A	19" / 443 mm	3 HU / 133 mm	350 mm	18 kg
NTN 700 - 6,5	0 - 6,5 V	0 - 60 A	19" / 443 mm	4 HU / 177 mm	450 mm	35 kg
NTN 1400 - 6,5	0 - 6,5 V	0 - 120 A	19" / 443 mm	7 HU / 310 mm	550 mm	70 kg
NTN 2800 - 6,5 2)	0 - 6,5 V	0 - 250 A	19" / 443 mm	9 HU / 399 mm	650 mm	120 kg
NTN 4200 - 6,5 3)	0 - 6,5 V	0 - 400 A	19" / 600 mm	27 HU / 1500 mm	650 mm	300 kg
NTN 7000 - 6,5 3)	0 - 6,5 V	0 - 600 A	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg
NTN 10500 - 6,5 3)	0 - 6,5 V	0 - 1000 A	19" / 600 mm	37 HU / 2000 mm	800 mm	500 kg
NTN 14000 - 6,5 3)	0 - 6,5 V	0 - 1500 A	19" / 600 mm	37 HU / 2000 mm	800 mm	550 kg
NTN 21000 - 6,5 3)	0 - 6,5 V	0 - 2000 A	19" / 600 mm	37 HU / 2000 mm	800 mm	650 kg
NTN 28000 - 6,5 3)	0 - 6,5 V	0 - 2500 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1000 kg
NTN 35000 - 6,5 3)	0 - 6,5 V	0 - 3000 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1300 kg
NTN 35 - 12,5	0 - 12,5 V	0 - 2,5 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NTN 140 - 12,5	0 - 12,5 V	0 - 8 A	½19" / 222 mm	3 HU / 133 mm	350 mm	8 kg
NTN 350 - 12,5	0 - 12,5 V	0 - 20 A	19" / 443 mm	3 HU / 133 mm	350 mm	14 kg
NTN 700 - 12,5	0 - 12,5 V	0 - 50 A	19" / 443 mm	4 HU / 177 mm	450 mm	29 kg
NTN 1400 - 12,5	0 - 12,5 V	0 - 80 A	19" / 443 mm	4 HU / 177 mm	550 mm	50 kg
NTN 2800 - 12,5 2)	0 - 12,5 V	0 - 150 A	19" / 443 mm	7 HU / 310 mm	650 mm	110 kg
NTN 4200 - 12,5 2)	0 - 12,5 V	0 - 250 A	19" / 443 mm	9 HU / 399 mm	650 mm	150 kg
NTN 7000 - 12,5 3)	0 - 12,5 V	0 - 500 A	19" / 600 mm	37 HU / 2000 mm	800 mm	340 kg
NTN 10500 - 12,5 3)	0 - 12,5 V	0 - 800 A	19" / 600 mm	37 HU / 2000 mm	800 mm	480 kg
NTN 14000 - 12,5 3)	0 - 12,5 V	0 - 1000 A	19" / 600 mm	37 HU / 2000 mm	800 mm	520 kg
NTN 21000 - 12,5 3)	0 - 12,5 V	0 - 1500 A	19" / 600 mm	37 HU / 2000 mm	800 mm	600 kg
NTN 28000 - 12,5 3)	0 - 12,5 V	0 - 2000 A	19" / 600 mm	37 HU / 2000 mm	800 mm	900 kg
NTN 35000 - 12,5 3)	0 - 12,5 V	0 - 2500 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1300 kg
NTN 50000 - 12,5 3)	0 - 12,5 V	0 - 4000 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1500 kg

2) Mains connection two-phase 3) Mains connection three-phase



# Low voltage power supplies

## Series NTN from 20 V to 35 V / 35 W to 70 kW

Type	Voltage	Current	Width	Height	Depth	Weight
NTN 35 - 20	0 - 20 V	0 - 1,5 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NTN 140 - 20	0 - 20 V	0 - 6 A	½19" / 222 mm	3 HU / 133 mm	350 mm	8 kg
NTN 350 - 20	0 - 20 V	0 - 15 A	19" / 443 mm	3 HU / 133 mm	350 mm	14 kg
NTN 700 - 20	0 - 20 V	0 - 30 A	19" / 443 mm	4 HU / 177 mm	450 mm	26 kg
NTN 1400 - 20	0 - 20 V	0 - 60 A	19" / 443 mm	4 HU / 177 mm	550 mm	45 kg
NTN 2800 - 20 2)	0 - 20 V	0 - 120 A	19" / 443 mm	7 HU / 310 mm	550 mm	100 kg
NTN 4200 - 20 2)	0 - 20 V	0 - 200 A	19" / 443 mm	9 HU / 399 mm	550 mm	145 kg
NTN 7000 - 20 3)	0 - 20 V	0 - 300 A	19" / 600 mm	27 HU / 1500 mm	650 mm	300 kg
NTN 10500 - 20 3)	0 - 20 V	0 - 500 A	19" / 600 mm	37 HU / 2000 mm	800 mm	440 kg
NTN 14000 - 20 3)	0 - 20 V	0 - 600 A	19" / 600 mm	37 HU / 2000 mm	800 mm	480 kg
NTN 21000 - 20 3)	0 - 20 V	0 - 800 A	19" / 600 mm	37 HU / 2000 mm	800 mm	580 kg
NTN 28000 - 20 3)	0 - 20 V	0 - 1200 A	19" / 600 mm	37 HU / 2000 mm	800 mm	800 kg
NTN 35000 - 20 3)	0 - 20 V	0 - 1500 A	19" / 600 mm	37 HU / 2000 mm	800 mm	1200 kg
NTN 50000 - 20 3)	0 - 20 V	0 - 2500 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1400 kg
NTN 35 - 35	0 - 35 V	0 - 1 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NTN 140 - 35	0 - 35 V	0 - 4 A	½19" / 222 mm	3 HU / 133 mm	350 mm	8 kg
NTN 350 - 35	0 - 35 V	0 - 10 A	19" / 443 mm	3 HU / 133 mm	350 mm	13 kg
NTN 700 - 35	0 - 35 V	0 - 20 A	19" / 443 mm	4 HU / 177 mm	450 mm	27 kg
NTN 1400 - 35	0 - 35 V	0 - 40 A	19" / 443 mm	4 HU / 177 mm	550 mm	47 kg
NTN 2800 - 35 2)	0 - 35 V	0 - 80 A	19" / 443 mm	7 HU / 310 mm	550 mm	90 kg
NTN 4200 - 35 2)	0 - 35 V	0 - 120 A	19" / 443 mm	9 HU / 399 mm	550 mm	120 kg
NTN 7000 - 35 3)	0 - 35 V	0 - 200 A	19" / 600 mm	18 HU / 1100 mm	650 mm	280 kg
NTN 10500 - 35 3)	0 - 35 V	0 - 300 A	19" / 600 mm	27 HU / 1500 mm	650 mm	420 kg
NTN 14000 - 35 3)	0 - 35 V	0 - 400 A	19" / 600 mm	37 HU / 2000 mm	800 mm	460 kg
NTN 21000 - 35 3)	0 - 35 V	0 - 600 A	19" / 600 mm	37 HU / 2000 mm	800 mm	530 kg
NTN 28000 - 35 3)	0 - 35 V	0 - 800 A	19" / 600 mm	37 HU / 2000 mm	800 mm	750 kg
NTN 35000 - 35 3)	0 - 35 V	0 - 1000 A	19" / 600 mm	37 HU / 2000 mm	800 mm	950 kg
NTN 70000 - 35 3)	0 - 35 V	0 - 2000 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1500 kg

2) Mains connection two-phase 3) Mains connection three-phase

# Low voltage power supplies

## Series NTN from 65 V to 125 V / 35 W to 100 kW

Type	Voltage	Current	Width	Height	Depth	Weight
NTN 35 - 65	0 - 65 V	0 - 0,5 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NTN 140 - 65	0 - 65 V	0 - 2 A	½19" / 222 mm	3 HU / 133 mm	350 mm	8 kg
NTN 350 - 65	0 - 65 V	0 - 5 A	19" / 443 mm	3 HU / 133 mm	350 mm	13 kg
NTN 700 - 65	0 - 65 V	0 - 10 A	19" / 443 mm	4 HU / 177 mm	350 mm	24 kg
NTN 1400 - 65	0 - 65 V	0 - 20 A	19" / 443 mm	4 HU / 177 mm	450 mm	40 kg
NTN 2800 - 65 2)	0 - 65 V	0 - 40 A	19" / 443 mm	5 HU / 221 mm	550 mm	70 kg
NTN 4200 - 65 2)	0 - 65 V	0 - 60 A	19" / 443 mm	9 HU / 399 mm	550 mm	110 kg
NTN 7000 - 65 3)	0 - 65 V	0 - 100 A	19" / 600 mm	18 HU / 1100 mm	650 mm	280 kg
NTN 10500 - 65 3)	0 - 65 V	0 - 150 A	19" / 600 mm	27 HU / 1500 mm	650 mm	390 kg
NTN 14000 - 65 3)	0 - 65 V	0 - 200 A	19" / 600 mm	37 HU / 2000 mm	800 mm	440 kg
NTN 21000 - 65 3)	0 - 65 V	0 - 300 A	19" / 600 mm	37 HU / 2000 mm	800 mm	510 kg
NTN 28000 - 65 3)	0 - 65 V	0 - 400 A	19" / 600 mm	37 HU / 2000 mm	800 mm	720 kg
NTN 35000 - 65 3)	0 - 65 V	0 - 500 A	19" / 600 mm	37 HU / 2000 mm	800 mm	900 kg
NTN 70000 - 65 3)	0 - 65 V	0 - 1000 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1400 kg
NTN 700 - 125	0 - 125 V	0 - 5 A	19" / 443 mm	4 HU / 177 mm	350 mm	24 kg
NTN 1400 - 125	0 - 125 V	0 - 10 A	19" / 443 mm	4 HU / 177 mm	450 mm	37 kg
NTN 2800 - 125 2)	0 - 125 V	0 - 20 A	19" / 443 mm	5 HU / 221 mm	550 mm	70 kg
NTN 4200 - 125 2)	0 - 125 V	0 - 30 A	19" / 443 mm	9 HU / 399 mm	550 mm	100 kg
NTN 7000 - 125 3)	0 - 125 V	0 - 50 A	19" / 600 mm	18 HU / 1100 mm	650 mm	250 kg
NTN 10500 - 125 3)	0 - 125 V	0 - 80 A	19" / 600 mm	27 HU / 1500 mm	650 mm	300 kg
NTN 14000 - 125 3)	0 - 125 V	0 - 100 A	19" / 600 mm	27 HU / 2000 mm	650 mm	400 kg
NTN 21000 - 125 3)	0 - 125 V	0 - 150 A	19" / 600 mm	37 HU / 2000 mm	800 mm	490 kg
NTN 28000 - 125 3)	0 - 125 V	0 - 200 A	19" / 600 mm	37 HU / 2000 mm	800 mm	680 kg
NTN 35000 - 125 3)	0 - 125 V	0 - 250 A	19" / 600 mm	37 HU / 2000 mm	800 mm	850 kg
NTN 50000 - 125 3)	0 - 125 V	0 - 400 A	19" / 600 mm	37 HU / 2000 mm	800 mm	1200 kg
NTN 100000 - 125 3)	0 - 125 V	0 - 800 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1700 kg

2) Mains connection two-phase 3) Mains connection three-phase

On request we also deliver intermediat values

# Low voltage power supplies

## Series NTN from 200 V to 350 V / 700 W to 100 kW

Type	Voltage	Current	Width	Height	Depth	Weight
NTN 700 - 200	0 - 200 V	0 - 3 A	19" / 443 mm	4 HU / 177 mm	350 mm	24 kg
NTN 1400 - 200	0 - 200 V	0 - 6 A	19" / 443 mm	4 HU / 177 mm	450 mm	37 kg
NTN 2800 - 200 2)	0 - 200 V	0 - 12 A	19" / 443 mm	5 HU / 221 mm	550 mm	70 kg
NTN 4200 - 200 2)	0 - 200 V	0 - 20 A	19" / 443 mm	9 HU / 399 mm	550 mm	100 kg
NTN 7000 - 200 3)	0 - 200 V	0 - 30 A	19" / 600 mm	18 HU / 1100 mm	650 mm	240 kg
NTN 10500 - 200 3)	0 - 200 V	0 - 50 A	19" / 600 mm	27 HU / 1500 mm	650 mm	360 kg
NTN 14000 - 200 3)	0 - 200 V	0 - 60 A	19" / 600 mm	27 HU / 1500 mm	650 mm	400 kg
NTN 21000 - 200 3)	0 - 200 V	0 - 100 A	19" / 600 mm	37 HU / 2000 mm	800 mm	490 kg
NTN 28000 - 200 3)	0 - 200 V	0 - 120 A	19" / 600 mm	37 HU / 2000 mm	800 mm	650 kg
NTN 35000 - 200 3)	0 - 200 V	0 - 150 A	19" / 600 mm	37 HU / 2000 mm	800 mm	800 kg
NTN 50000 - 200 3)	0 - 200 V	0 - 250 A	19" / 600 mm	37 HU / 2000 mm	800 mm	1200 kg
NTN 100000 - 200 3)	0 - 200 V	0 - 500 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1600 kg
NTN 700 - 350	0 - 350 V	0 - 2 A	19" / 443 mm	4 HU / 177 mm	350 mm	24 kg
NTN 1400 - 350	0 - 350 V	0 - 4 A	19" / 443 mm	4 HU / 177 mm	450 mm	37 kg
NTN 2800 - 350 2)	0 - 350 V	0 - 8 A	19" / 443 mm	5 HU / 221 mm	550 mm	70 kg
NTN 4200 - 350 2)	0 - 350 V	0 - 12 A	19" / 443 mm	9 HU / 399 mm	550 mm	100 kg
NTN 7000 - 350 3)	0 - 350 V	0 - 20 A	19" / 600 mm	18 HU / 1100 mm	650 mm	240 kg
NTN 10500 - 350 3)	0 - 350 V	0 - 30 A	19" / 600 mm	27 HU / 1500 mm	650 mm	275 kg
NTN 14000 - 350 3)	0 - 350 V	0 - 40 A	19" / 600 mm	27 HU / 1500 mm	650 mm	400 kg
NTN 21000 - 350 3)	0 - 350 V	0 - 60 A	19" / 600 mm	37 HU / 2000 mm	800 mm	490 kg
NTN 28000 - 350 3)	0 - 350 V	0 - 80 A	19" / 600 mm	37 HU / 2000 mm	800 mm	650 kg
NTN 35000 - 350 3)	0 - 350 V	0 - 100 A	19" / 600 mm	37 HU / 2000 mm	800 mm	800 kg
NTN 70000 - 350 3)	0 - 350 V	0 - 200 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1350 kg
NTN 100000 - 350 3)	0 - 350 V	0 - 300 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1600 kg

2) Mains connection two-phase 3) Mains connection three-phase

Units with lower power from 125 V on see also at medium voltage power supplies series MCL page 30 and MCN page 32.

# High power units thyristor controlled



## Design examples



**HYN 35000 - 3500**  
3500 V / 10 A

**MYN 14000 - 500**  
500 V / 28 A

For other high power units, please see pages 6 and 46

# High power units

Series NYN from 12,5 V to 350 V / 7 kW to 100 kW

Series MYN from 650 V to 2000 V / 7 kW to 70 kW

Series HYN from 3,5 kV to 20 kV / 7 kW to 70 kW

## Function

Thyristor phase control. The rectified voltage is filtered by a LC-filter.

## Features

- Simple construction
- Extremely robust
- High efficiency
- Short circuit proof and unlimited operation with full current in short circuit condition
- Voltage and current regulation with automatic and sharp transition
- Control mode indicated by LEDs
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- 3½ digit DVM for voltage and current
- At NYN series, sensor terminals for the compensation of voltage drop on the load lines are standard. The nominal voltage always refers to the output terminals.
- Suitable for inductive and capacitive loads
- An interlock control loop to monitor the external load and an internal loop are standard
- Elapsed-hour meter
- Starting current limitation

## Design

- All units are supplied as 19" cabinets, height depending on type. The side walls can be removed, the rear door can be locked.
- All cabinets have removable crane-eyes.
- All racks are equipped with casters.
- Racks with 37 HU are also equipped for fork lift transport.
- Cooling: convection or built-in fan with air outlet on the rear or the top, (depending on type).

## Outputs

- Feed through terminals on the rear. From 400 A on the outputs are copper bars.

At MYN and HYN units up to 10 A the outputs are HV-sockets, mating connectors are included.

## Technical Data

- Mains connection: 400 V  $\pm 10\%$  47 Hz to 53 Hz three-phase
- Ambient temperature: 0°C to +40°C
- Output isolation: at series NYN and MYN the output is floating. Operating voltage with respect to earth: at NYN-series  $\pm 500$  V, at MYN-series  $\pm 2000$  V.

Either the positive or the negative terminal may be connected to earth.

At series HYN one output pole is connected to earth, the output polarity has to be indicated when ordering.

All further data apply for voltage and current regulation and refer to the rated value, if not otherwise stated.

- Setting range: from appr. 1% to 100%
- Setting resolution:  $\pm 2 \times 10^{-4}$
- Reproducibility:  $\pm 2 \times 10^{-3}$
- Residual ripple:  $< 1\%_{pp} + 100$  mVpp
- Deviation: for  $\pm 10\%$  mains voltage variation:  $< \pm 1 \times 10^{-4}$   
for no load / full load:  $< \pm 1 \times 10^{-3}$   
over 8 hours under constant conditions:  $< \pm 3 \times 10^{-4}$   
within the temperature range:  $< \pm 3 \times 10^{-4} / K$
- Recovery time for  $\pm 10\%$  load variation, depending on type, 100 ms to 500 ms (depending on type).

- Setting time at nominal load: 100 ms to 2sec (depending on type) for changes of the output voltage from 10% to 90% or 90% to 10%.

- Discharging time constant for output without load: approx. 5 sec to 60 sec (depending on type).

## Options

- Analog programming
- Analog programming, floating
- Information on the output isolation please see page 60
- IEEE 488 / RS232 interface
- DVM with higher resolution
- Water cooling
- Polarity reversal switch for HYN units.
- Power regulation with display
- Internal resistance setting and regulation, also via computer interface.

For more information on our options please see pages 60 and 61. Also, some options may contain changes of the description of the unit.

Types see on the following pages

# Low voltage power supplies

## Series NYN from 12,5 V to 65 V / 7 kW to 70 kW

Type	Voltage	Current	Width	Height	Depth	Weight
NYN 7000 - 12,5 3)	0 - 12,5 V	0 - 500 A	19" / 600 mm	18 HU / 1100 mm	650 mm	300 kg
NYN 10500 - 12,5 3)	0 - 12,5 V	0 - 800 A	19" / 600 mm	37 HU / 2000 mm	800 mm	440 kg
NYN 14000 - 12,5 3)	0 - 12,5 V	0 - 1000 A	19" / 600 mm	37 HU / 2000 mm	800 mm	480 kg
NYN 21000 - 12,5 3)	0 - 12,5 V	0 - 1500 A	19" / 600 mm	37 HU / 2000 mm	800 mm	550 kg
NYN 28000 - 12,5 3)	0 - 12,5 V	0 - 2000 A	19" / 600 mm	37 HU / 2000 mm	800 mm	820 kg
NYN 35000 - 12,5 3)	0 - 12,5 V	0 - 2500 A	19" / 600 mm	37 HU / 2000 mm	800 mm	1200 kg
NYN 50000 - 12,5 3)	0 - 12,5 V	0 - 4000 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1300 kg
NYN 7000 - 20 3)	0 - 20 V	0 - 300 A	19" / 600 mm	18 HU / 1100 mm	650 mm	280 kg
NYN 10500 - 20 3)	0 - 20 V	0 - 500 A	19" / 600 mm	37 HU / 2000 mm	800 mm	400 kg
NYN 14000 - 20 3)	0 - 20 V	0 - 600 A	19" / 600 mm	37 HU / 2000 mm	800 mm	440 kg
NYN 21000 - 20 3)	0 - 20 V	0 - 800 A	19" / 600 mm	37 HU / 2000 mm	800 mm	530 kg
NYN 28000 - 20 3)	0 - 20 V	0 - 1200 A	19" / 600 mm	37 HU / 2000 mm	800 mm	750 kg
NYN 35000 - 20 3)	0 - 20 V	0 - 1500 A	19" / 600 mm	37 HU / 2000 mm	800 mm	1100 kg
NYN 50000 - 20 3)	0 - 20 V	0 - 2500 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1250 kg
NYN 7000 - 35 3)	0 - 35 V	0 - 200 A	19" / 600 mm	18 HU / 1100 mm	650 mm	260 kg
NYN 10500 - 35 3)	0 - 35 V	0 - 300 A	19" / 600 mm	27 HU / 1500 mm	650 mm	380 kg
NYN 14000 - 35 3)	0 - 35 V	0 - 400 A	19" / 600 mm	37 HU / 2000 mm	800 mm	420 kg
NYN 21000 - 35 3)	0 - 35 V	0 - 600 A	19" / 600 mm	37 HU / 2000 mm	800 mm	500 kg
NYN 28000 - 35 3)	0 - 35 V	0 - 800 A	19" / 600 mm	37 HU / 2000 mm	800 mm	700 kg
NYN 35000 - 35 3)	0 - 35 V	0 - 1000 A	19" / 600 mm	37 HU / 2000 mm	800 mm	900 kg
NYN 70000 - 35 3)	0 - 35 V	0 - 2000 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1300 kg
NYN 7000 - 65 3)	0 - 65 V	0 - 100 A	19" / 600 mm	18 HU / 1100 mm	650 mm	260 kg
NYN 10500 - 65 3)	0 - 65 V	0 - 150 A	19" / 600 mm	27 HU / 1500 mm	650 mm	360 kg
NYN 14000 - 65 3)	0 - 65 V	0 - 200 A	19" / 600 mm	27 HU / 1500 mm	650 mm	400 kg
NYN 21000 - 65 3)	0 - 65 V	0 - 300 A	19" / 600 mm	37 HU / 2000 mm	800 mm	480 kg
NYN 28000 - 65 3)	0 - 65 V	0 - 400 A	19" / 600 mm	37 HU / 2000 mm	800 mm	680 kg
NYN 35000 - 65 3)	0 - 65 V	0 - 500 A	19" / 600 mm	37 HU / 2000 mm	800 mm	850 kg
NYN 70000 - 65 3)	0 - 65 V	0 - 1000 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1250 kg

3) Mains connection three-phase

Double stabilized power supplies see series NTN page 6

# Low voltage power supplies

## Series NYN from 125 V to 350 V / 7 kW to 100 kW

Type	Voltage	Current	Width	Height	Depth	Weight
NYN 7000 - 125 3)	0 - 125 V	0 - 50 A	19" / 600 mm	18 HU / 1100 mm	650 mm	220 kg
NYN 10500 - 125 3)	0 - 125 V	0 - 80 A	19" / 600 mm	18 HU / 1100 mm	650 mm	330 kg
NYN 14000 - 125 3)	0 - 125 V	0 - 100 A	19" / 600 mm	27 HU / 1500 mm	650 mm	400 kg
NYN 21000 - 125 3)	0 - 125 V	0 - 150 A	19" / 600 mm	37 HU / 2000 mm	800 mm	450 kg
NYN 28000 - 125 3)	0 - 125 V	0 - 200 A	19" / 600 mm	37 HU / 2000 mm	800 mm	650 kg
NYN 35000 - 125 3)	0 - 125 V	0 - 250 A	19" / 600 mm	37 HU / 2000 mm	800 mm	800 kg
NYN 50000 - 125 3)	0 - 125 V	0 - 400 A	19" / 600 mm	37 HU / 2000 mm	800 mm	1100 kg
NYN 100000 - 125 3)	0 - 125 V	0 - 800 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1600 kg
NYN 7000 - 200 3)	0 - 200 V	0 - 30 A	19" / 600 mm	18 HU / 1100 mm	650 mm	220 kg
NYN 10500 - 200 3)	0 - 200 V	0 - 50 A	19" / 600 mm	18 HU / 1100 mm	650 mm	330 kg
NYN 14000 - 200 3)	0 - 200 V	0 - 60 A	19" / 600 mm	27 HU / 1500 mm	650 mm	380 kg
NYN 21000 - 200 3)	0 - 200 V	0 - 100 A	19" / 600 mm	37 HU / 2000 mm	800 mm	450 kg
NYN 28000 - 200 3)	0 - 200 V	0 - 120 A	19" / 600 mm	37 HU / 2000 mm	800 mm	630 kg
NYN 35000 - 200 3)	0 - 200 V	0 - 150 A	19" / 600 mm	37 HU / 2000 mm	800 mm	750 kg
NYN 50000 - 200 3)	0 - 200 V	0 - 250 A	19" / 600 mm	37 HU / 2000 mm	800 mm	1100 kg
NYN 100000 - 200 3)	0 - 200 V	0 - 500 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1500 kg
NYN 7000 - 350 3)	0 - 350 V	0 - 20 A	19" / 600 mm	18 HU / 1100 mm	650 mm	220 kg
NYN 10500 - 350 3)	0 - 350 V	0 - 30 A	19" / 600 mm	18 HU / 1100 mm	650 mm	330 kg
NYN 14000 - 350 3)	0 - 350 V	0 - 40 A	19" / 600 mm	27 HU / 1500 mm	650 mm	380 kg
NYN 21000 - 350 3)	0 - 350 V	0 - 60 A	19" / 600 mm	37 HU / 2000 mm	800 mm	450 kg
NYN 28000 - 350 3)	0 - 350 V	0 - 80 A	19" / 600 mm	37 HU / 2000 mm	800 mm	630 kg
NYN 35000 - 350 3)	0 - 350 V	0 - 100 A	19" / 600 mm	37 HU / 2000 mm	800 mm	750 kg
NYN 70000 - 350 3)	0 - 350 V	0 - 200 A	19" / 600 mm	37 HU / 2000 mm	800 mm	1200 kg
NYN 100000 - 350 3)	0 - 350 V	0 - 300 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1500 kg

3) Mains connection three-phase

Units with higher voltages see next page !

# Medium voltage power supplies

## Series MYN from 650 V to 2000 V / 7 kW to 70 kW

Type	Voltage	Current	Width	Height	Depth	Weight
MYN 7000 - 650 3)	0 - 650 V	0 - 10 A	19" / 600 mm	18 HU / 1100 mm	650 mm	230 kg
MYN 10500 - 650 3)	0 - 650 V	0 - 15 A	19" / 600 mm	27 HU / 1500 mm	650 mm	340 kg
MYN 14000 - 650 3)	0 - 650 V	0 - 20 A	19" / 600 mm	27 HU / 1500 mm	650 mm	400 kg
MYN 21000 - 650 3)	0 - 650 V	0 - 30 A	19" / 600 mm	37 HU / 2000 mm	800 mm	480 kg
MYN 28000 - 650 3)	0 - 650 V	0 - 40 A	19" / 600 mm	37 HU / 2000 mm	800 mm	600 kg
MYN 35000 - 650 3)	0 - 650 V	0 - 50 A	19" / 600 mm	37 HU / 2000 mm	800 mm	800 kg
MYN 70000 - 650 3)	0 - 650 V	0 - 100 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1400 kg
MYN 7000 - 1250 3)	0 - 1250 V	0 - 5 A	19" / 600 mm	18 HU / 1100 mm	650 mm	230 kg
MYN 10500 - 1250 3)	0 - 1250 V	0 - 8 A	19" / 600 mm	27 HU / 1500 mm	650 mm	340 kg
MYN 14000 - 1250 3)	0 - 1250 V	0 - 10 A	19" / 600 mm	27 HU / 1500 mm	650 mm	400 kg
MYN 21000 - 1250 3)	0 - 1250 V	0 - 15 A	19" / 600 mm	37 HU / 2000 mm	800 mm	480 kg
MYN 28000 - 1250 3)	0 - 1250 V	0 - 20 A	19" / 600 mm	37 HU / 2000 mm	800 mm	600 kg
MYN 35000 - 1250 3)	0 - 1250 V	0 - 25 A	19" / 600 mm	37 HU / 2000 mm	800 mm	800 kg
MYN 70000 - 1250 3)	0 - 1250 V	0 - 50 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1400 kg
MYN 7000 - 2000 3)	0 - 2000 V	0 - 3 A	19" / 600 mm	18 HU / 1100 mm	650 mm	230 kg
MYN 10500 - 2000 3)	0 - 2000 V	0 - 5 A	19" / 600 mm	27 HU / 1500 mm	650 mm	340 kg
MYN 14000 - 2000 3)	0 - 2000 V	0 - 6 A	19" / 600 mm	37 HU / 2000 mm	800 mm	400 kg
MYN 21000 - 2000 3)	0 - 2000 V	0 - 10 A	19" / 600 mm	37 HU / 2000 mm	800 mm	480 kg
MYN 28000 - 2000 3)	0 - 2000 V	0 - 12 A	19" / 600 mm	37 HU / 2000 mm	800 mm	600 kg
MYN 35000 - 2000 3)	0 - 2000 V	0 - 15 A	19" / 600 mm	37 HU / 2000 mm	800 mm	800 kg
MYN 50000 - 2000 3)	0 - 2000 V	0 - 25 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1200 kg

3) Mains connection three-phase

We design & build also units with different voltages, current and power



# High voltage power supplies

## Series HYN from 3500 V to 20000 V / 7 kW to 70 kW

Type	Voltage	Current	Width	Height	Depth	Weight
HYN 7000 - 3500 3)	0 - 3500 V	0 - 2 A	19" / 600 mm	27 HU / 1500 mm	650 mm	230 kg
HYN 10500 - 3500 3)	0 - 3500 V	0 - 3 A	19" / 600 mm	27 HU / 1500 mm	650 mm	340 kg
HYN 14000 - 3500 3)	0 - 3500 V	0 - 4 A	19" / 600 mm	27 HU / 1500 mm	650 mm	400 kg
HYN 21000 - 3500 3)	0 - 3500 V	0 - 6 A	19" / 600 mm	37 HU / 2000 mm	800 mm	480 kg
HYN 28000 - 3500 3)	0 - 3500 V	0 - 8 A	19" / 600 mm	37 HU / 2000 mm	800 mm	600 kg
HYN 35000 - 3500 3)	0 - 3500 V	0 - 10 A	19" / 600 mm	37 HU / 2000 mm	800 mm	800 kg
HYN 70000 - 3500 3)	0 - 3500 V	0 - 20 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1400 kg
HYN 7000 - 6500 3)	0 - 6500 V	0 - 1 A	19" / 600 mm	27 HU / 1500 mm	650 mm	230 kg
HYN 10500 - 6500 3)	0 - 6500 V	0 - 1,5 A	19" / 600 mm	27 HU / 1500 mm	650 mm	340 kg
HYN 14000 - 6500 3)	0 - 6500 V	0 - 2 A	19" / 600 mm	37 HU / 2000 mm	800 mm	400 kg
HYN 21000 - 6500 3)	0 - 6500 V	0 - 3 A	19" / 600 mm	37 HU / 2000 mm	800 mm	480 kg
HYN 28000 - 6500 3)	0 - 6500 V	0 - 4 A	19" / 600 mm	37 HU / 2000 mm	800 mm	600 kg
HYN 35000 - 6500 3)	0 - 6500 V	0 - 5 A	19" / 600 mm	37 HU / 2000 mm	800 mm	800 kg
HYN 70000 - 6500 3)	0 - 6500 V	0 - 10 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1400 kg
HYN 7000 - 12500 3)	0 - 12500 V	0 - 0,5 A	19" / 600 mm	27 HU / 1500 mm	650 mm	230 kg
HYN 10500 - 12500 3)	0 - 12500 V	0 - 0,8 A	19" / 600 mm	27 HU / 1500 mm	650 mm	340 kg
HYN 14000 - 12500 3)	0 - 12500 V	0 - 1 A	19" / 600 mm	37 HU / 2000 mm	800 mm	400 kg
HYN 21000 - 12500 3)	0 - 12500 V	0 - 1,5 A	19" / 600 mm	37 HU / 2000 mm	800 mm	480 kg
HYN 28000 - 12500 3)	0 - 12500 V	0 - 2 A	19" / 600 mm	37 HU / 2000 mm	800 mm	600 kg
HYN 35000 - 12500 3)	0 - 12500 V	0 - 2,5 A	19" / 600 mm	37 HU / 2000 mm	800 mm	800 kg
HYN 50000 - 12500 3)	0 - 12500 V	0 - 4 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1200 kg
HYN 7000 - 20000 3)	0 - 20000 V	0 - 0,3 A	19" / 600 mm	27 HU / 1500 mm	650 mm	230 kg
HYN 10500 - 20000 3)	0 - 20000 V	0 - 0,5 A	19" / 600 mm	27 HU / 1500 mm	650 mm	340 kg
HYN 14000 - 20000 3)	0 - 20000 V	0 - 0,6 A	19" / 600 mm	37 HU / 2000 mm	800 mm	400 kg
HYN 21000 - 20000 3)	0 - 20000 V	0 - 1 A	19" / 600 mm	37 HU / 2000 mm	800 mm	480 kg
HYN 28000 - 20000 3)	0 - 20000 V	0 - 1,2 A	19" / 600 mm	37 HU / 2000 mm	800 mm	600 kg
HYN 35000 - 20000 3)	0 - 20000 V	0 - 1,5 A	19" / 600 mm	37 HU / 2000 mm	800 mm	800 kg
HYN 50000 - 20000 3)	0 - 20000 V	0 - 2,5 A	2 x 19" / 1200 mm	37 HU / 2000 mm	800 mm	1200 kg

3) Mains connection three-phase

For orders without polarity reversal, please indicate the polarity

Low voltage power supplies  
linear controlled, fast programmable,  
unipolar and bipolar

Design examples



**NLN 1400 - 350**  
350 V / 4 A



**NLB 350 - 20**  
 $\pm 20$  V /  $\pm 15$  A

Bipolar power supplies for high voltage please see page 46

# Linear controlled power supplies, unipolar and bipolar

## Series NLN (unipolar) from 6,5 V to 500 V / 35 W to 1400 W

## Series NLB (bipolar) from ±6,5 V to 350 V / 35 W to 1400 W

### Function

Series regulated with a set of parallel power transistors; bipolar units have a push-pull output stage.

### Features

- Output voltage and output current are fast programmable
- No output capacitor
- All units are short circuit proof and allow unlimited operation with full current in short circuit condition
- Voltage and current regulation with automatic and sharp transition
- Control mode indicated by LEDs
- Voltage and current setting with 10-turn potentiometers with precision scale ; the adjusting knob can be locked.
- At bipolar units the potentiometer is used for voltage or current, the limiting values can be adjusted in addition.
- 3½ digit DVM for voltage and current (at ½19" units switch-selected)
- Sensor terminals for the compensation of voltage drop on the load lines, for units up to 350 V nominal voltage. The rated voltage always refers to the output terminals.

- Suitable for inductive and capacitive loads
- With bipolar units a 4-quadrant operation is possible on passive loads.
- Standard starting current limitation from 700 W nominal power on

### Design

- NLN with 35 W nominal power - ½19" table-top case, other models - 19" table-top case.
- 19" rack-adapters see page 56
- Cooling: Convection or built-in fan with air outlet on the rear

### Outputs

- 4 mm safety connectors up to 20 A on the front panel. For higher currents clamps on the rear.

### Technical Data

- Mains connection: 230 V ±10% 47 Hz to 63 Hz
- Ambient temperature: 0°C to +40°C
- Output isolation: The output is floating. Operating voltage with respect to earth: max. ±500 V. Either the positive or the negative terminal may be connected to earth.

All further data apply for voltage and current regulation and refer to the rated value, if not otherwise stated.

### For NLN series:

- Setting range: from appr. 0,1% to 100%
- Setting resolution:  $\pm 1 \times 10^{-4}$
- Reproducibility:  $\pm 1 \times 10^{-3}$
- Power lost: at nominal load approx. 25%, during short circuit approx. 125% of the nominal power.

### For NLB series:

- Setting range: from -100% ..0.. +100%
- Setting resolution:  $\pm 2 \times 10^{-4}$
- Reproducibility:  $\pm 2 \times 10^{-3}$
- Power lost: at nominal load approx. 35%, during short circuit with nominal current approx. 140% and at no load approx. 15% of the nominal power.

The following data are valid for NLN and NLB.

- Residual ripple:  $< 5 \times 10^{-4} \text{pp} + 10 \text{ mVpp}$
- Deviation: for ±10% mains voltage variation:  $< \pm 2 \times 10^{-5}$

- For no load / full load:  $< \pm 2 \times 10^{-4}$
- Over 8 hours under constant conditions:  $< \pm 2 \times 10^{-4}$
- Within the temperature range  $< \pm 2 \times 10^{-4} / \text{K}$
- Recovery time for load changes:  $< 50 \mu\text{s}$  for load changes from 10% to 100% or from 100% to 10%.
- Programming speed:  $< 1 \text{ ms}$  for the full range

### Options

- Analog programming
- Analog programming, floating
- IEEE488 / RS232 interface
- DVM with higher resolution
- For unipolar units active pull-down control. Parallel to the output a set of power transistors is working as a current sink.
- Full 4-quadrant operation for bipolar units also for active loads.
- Higher programming speed

For more information on our options please see pages 60 and 61. Also, some options may contain changes of the description of the unit.

Types see next pages

# Linear controlled power supplies, unipolar

## Series NLN from 6,5 V to 65 V / 35 W to 1400 W

Type	Voltage	Current	Width	Height	Depth	Weight
NLN 35 - 6,5	0 - 6,5 V	0 - 5 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NLN 140 - 6,5	0 - 6,5 V	0 - 10 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
NLN 350 - 6,5	0 - 6,5 V	0 - 30 A	19" / 443 mm	4 HU / 177 mm	450 mm	19 kg
NLN 700 - 6,5	0 - 6,5 V	0 - 60 A	19" / 443 mm	4 HU / 177 mm	550 mm	25 kg
NLN 1400 - 6,5	0 - 6,5 V	0 - 120 A	19" / 443 mm	7 HU / 310 mm	550 mm	50 kg
NLN 35 - 12,5	0 - 12,5 V	0 - 2,5 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NLN 140 - 12,5	0 - 12,5 V	0 - 8 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
NLN 350 - 12,5	0 - 12,5 V	0 - 20 A	19" / 443 mm	4 HU / 177 mm	450 mm	19 kg
NLN 700 - 12,5	0 - 12,5 V	0 - 50 A	19" / 443 mm	4 HU / 177 mm	550 mm	25 kg
NLN 1400 - 12,5	0 - 12,5 V	0 - 80 A	19" / 443 mm	7 HU / 310 mm	550 mm	50 kg
NLN 35 - 20	0 - 20 V	0 - 1,5 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NLN 140 - 20	0 - 20 V	0 - 6 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
NLN 350 - 20	0 - 20 V	0 - 15 A	19" / 443 mm	4 HU / 177 mm	450 mm	19 kg
NLN 700 - 20	0 - 20 V	0 - 30 A	19" / 443 mm	4 HU / 177 mm	550 mm	25 kg
NLN 1400 - 20	0 - 20 V	0 - 60 A	19" / 443 mm	7 HU / 310 mm	550 mm	50 kg
NLN 35 - 35	0 - 35 V	0 - 1 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NLN 140 - 35	0 - 35 V	0 - 4 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
NLN 350 - 35	0 - 35 V	0 - 10 A	19" / 443 mm	4 HU / 177 mm	450 mm	19 kg
NLN 700 - 35	0 - 35 V	0 - 20 A	19" / 443 mm	4 HU / 177 mm	550 mm	25 kg
NLN 1400 - 35	0 - 35 V	0 - 40 A	19" / 443 mm	7 HU / 310 mm	550 mm	50 kg
NLN 35 - 65	0 - 65 V	0 - 0,5 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NLN 140 - 65	0 - 65 V	0 - 2 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
NLN 350 - 65	0 - 65 V	0 - 5 A	19" / 443 mm	4 HU / 177 mm	450 mm	19 kg
NLN 700 - 65	0 - 65 V	0 - 10 A	19" / 443 mm	4 HU / 177 mm	550 mm	25 kg
NLN 1400 - 65	0 - 65 V	0 - 20 A	19" / 443 mm	7 HU / 310 mm	550 mm	50 kg

On request we deliver these power supplies up to 20 kW !

# Linear controlled power supplies, unipolar

## Series NLN from 125 V to 500 V / 35 W to 1400 W

Type	Voltage	Current	Width	Height	Depth	Weight
NLN 35 - 125	0 - 125 V	0 - 0,25 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NLN 140 - 125	0 - 125 V	0 - 1 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
NLN 350 - 125	0 - 125 V	0 - 2,5 A	19" / 443 mm	4 HU / 177 mm	450 mm	19 kg
NLN 700 - 125	0 - 125 V	0 - 5 A	19" / 443 mm	4 HU / 177 mm	550 mm	25 kg
NLN 1400 - 125	0 - 125 V	0 - 10 A	19" / 443 mm	7 HU / 310 mm	550 mm	50 kg
NLN 35 - 200	0 - 200 V	0 - 0,15 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NLN 140 - 200	0 - 200 V	0 - 0,6 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
NLN 350 - 200	0 - 200 V	0 - 1,5 A	19" / 443 mm	4 HU / 177 mm	450 mm	19 kg
NLN 700 - 200	0 - 200 V	0 - 3 A	19" / 443 mm	4 HU / 177 mm	550 mm	25 kg
NLN 1400 - 200	0 - 200 V	0 - 6 A	19" / 443 mm	7 HU / 310 mm	550 mm	50 kg
NLN 35 - 350	0 - 350 V	0 - 0,1 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NLN 140 - 350	0 - 350 V	0 - 0,4 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
NLN 350 - 350	0 - 350 V	0 - 1 A	19" / 443 mm	4 HU / 177 mm	450 mm	19 kg
NLN 700 - 350	0 - 350 V	0 - 2 A	19" / 443 mm	4 HU / 177 mm	550 mm	25 kg
NLN 1400 - 350	0 - 350 V	0 - 4 A	19" / 443 mm	7 HU / 310 mm	550 mm	50 kg
NLN 35 - 500	0 - 500 V	0 - 0,06 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
NLN 140 - 500	0 - 500 V	0 - 0,25 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
NLN 350 - 500	0 - 500 V	0 - 0,6 A	19" / 443 mm	4 HU / 177 mm	450 mm	19 kg
NLN 700 - 500	0 - 500 V	0 - 1,2 A	19" / 443 mm	4 HU / 177 mm	550 mm	25 kg
NLN 1400 - 500	0 - 500 V	0 - 2,5 A	19" / 443 mm	7 HU / 310 mm	550 mm	50 kg

On request we deliver these power supplies up to 20 kW !

# Linear controlled power supplies, bipolar

## Series NLB from 6,5 V to 35 V / 35 W to 1400 W

Type	Voltage	Current	Width	Height	Depth	Weight
NLB 35 - 6,5	0 - $\pm 6,5$ V	0 - $\pm 5$ A	19" / 443 mm	4 HU / 177 mm	350 mm	9 kg
NLB 140 - 6,5	0 - $\pm 6,5$ V	0 - $\pm 10$ A	19" / 443 mm	4 HU / 177 mm	350 mm	12 kg
NLB 350 - 6,5	0 - $\pm 6,5$ V	0 - $\pm 30$ A	19" / 443 mm	4 HU / 177 mm	550 mm	22 kg
NLB 700 - 6,5	0 - $\pm 6,5$ V	0 - $\pm 60$ A	19" / 443 mm	5 HU / 221 mm	550 mm	35 kg
NLB 1400 - 6,5	0 - $\pm 6,5$ V	0 - $\pm 120$ A	19" / 443 mm	7 HU / 310 mm	550 mm	55 kg
NLB 35 - 12,5	0 - $\pm 12,5$ V	0 - $\pm 2,5$ A	19" / 443 mm	4 HU / 177 mm	350 mm	9 kg
NLB 140 - 12,5	0 - $\pm 12,5$ V	0 - $\pm 8$ A	19" / 443 mm	4 HU / 177 mm	350 mm	12 kg
NLB 350 - 12,5	0 - $\pm 12,5$ V	0 - $\pm 20$ A	19" / 443 mm	4 HU / 177 mm	550 mm	22 kg
NLB 700 - 12,5	0 - $\pm 12,5$ V	0 - $\pm 50$ A	19" / 443 mm	5 HU / 221 mm	550 mm	35 kg
NLB 1400 - 12,5	0 - $\pm 12,5$ V	0 - $\pm 80$ A	19" / 443 mm	7 HU / 310 mm	550 mm	55 kg
NLB 35 - 20	0 - $\pm 20$ V	0 - $\pm 1,5$ A	19" / 443 mm	4 HU / 177 mm	350 mm	9 kg
NLB 140 - 20	0 - $\pm 20$ V	0 - $\pm 6$ A	19" / 443 mm	4 HU / 177 mm	350 mm	12 kg
NLB 350 - 20	0 - $\pm 20$ V	0 - $\pm 15$ A	19" / 443 mm	4 HU / 177 mm	550 mm	22 kg
NLB 700 - 20	0 - $\pm 20$ V	0 - $\pm 30$ A	19" / 443 mm	5 HU / 221 mm	550 mm	35 kg
NLB 1400 - 20	0 - $\pm 20$ V	0 - $\pm 60$ A	19" / 443 mm	7 HU / 310 mm	550 mm	55 kg
NLB 35 - 35	0 - $\pm 35$ V	0 - $\pm 1$ A	19" / 443 mm	4 HU / 177 mm	350 mm	9 kg
NLB 140 - 35	0 - $\pm 35$ V	0 - $\pm 4$ A	19" / 443 mm	4 HU / 177 mm	350 mm	12 kg
NLB 350 - 35	0 - $\pm 35$ V	0 - $\pm 10$ A	19" / 443 mm	4 HU / 177 mm	550 mm	22 kg
NLB 700 - 35	0 - $\pm 35$ V	0 - $\pm 20$ A	19" / 443 mm	5 HU / 221 mm	550 mm	35 kg
NLB 1400 - 35	0 - $\pm 35$ V	0 - $\pm 40$ A	19" / 443 mm	7 HU / 310 mm	550 mm	55 kg

On request we deliver these power supplies up to 5 kW !

# Linear controlled power supplies, bipolar

## Series NLB from 65 V to 350 V / 35 W to 1400 W

Type	Voltage	Current	Width	Height	Depth	Weight
NLB 35 - 65	0 - $\pm 65$ V	0 - $\pm 0,5$ A	19" / 443 mm	4 HU / 177 mm	350 mm	9 kg
NLB 140 - 65	0 - $\pm 65$ V	0 - $\pm 2$ A	19" / 443 mm	4 HU / 177 mm	350 mm	12 kg
NLB 350 - 65	0 - $\pm 65$ V	0 - $\pm 5$ A	19" / 443 mm	4 HU / 177 mm	550 mm	22 kg
NLB 700 - 65	0 - $\pm 65$ V	0 - $\pm 10$ A	19" / 443 mm	5 HU / 221 mm	550 mm	35 kg
NLB 1400 - 65	0 - $\pm 65$ V	0 - $\pm 20$ A	19" / 443 mm	7 HU / 310 mm	550 mm	55 kg
NLB 35 - 125	0 - $\pm 125$ V	0 - $\pm 0,25$ A	19" / 443 mm	4 HU / 177 mm	350 mm	9 kg
NLB 140 - 125	0 - $\pm 125$ V	0 - $\pm 1$ A	19" / 443 mm	4 HU / 177 mm	350 mm	12 kg
NLB 350 - 125	0 - $\pm 125$ V	0 - $\pm 2,5$ A	19" / 443 mm	4 HU / 177 mm	550 mm	22 kg
NLB 700 - 125	0 - $\pm 125$ V	0 - $\pm 5$ A	19" / 443 mm	5 HU / 221 mm	550 mm	35 kg
NLB 1400 - 125	0 - $\pm 125$ V	0 - $\pm 10$ A	19" / 443 mm	7 HU / 310 mm	550 mm	55 kg
NLB 35 - 200	0 - $\pm 200$ V	0 - $\pm 0,15$ A	19" / 443 mm	4 HU / 177 mm	350 mm	9 kg
NLB 140 - 200	0 - $\pm 200$ V	0 - $\pm 0,6$ A	19" / 443 mm	4 HU / 177 mm	350 mm	12 kg
NLB 350 - 200	0 - $\pm 200$ V	0 - $\pm 1,5$ A	19" / 443 mm	4 HU / 177 mm	550 mm	22 kg
NLB 700 - 200	0 - $\pm 200$ V	0 - $\pm 3$ A	19" / 443 mm	5 HU / 221 mm	550 mm	35 kg
NLB 1400 - 200	0 - $\pm 200$ V	0 - $\pm 6$ A	19" / 443 mm	7 HU / 310 mm	550 mm	55 kg
NLB 35 - 350	0 - $\pm 350$ V	0 - $\pm 0,1$ A	19" / 443 mm	4 HU / 177 mm	350 mm	9 kg
NLB 140 - 350	0 - $\pm 350$ V	0 - $\pm 0,4$ A	19" / 443 mm	4 HU / 177 mm	350 mm	12 kg
NLB 350 - 350	0 - $\pm 350$ V	0 - $\pm 1$ A	19" / 443 mm	4 HU / 177 mm	550 mm	22 kg
NLB 700 - 350	0 - $\pm 350$ V	0 - $\pm 2$ A	19" / 443 mm	5 HU / 221 mm	550 mm	35 kg
NLB 1400 - 350	0 - $\pm 350$ V	0 - $\pm 4$ A	19" / 443 mm	7 HU / 310 mm	550 mm	55 kg

On request we deliver these power supplies up to 5 kW !



## Design examples

### HCN 7E - Cassettes

2000 V / 7 W  
12500 V / 7 W  
35000 V / 7 W

Table-top cases are available as accessories



### Function

The rectified line voltage maintains a square wave generator of constant frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For the regulation the square wave voltage is pulse width modulated.

### Features

- Compact size
- Light-weight
- For units from 6,5 kV nominal voltage on, all HV components are moulded in (removable) silicon
- Short circuit and flashover proof
- Unlimited operation with rated current in a short-circuit condition
- Unlimited operation with rated power
- Voltage regulation with current limitation
- Control mode indicated by LEDs
- Voltage setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked

- Standard analog programming plus HV ON/OFF input and monitor outputs
- Measuring terminals for voltage and current on the front panel
- Suitable for capacitive loads
- Suitable for photomultipliers

### Design

- IMS-cassette design. Width depending on types
- 19" chassis and table-top cases are available as an option

### Outputs

- For units up to 650 V nominal voltage, the output is on 4 mm safety connectors
- From 1250 V nominal voltage on, HV-connectors are provided.
- Outputs are located on the rear of the units
- Mating HV-connectors are included.

### Technical Data

- Mains connection: 230 V  $\pm 10\%$  47 Hz to 63 Hz
  - Ambient temperature: 0°C to +40°C
  - Output isolation: Up to 350 V nominal voltage the output is floating. Operating voltage with respect to earth is max.  $\pm 500$  V.
- From 650 V nominal voltage on the "0V" terminal is connected to earth but may be disconnected as needed. The "0V" terminal than is earthy and may float with respect to earth up to  $\pm 300$  V. The polarity is positive or negative.

### The polarity has to be indicated with the order.

All further data apply to voltage regulation and refer to the rated value.

- Setting range: from appr. 0,1% to 100%
- Setting resolution:  $\pm 1 \times 10^{-4}$

- Reproducibility:  $\pm 1 \times 10^{-3}$
- Residual ripple:  $< 1 \times 10^{-4}$ pp +50mVpp typ.  $5 \times 10^{-5}$ pp
- Deviation: for  $\pm 10\%$  mains voltage variation:  $< \pm 1 \times 10^{-5}$  for no load / full load:  $< 2 \times 10^{-4}$  over 8 hours under constant conditions:  $< \pm 1 \times 10^{-4}$  within the temperature range:  $< \pm 1,5 \times 10^{-4} / K$
- Recovery time:  $< 1$ ms for load changes from 10% to 100% or from 100% to 10%.
- Setting time at nominal load:  $< 200$ ms for changes of the output voltage from 10% to 90% or 90% to 10%.
- Discharging time constant for output without load: approx. 0,5 sec. to 2 sec (depending on type).

Cassette Power Supplies Series HCE see page 26.



# High voltage cassettes

## Series HCN 7E from 125 V to 35000 V / 7 W



Design example

19"- chassis for  
6 HCN 7E - cassettes,  
available as accessories

Type	Voltage	Current	Width	Height	Depth	Weight
HCN 7E - 125	0 - 125 V	max. 50 mA	2/12 19" / 69 mm	4 HU / 177 mm	250 mm	2 kg
HCN 7E - 200	0 - 200 V	max. 30 mA	2/12 19" / 69 mm	4 HU / 177 mm	250 mm	2 kg
HCN 7E - 350	0 - 350 V	max. 20 mA	2/12 19" / 69 mm	4 HU / 177 mm	250 mm	2 kg
HCN 7E - 650	0 - 650 V	max. 10 mA	2/12 19" / 69 mm	4 HU / 177 mm	250 mm	2 kg
HCN 7E - 1250	0 - 1250 V	max. 5 mA	2/12 19" / 69 mm	4 HU / 177 mm	250 mm	2 kg
HCN 7E - 2000	0 - 2000 V	max. 3 mA	2/12 19" / 69 mm	4 HU / 177 mm	250 mm	2 kg
HCN 7E - 3500	0 - 3500 V	max. 2 mA	2/12 19" / 69 mm	4 HU / 177 mm	250 mm	2 kg
HCN 7E - 6500	0 - 6500 V	max. 1 mA	2/12 19" / 69 mm	4 HU / 177 mm	250 mm	2 kg
HCN 7E - 12500	0 - 12500 V	max. 0,5 mA	2/12 19" / 69 mm	4 HU / 177 mm	250 mm	2 kg
HCN 7E - 20000	0 - 20000 V	max. 0,3 mA	2/12 19" / 69 mm	4 HU / 177 mm	250 mm	2 kg
HCN 7E - 35000	0 - 35000 V	max. 0,2 mA	3/12 19" / 104 mm	4 HU / 177 mm	250 mm	3,5 kg

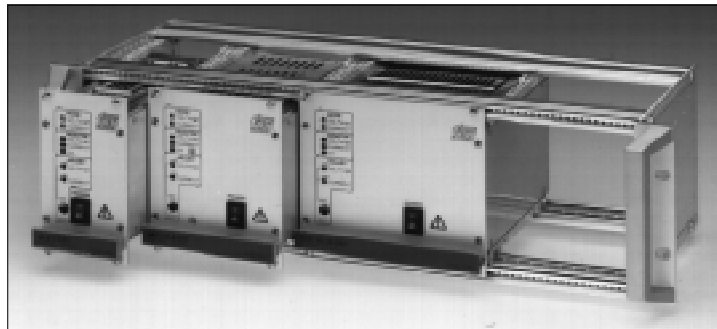
When placing an order for cassettes from 650 V nominal voltage on, please indicate the output polarity.



Design examples

## HCE - Cassettes

6500 V / 7 W  
20000 V / 7 W  
35000 V / 35 W



Picture on the left :  
On the rear of the cassette are the mains connector, the HV-output and the programming terminal.

Picture on the right:  
19" frames are available as an option.

### Function

The rectified line voltage maintains a square wave generator of constant frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For the regulation the square wave voltage is pulse width modulated.

### Features

- Compact size
- Light-weight
- For units from 6,5 kV nominal voltage on, all HV components are moulded in (removable) silicon
- Short circuit and flashover proof
- Unlimited operation with rated current in a short-circuit condition
- Unlimited operation with rated power
- Voltage regulation
- Adjustable current limitation
- Control mode indicated by LEDs
- Voltage and current adjustment on the front panel is possible with a screwdriver

- Standard analog programming plus HV ON/OFF input and monitor outputs
- Measuring terminals for voltage and current on the front panel
- Suitable for capacitive loads
- Suitable for photomultipliers

### Design

- EURO-Cassette design. Widths depend on types
- 19" frames are available

### Outputs

- For units up to 650 V nominal voltage the output is on 4 mm safety connectors. From 1250 V nominal voltage on HV-connectors are provided. Outputs are located on the rear of the unit.
- Mating HV-connectors are included.

### Technical Data

- Mains connection: 230 V  $\pm 10\%$  47 Hz to 63 Hz
- Ambient temperature: 0°C to +40°C
- Output isolation: The "0V" - terminal of the output is connected to earth but may be disconnected as needed. The "0V" terminal than is earthy and may float with respect to earth up to  $\pm 125$  V. The polarity is positive or negative.

### The polarity has to be indicated when placing an order.

All further data apply for voltage regulation and refer to the rated value.

- Setting range: from appr. 0,1% to 100%
- Setting resolution:  $< \pm 1 \times 10^{-4}$

- Residual ripple:  $< 1 \times 10^{-4}$ pp +50mVpp typ.  $5 \times 10^{-5}$ pp
- Deviation: for  $\pm 10\%$  mains voltage variation:  $< \pm 1 \times 10^{-5}$  for no load / full load:  $< 2 \times 10^{-4}$  over 8 hours under constant conditions:  $< \pm 1 \times 10^{-4}$  within the temperature range:  $< \pm 1,5 \times 10^{-4}$  / K
- Recovery time:  $< 1$ ms for load changes from 10% to 100% or from 100% to 10%.
- Setting time at nominal load:  $< 200$ ms for changes of the output voltage from 10% to 90% or 90% to 10%.
- Discharging time constant for output without load: appr. 0,5 sec. to 5 sec., depending on type.

Cassette Power Supplies Series HCN 7E see page 24.

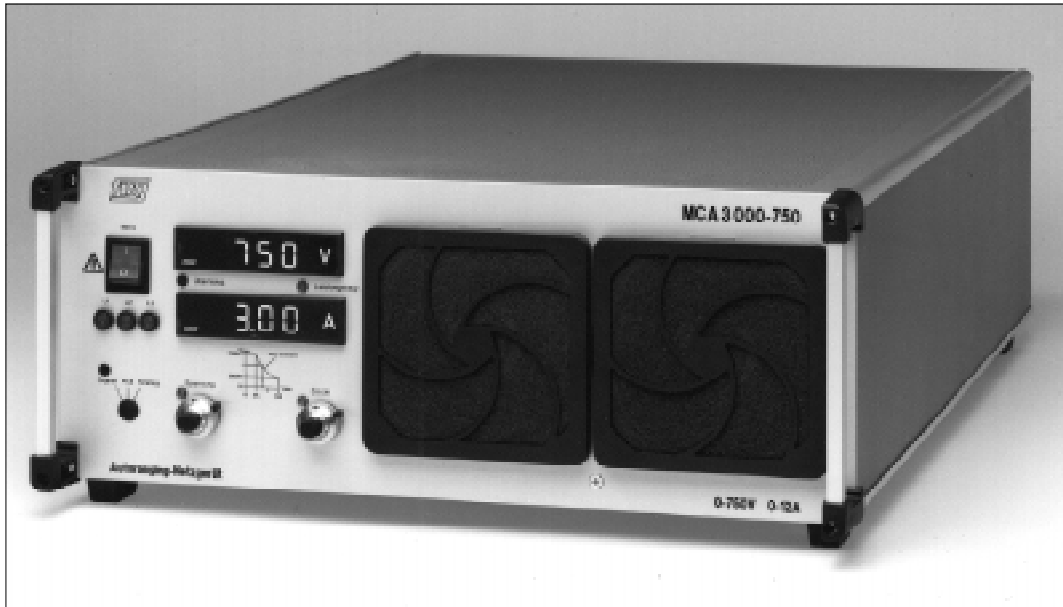
# High voltage cassettes

## Series HCE from 125 V to 35000 V / 7 W and 35 W

Type		Voltage	Current	Width	Height	Depth	Weight
HCE	7 - 125	0 - 125 V	0 - 50 mA	14 HP / 71 mm	3 HU / 133 mm	170 mm	1,2 kg
HCE	35 - 125	0 - 125 V	0 - 250 mA	21 HP / 107 mm	3 HU / 133 mm	170 mm	1,5 kg
HCE	7 - 200	0 - 200 V	0 - 30 mA	14 HP / 71 mm	3 HU / 133 mm	170 mm	1,2 kg
HCE	35 - 200	0 - 200 V	0 - 150 mA	21 HP / 107 mm	3 HU / 133 mm	170 mm	1,5 kg
HCE	7 - 350	0 - 350 V	0 - 20 mA	14 HP / 71 mm	3 HU / 133 mm	170 mm	1,2 kg
HCE	35 - 350	0 - 350 V	0 - 100 mA	21 HP / 107 mm	3 HU / 133 mm	170 mm	1,5 kg
HCE	7 - 650	0 - 650 V	0 - 10 mA	14 HP / 71 mm	3 HU / 133 mm	170 mm	1,2 kg
HCE	35 - 650	0 - 650 V	0 - 50 mA	21 HP / 107 mm	3 HU / 133 mm	170 mm	1,5 kg
HCE	7 - 1250	0 - 1250 V	0 - 5 mA	14 HP / 71 mm	3 HU / 133 mm	170 mm	1,2 kg
HCE	35 - 1250	0 - 1250 V	0 - 25 mA	21 HP / 107 mm	3 HU / 133 mm	170 mm	1,5 kg
HCE	7 - 2000	0 - 2000 V	0 - 3 mA	14 HP / 71 mm	3 HU / 133 mm	170 mm	1,2 kg
HCE	35 - 2000	0 - 2000 V	0 - 15 mA	21 HP / 107 mm	3 HU / 133 mm	170 mm	1,5 kg
HCE	7 - 3500	0 - 3500 V	0 - 2 mA	14 HP / 71 mm	3 HU / 133 mm	170 mm	1,2 kg
HCE	35 - 3500	0 - 3500 V	0 - 10 mA	21 HP / 107 mm	3 HU / 133 mm	170 mm	1,5 kg
HCE	7 - 6500	0 - 6500 V	0 - 1 mA	14 HP / 71 mm	3 HU / 133 mm	170 mm	1,3 kg
HCE	35 - 6500	0 - 6500 V	0 - 5 mA	21 HP / 107 mm	3 HU / 133 mm	170 mm	1,5 kg
HCE	7 - 12500	0 - 12500 V	0 - 0,5 mA	14 HP / 71 mm	3 HU / 133 mm	170 mm	1,3 kg
HCE	35 - 12500	0 - 12500 V	0 - 2,5 mA	21 HP / 107 mm	3 HU / 133 mm	170 mm	1,7 kg
HCE	7 - 20000	0 - 20000 V	0 - 0,3 mA	21 HP / 107 mm	3 HU / 133 mm	170 mm	2,3 kg
HCE	35 - 20000	0 - 20000 V	0 - 1,5 mA	21 HP / 107 mm	3 HU / 133 mm	170 mm	2,5 kg
HCE	7 - 35000	0 - 35000 V	0 - 0,2 mA	28 HP / 142 mm	3 HU / 133 mm	170 mm	2,5 kg
HCE	35 - 35000	0 - 35000 V	0 - 1 mA	28 HP / 142 mm	3 HU / 133 mm	170 mm	2,8 kg

Please indicate the output polarity when placing an order.

# Autoranging power supplies



## Design example

**MCA 3000 - 750**  
3000 W  
750 V / 12 A

### Function

Automatic adaption to the operating range, without switching, "AUTORANGING".

The rectified line voltage maintains a square wave generator of variable frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For the regulation the square wave voltage is pulse width modulated.

Because of the automatic power limitation it creates a large current/voltage range, which is approximately three times higher than in other power supplies.

### Features

- Compact size
- Light-weight
- High efficiency
- Short circuit proof
- Unlimited operation with nominal power and in a short-circuit condition.
- Voltage and current regulation with automatic, sharp transition and additional power limitation.
- Control mode indicated by LED
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- 3½ digit DVM for voltage and current
- Suitable for capacitive loads

### Design

- 19" table-top case
- 19" rack-adapters see page 56

### Outputs

- Units up to 750 V nominal voltage have 4mm safety connectors.  
From 1500 V nominal voltage on SHV connectors are provided. HV-cable connectors are included.

- Units from 24 A nominal current on have binding posts.

### Technical Data

- Mains connection:  
Up to 1500 W nominal power  
230 V  $\pm 10\%$  47 Hz to 63 Hz;

At 3000 W nominal power  
400 V  $\pm 10\%$  47 Hz to 63 Hz  
three-phase

- Ambient temperature:  
0°C to +40°C

- Output isolation:  
**up to 1500 V** nominal voltage the output is floating. Either the positive or the negative pole may be connected to earth. (Not valid with the option analog programming. If the floating function should remain, the floating analog programming must be chosen)

- Maximum isolation voltage:  
**up to 400 V** nominal voltage  $\pm 500$  V  
**at 750 V** nominal voltage  $\pm 1000$  V  
**at 1500 V** nominal voltage  $\pm 2000$  V  
**at 3000 V** nominal voltage one pole is earthed, the polarity must be indicated when ordering.

All further data apply for voltage and current regulation and refer to the rated value, if not otherwise stated.

- Setting range:  
from appr. 0,1% to 100%

- Setting resolution:  
 $\pm 1 \times 10^{-4}$

- Reproducibility:  
 $\pm 1 \times 10^{-3}$

- Residual ripple:  
 $< 2 \times 10^{-4}$ pp + 200 mVpp

- Deviation:  
for  $\pm 10\%$  mains voltage variation:  
 $< \pm 1 \times 10^{-5}$   
for no load / full load:  
 $< 5 \times 10^{-4}$   
over 8 h under const. cond.:  
 $< \pm 2 \times 10^{-4}$   
within the temperature range:  
 $< \pm 1 \times 10^{-4} / K$

- Recovery time:  
Voltage control:  
 $< 1$  ms for load changes from 10% to 100% or from 100% to 10%.

- Current control:  
 $< 10$  ms for load changes causing an output change of less than 10% of the rated voltage

- Setting time at nominal load:  
 $< 300$  ms for changes of the output voltage from 10% to 90% or 90% to 10%.

- Discharging time constant for output without load:  
approx. 10 sec.

### Options

- Analog programming
- Analog programming, floating

**Please note the remarks about the isolation voltage on page 60**

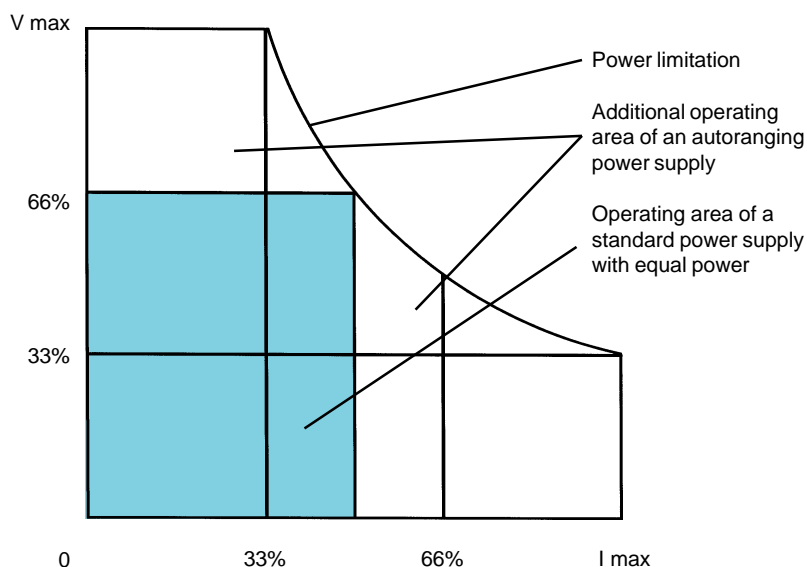
- DVM with higher resolution
- Computer interface  
IEEE 488 and RS 232

For more information on our options please see pages 60 and 61. Also, some options contain changes of the description of the unit.

# Autoranging power supplies

## Series NCA / MCA from 55 V to 3000 V

### 750 W; 1500 W; 3000 W



#### Operating area NCA / MCA units:

**Autoranging power supplies from F.u.G. have a three times larger operating area compared with standard power supplies with the same power.**

The power supply can operate either with full nominal voltage and about 1/3 of the nominal current or with full nominal current and about 1/3 of the nominal voltage.

Other values correspond to the diagram on the left. (e.g. 66% nominal voltage at 50% nominal current).

Type	Power max.	Voltage	Current	Width	Height	Depth	Weight
NCA 750 - 55 *)	750 W	0 - 55 V	0 - 40 A	19" / 443 mm	3 HU / 133 mm	350 mm	14 kg
NCA 1500 - 55 *)	1500 W	0 - 55 V	0 - 80 A	19" / 443 mm	4 HU / 177 mm	550 mm	24 kg
NCA 3000 - 55 3) *)	3000 W	0 - 55 V	0 - 160 A	19" / 443 mm	4 HU / 177 mm	650 mm	39 kg
MCA 750 - 150	750 W	0 - 150 V	0 - 15 A	19" / 443 mm	3 HU / 133 mm	350 mm	20 kg
MCA 1500 - 150 *)	1500 W	0 - 150 V	0 - 30 A	19" / 443 mm	4 HU / 177 mm	550 mm	22 kg
MCA 3000 - 150 3) *)	3000 W	0 - 150 V	0 - 60 A	19" / 443 mm	4 HU / 177 mm	650 mm	37 kg
MCA 750 - 400	750 W	0 - 400 V	0 - 6 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
MCA 1500 - 400	1500 W	0 - 400 V	0 - 12 A	19" / 443 mm	4 HU / 177 mm	550 mm	19 kg
MCA 3000 - 400 3) *)	3000 W	0 - 400 V	0 - 24 A	19" / 443 mm	4 HU / 177 mm	650 mm	35 kg
MCA 750 - 750	750 W	0 - 750 V	0 - 3 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
MCA 1500 - 750	1500 W	0 - 750 V	0 - 6 A	19" / 443 mm	4 HU / 177 mm	550 mm	18 kg
MCA 3000 - 750 3) *)	3000 W	0 - 750 V	0 - 12 A	19" / 443 mm	4 HU / 177 mm	650 mm	33 kg
MCA 750 - 1500	750 W	0 - 1500 V	0 - 1,5 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
MCA 1500 - 1500	1500 W	0 - 1500 V	0 - 3 A	19" / 443 mm	4 HU / 177 mm	550 mm	17 kg
MCA 3000 - 1500 3) *)	3000 W	0 - 1500 V	0 - 6 A	19" / 443 mm	4 HU / 177 mm	650 mm	32 kg
MCA 750 - 3000	750 W	0 - 3000 V	0 - 0,75 A	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
MCA 1500 - 3000	1500 W	0 - 3000 V	0 - 1,5 A	19" / 443 mm	4 HU / 177 mm	550 mm	17 kg
MCA 3000 - 3000 3) *)	3000 W	0 - 3000 V	0 - 3 A	19" / 443 mm	4 HU / 177 mm	650 mm	32 kg

3) Mains connection three-phase \*) These models have the output on the rear

When placing an order for power supplies of 3000 V nominal voltage, please indicate the output polarity

# Medium voltage power supplies



## Design example

**MCL 14 - 2000**  
2000 V / 6 mA

### Function

The rectified line voltage maintains a square wave generator of constant frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For the regulation the square wave voltage is pulse width modulated.

### Features

- Compact size
- Light-weight
- Efficiency appr. 90%
- Unlimited operation with rated current in a short-circuit condition

- Unlimited operation with nominal power
- Voltage and current regulation with automatic, sharp transition
- Control mode indicated by LED
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- 4½-digits DVM for voltage and current
- Suitable for inductive and capacitive loads

### Design

- ½19" table-top case
- 19" rackadapters are available as accessories

### Outputs

- At units up to 350 V nominal voltage 4 mm safety connectors.
- From 650 V nominal voltage on SHV high-voltage connectors, mating cable connectors are included.

### Technical Data

- Mains connection: 230 V ±10% 47 Hz to 63 Hz

- Ambient temperature: 0°C to +40°C
- Output isolation: The output is floating, either the positive or the negative pole may be connected to earth. (Not with standard analog programming)
- Maximum isolating voltage: **Up to 350 V** nominal voltage ±500 V **From 650 V** nominal voltage on ±2000 V

Further medium-voltage power supplies see page 32

# Medium voltage power supplies

## Series MCL from 125 V to 2000 V / 14 W to 350 W

All further data apply for voltage and current regulation and refer to the rated value, if not otherwise stated.

- Setting range:  
from appr. 0,1% to 100%
- Reproducibility:  
 $1 \times 10^{-3}$
- Residual ripple:  
 $<5 \times 10^{-5}$ pp + 50 mVpp

- Deviation:  
for  $\pm 10\%$  mains voltage variation:  $\pm 1 \times 10^{-5}$   
  
for no load / full load:  $<1 \times 10^{-4}$   
  
over 8 hours under constant conditions:  $<\pm 1 \times 10^{-4}$   
  
within the temperature range:  
 $<\pm 1 \times 10^{-4}/K$
- Recovery time:  
Voltage control:  
 $<1$  ms for load changes from 10% to 100%  
or from 100% to 10%.

### Current control:

- $<10$  ms for load changes causing an output change of less than 10% of the rated voltage
- Setting time at nominal load:  
 $<300$  ms for changes of the output voltage from 10% to 90% or from 90% to 10%, depending on type
- Discharging time constant  
approx. 2 to 10 sec. depending on type

### Options

- Analog programming
  - Analog programming, floating
- For information about the output isolation please see page 60
- Computer interface  
IEEE 488 and RS 232

Type	Voltage	Current	Width	Height	Depth	Weight
MCL 35 - 125	0 - 125 V	0 - 250 mA	½19" / 222 mm	2 HU 89 mm	450 mm	4 kg
MCL 140 - 125	0 - 125 V	0 - 1 A	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 350 - 125	0 - 125 V	0 - 2,5 A	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 35 - 200	0 - 200 V	0 - 150 mA	½19" / 222 mm	2 HU 89 mm	450 mm	4 kg
MCL 140 - 200	0 - 200 V	0 - 600 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 350 - 200	0 - 200 V	0 - 1,5 A	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 35 - 350	0 - 350 V	0 - 100 mA	½19" / 222 mm	2 HU 89 mm	450 mm	4 kg
MCL 140 - 350	0 - 350 V	0 - 400 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 350 - 350	0 - 350 V	0 - 1 A	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 14 - 650	0 - 650 V	0 - 20 mA	½19" / 222 mm	2 HU 89 mm	450 mm	4 kg
MCL 35 - 650	0 - 650 V	0 - 50 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 140 - 650	0 - 650 V	0 - 200 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 350 - 650	0 - 650 V	0 - 500 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 14 - 1250	0 - 1250 V	0 - 10 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 35 - 1250	0 - 1250 V	0 - 25 mA	½19" / 222 mm	2 HU 89 mm	450 mm	4 kg
MCL 140 - 1250	0 - 1250 V	0 - 100 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 350 - 1250	0 - 1250 V	0 - 250 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 14 - 2000	0 - 2000 V	0 - 6 mA	½19" / 222 mm	2 HU 89 mm	450 mm	4 kg
MCL 35 - 2000	0 - 2000 V	0 - 15 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 140 - 2000	0 - 2000 V	0 - 60 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
MCL 350 - 2000	0 - 2000 V	0 - 150 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg

From 650 V on mating SHV connectors are included; recommended cable RG 58, see page 57

# Medium voltage power supplies



Design examples

Two 1/2 19" table-top units

**MCN 140 - 350**

350 V / 400 mA

**MCN 35 - 2000**

2000 V / 15 mA

Up to 350 W  
the units are 1/2 19" wide



**MCN 700 - 2000**

2000 V / 300 mA



**MCN 1400 - 1250**

1250 V / 1 A



# Medium voltage power supplies

## Series MCN from 125 V to 2000 V / 14 W to 4200 W

### Function

The rectified line voltage maintains a square wave generator of constant frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For the regulation the square wave voltage is pulse width modulated.

### Features

- Compact size
- Light-weight
- Efficiency appr. 90%
- Short-circuit and flashover proof
- Unlimited operation with rated current in a short-circuit condition
- Unlimited operation with rated power
- Voltage and current regulation with automatic, sharp transition
- Control mode indicated by LEDs
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- 3½ digit DVM for voltage and current (at ½19" units switch-selected)
- Suitable for inductive and capacitive loads
- Suitable for photomultiplier

### Design

- Up to 350 W nominal power ½19" table-top case, from 700 W nominal power on 19" table-top case
- 19" rack-adapters see page 56

### Outputs

- Units up to 350 V nominal voltage have 4mm safety connectors.
- From 650 V nominal voltage on SHV connectors are provided. HV-connectors are included.

### Technical Data

- Mains connection: up to 1400 W nominal power 230 V  $\pm 10\%$  47 Hz to 63 Hz; from 2800 W nominal power on 400 V  $\pm 10\%$  47 Hz to 63 Hz three-phase
- Ambient temperature: 0°C to +40°C
- Output isolation: The output is floating. Either the positive or the negative pole may be connected to earth.

(Not valid with the option analog programming. If the floating function should remain, the floating analog programming option must be chosen)

- Maximum isolation voltage:

**Up to 350 V** nominal voltage  $\pm 500$  V

**from 650 V** nominal voltage on  $\pm 2000$  V

All further data apply for voltage and current regulation and refer to the rated value, if not otherwise stated.

- Setting range: from appr. 0,1% to 100%

- Setting resolution:  $\pm 1 \times 10^{-4}$
- Reproducibility:  $\pm 1 \times 10^{-3}$
- Residual ripple: Up to 350 W nominal power  $< 5 \times 10^{-5}$ pp + 50 mVpp, from 700 W nominal power on  $< 2 \times 10^{-4}$ pp + 200 mVpp
- Deviation: for  $\pm 10\%$  mains voltage variation:  $< \pm 1 \times 10^{-5}$   
for no load / full load:  $< 1 \times 10^{-4}$   
over 8 hours under constant conditions:  $< \pm 1 \times 10^{-4}$   
within the temperature range:  $< \pm 1 \times 10^{-4}$ /K
- Recovery time: Voltage control:  $< 1$  ms for load changes from 10% to 100% or from 100% to 10%.  
Current control:  $< 10$  ms for load changes causing an output change of less than 10% of the rated voltage
- Setting time at nominal load:  $< 300$  ms for changes of the output voltage from 10% to 90% or from 90% to 10%. ,depending on type
- Discharging time constant approx. 2 to 10 sec. depending on type

### Options

- Analog programming
  - Analog programming, floating
- For information about the output isolation please see page 60
- Computer interface IEEE 488 and RS 232
  - DVM with higher resolution
  - Lower ripple
  - Higher stability

For more information on our options please see pages 60 and 61. Also, some options may contain changes of the description of the unit.

Types see next pages

**Power supplies for higher voltages please see series HCN from page 38 on and from page 42 on, series HCH.**

# Medium voltage power supplies

## Series MCN from 125 V to 650 V / 14 W to 4200 W

Type	Voltage	Current	Width	Height	Depth	Weight
MCN 35 - 125	0 - 125 V	0 - 250 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
MCN 140 - 125	0 - 125 V	0 - 1 A	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
MCN 350 - 125	0 - 125 V	0 - 2,5 A	½19" / 222 mm*)	3 HU / 133 mm	350 mm	6 kg
MCN 700 - 125	0 - 125 V	0 - 5 A	19" / 443 mm	3 HU / 133 mm	350 mm	9 kg
MCN 1400 - 125	0 - 125 V	0 - 10 A	19" / 443 mm	4 HU / 177 mm	550 mm	19 kg
MCN 2800 - 125 3)	0 - 125 V	0 - 20 A	19" / 443 mm	4 HU / 177 mm	650 mm	23 kg
MCN 35 - 200	0 - 200 V	0 - 150 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
MCN 140 - 200	0 - 200 V	0 - 600 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
MCN 350 - 200	0 - 200 V	0 - 1,5 A	½19" / 222 mm*)	3 HU / 133 mm	350 mm	6 kg
MCN 700 - 200	0 - 200 V	0 - 3 A	19" / 443 mm	3 HU / 133 mm	350 mm	9 kg
MCN 1400 - 200	0 - 200 V	0 - 6 A	19" / 443 mm	4 HU / 177 mm	550 mm	19 kg
MCN 2800 - 200 3)	0 - 200 V	0 - 12 A	19" / 443 mm	4 HU / 177 mm	650 mm	23 kg
MCN 35 - 350	0 - 350 V	0 - 100 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
MCN 140 - 350	0 - 350 V	0 - 400 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
MCN 350 - 350	0 - 350 V	0 - 1 A	½19" / 222 mm*)	3 HU / 133 mm	350 mm	6 kg
MCN 700 - 350	0 - 350 V	0 - 2 A	19" / 443 mm	3 HU / 133 mm	350 mm	9 kg
MCN 1400 - 350	0 - 350 V	0 - 4 A	19" / 443 mm	4 HU / 177 mm	550 mm	19 kg
MCN 2800 - 350 3)	0 - 350 V	0 - 8 A	19" / 443 mm	4 HU / 177 mm	650 mm	23 kg
MCN 14 - 650	0 - 650 V	0 - 20 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
MCN 35 - 650	0 - 650 V	0 - 50 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
MCN 140 - 650	0 - 650 V	0 - 200 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
MCN 350 - 650	0 - 650 V	0 - 500 mA	½19" / 222 mm*)	3 HU / 133 mm	350 mm	6 kg
MCN 700 - 650	0 - 650 V	0 - 1 A	19" / 443 mm	3 HU / 133 mm	350 mm	9 kg
MCN 1400 - 650	0 - 650 V	0 - 2 A	19" / 443 mm	4 HU / 177 mm	550 mm	19 kg
MCN 2800 - 650 3)	0 - 650 V	0 - 4 A	19" / 443 mm	4 HU / 177 mm	650 mm	23 kg
MCN 4200 - 650 3)	0 - 650 V	0 - 6 A	19" / 443 mm	4 HU / 177 mm	650 mm	30 kg

3) Mains connection three-phase

\*) With the options computer interface or floating analog programming these units will become 19" wide.

Power supplies with higher power ratings see series NTN and HCH pages 6 and 42

## Medium voltage power supplies

### Series MCN from 1250 V to 2000 V / 14 W to 4200 W

Type	Voltage	Current	Width	Height	Depth	Weight
MCN 14 - 1250	0 - 1250 V	0 - 10 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
MCN 35 - 1250	0 - 1250 V	0 - 25 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
MCN 140 - 1250	0 - 1250 V	0 - 100 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
MCN 350 - 1250	0 - 1250 V	0 - 250 mA	½19" / 222 mm*)	3 HU / 133 mm	350 mm	6 kg
MCN 700 - 1250	0 - 1250 V	0 - 500 mA	19" / 443 mm	3 HU / 133 mm	350 mm	9 kg
MCN 1400 - 1250	0 - 1250 V	0 - 1 A	19" / 443 mm	4 HU / 177 mm	550 mm	19 kg
MCN 2800 - 1250 3)	0 - 1250 V	0 - 2 A	19" / 443 mm	4 HU / 177 mm	650 mm	23 kg
MCN 4200 - 1250 3)	0 - 1250 V	0 - 3 A	19" / 443 mm	4 HU / 177 mm	650 mm	30 kg
MCN 14 - 2000	0 - 2000 V	0 - 6 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
MCN 35 - 2000	0 - 2000 V	0 - 15 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
MCN 140 - 2000	0 - 2000 V	0 - 60 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
MCN 350 - 2000	0 - 2000 V	0 - 150 mA	½19" / 222 mm*)	3 HU / 133 mm	350 mm	6 kg
MCN 700 - 2000	0 - 2000 V	0 - 300 mA	19" / 443 mm	3 HU / 133 mm	350 mm	9 kg
MCN 1400 - 2000	0 - 2000 V	0 - 600 mA	19" / 443 mm	4 HU / 177 mm	550 mm	19 kg
MCN 2800 - 2000 3)	0 - 2000 V	0 - 1 A	19" / 443 mm	4 HU / 177 mm	650 mm	23 kg
MCN 4200 - 2000 3)	0 - 2000 V	0 - 2 A	19" / 443 mm	4 HU / 177 mm	650 mm	30 kg

3) Mains connection three-phase

\*) With the options computer interface or floating analog programming these units will become 19" wide.

Power supplies with higher power ratings see series HCH page 42

# High voltage power supplies



## Design examples

**HCL 35-20000**  
20000 V / 1,5 mA

**HCL 35-35000**  
35000 V / 1 mA

## Function

The rectified line voltage maintains a square wave generator of constant frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For the regulation the square wave voltage is pulse width modulated.

## Features

- Light-weight
- Efficiency appr. 90%
- In units from 12,5 kV on, the HV-components are moulded in (removable) silicon resin.

- Unlimited operation with rated current in a short-circuit condition
- Unlimited operation with nominal power
- Voltage and current regulation with automatic, sharp transition
- Control mode indicated by LED
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- 4½-digits DVM for voltage and current
- Suitable for capacitive loads

## Design

- Depending on voltage and nominal power ½19" or 19" table-top case
- 19" rackadapters are available as accessories

## Outputs

- At all units are the outputs on the rear.
- Mating HV-connectors are included.

## Technical Data

- Mains connection: 230 V  $\pm$ 10% 47 Hz to 63 Hz
- Ambient temperature: 0°C to +40°C

- Output polarity: Positive or negative, the polarity has to be indicated with the order
- Output isolation: The "0V" terminal is connected to earth, but may be disconnected on need. The "0V" terminal than is earthy and may float with respect to earth up to  $\pm$ 300 V.

**Further high-voltage power supplies see page 38**

# High voltage power supplies

## Series HCL from 3500 V to 35000 V / 14 W to 350 W

All further data apply for voltage and current regulation and refer to the rated value, if not otherwise stated.

- Setting range:  
from appr. 0,1% to 100%
- Setting resolution:  
 $\pm 1 \times 10^{-4}$
- Reproducibility:  
 $1 \times 10^{-3}$
- Residual ripple:  
<  $1 \times 10^{-4}$ pp  
typ.  $5 \times 10^{-5}$ pp

- Deviation:  
for  $\pm 10\%$  mains voltage  
variation:  $< \pm 1 \times 10^{-5}$   
  
for no load / full load:  $< \pm 2 \times 10^{-4}$   
  
over 8 hours under constant  
conditions:  $< \pm 1 \times 10^{-4}$   
  
within the temperature range:  
 $< \pm 1,5 \times 10^{-4} / K$
- Recovery time:  
  
Voltage control:  
< 1 ms for load changes from  
10% to 100%  
or from 100% to 10%.

- Current control:  
< 10 ms for load changes  
causing an output change of  
less than 10% of the rated  
voltage
- Setting time at nominal load:  
< 100 ms to 500 ms, depending  
on type, for output voltage  
changes from 10% to 90% or  
90% to 10%.
  - Discharging time constant for  
output without load:  
appr. 1 to 10 sec.  
(depending on type).

### Options

- Analog programming
- Analog programming, floating
- Computer interface  
IEEE 488 and RS 232
- Polarity reversal switch, in  
combination with the analog  
programming or computer  
interface remote controlled
- Lower ripple
- Higher stability

Type	Voltage	Current	Width	Height	Depth	Weight
HCL 14 - 3500	0 - 3500 V	0 - 4 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
HCL 35 - 3500	0 - 3500 V	0 - 10 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
HCL 140 - 3500	0 - 3500 V	0 - 40 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
HCL 350 - 3500	0 - 3500 V	0 - 100 mA	19" / 443 mm	2 HU / 89 mm	450 mm	7 kg
HCL 14 - 6500	0 - 6500 V	0 - 2 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
HCL 35 - 6500	0 - 6500 V	0 - 5 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
HCL 140 - 6500	0 - 6500 V	0 - 20 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4 kg
HCL 350 - 6500	0 - 6500 V	0 - 50 mA	19" / 443 mm	2 HU / 89 mm	450 mm	7 kg
HCL 14 - 12500	0 - 12500 V	0 - 1 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4,3 kg
HCL 35 - 12500	0 - 12500 V	0 - 2,5 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4,3 kg
HCL 140 - 12500	0 - 12500 V	0 - 10 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4,3 kg
HCL 350 - 12500	0 - 12500 V	0 - 25 mA	19" / 443 mm	2 HU / 89 mm	450 mm	7,5 kg
HCL 14 - 20000	0 - 20000 V	0 - 0,6 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4,3 kg
HCL 35 - 20000	0 - 20000 V	0 - 1,5 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4,3 kg
HCL 140 - 20000	0 - 20000 V	0 - 6 mA	½19" / 222 mm	2 HU / 89 mm	450 mm	4,3 kg
HCL 350 - 20000	0 - 20000 V	0 - 15 mA	19" / 443 mm	2 HU / 89 mm	450 mm	7,5 kg
HCL 35 - 35000	0 - 35000 V	0 - 1 mA	19" / 443 mm	2 HU / 89 mm	450 mm	7,7 kg
HCL 140 - 35000	0 - 35000 V	0 - 4 mA	19" / 443 mm	2 HU / 89 mm	450 mm	7,7 kg
HCL 350 - 35000	0 - 35000 V	0 - 10 mA	19" / 443 mm	2 HU / 89 mm	450 mm	7,7 kg

Mating HV-connectors are included

For orders without polarity reversal switch, please indicate the output polarity with the order.

For 3,5 kV and 6,5 kV type SHV, recommended cable RG 58, see page 57

For 12,5 kV and 20 kV type HS 21, recommended cable 130 660, "

For 35 kV type F3430, recommended cable RG 11, "

# High voltage power supplies

## Design examples



**HCN 14 - 12500**  
12500 V / 1 mA



**HCN 140 - 6500**  
6500 V / 20 mA



**HCN 700 - 20000**  
20000 V / 30 mA

# High voltage power supplies

## Series HCN from 3500 V to 150 kV / 14 W to 4200 W

### Function

The rectified line voltage maintains a square wave generator of constant frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For the regulation the square wave voltage is pulse width modulated.

### Features

- Compact size
- Efficiency appr. 90%
- In units from 6,5 kV ; 12,5 kV or 20 kV on (depending on power) the HV-components are moulded in (removable) silicon resin.
- Unlimited operation with rated current in a short-circuit condition
- Unlimited operation with nominal power
- Voltage and current regulation with automatic, sharp transition
- Control mode indicated by LED
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- 3½ digit DVM for voltage and current (at ½19" switch-selected)
- Standard starting current limitation for units from 700 W nominal power on
- Suitable for capacitive loads

### Design

- Up to 35 W, 20 kV nominal power - ½19" table-top case, from 140 W nominal power on, 19" table-top case.
- 19" rack-adapters see page 56

### Outputs

- For units up to 35 kV nominal voltage, the output is located on the front panel, from 65 kV nominal voltage on the rear
- Mating HV-connectors are included. From 65 kV on, delivery complete with 3 m cable

### Technical Data

- Mains connection: up to 1400 W nominal power 230 V  $\pm 10\%$  47 Hz to 63 Hz; from 2800 W nominal power on 400 V  $\pm 10\%$  47 Hz to 63 Hz three-phase
- Ambient temperature: 0°C to +40°C
- Output polarity: positive or negative, the polarity has to be indicated with the order  
  
As an option units up to 65 kV are available with polarity reversal switch
- Output isolation: The "0V" terminal is connected to earth, but may be disconnected on need. The "0V" terminal than is earthy and may float with respect to earth up to  $\pm 300$  V.

All further data apply for voltage and current regulation and refer to the rated value, if not otherwise stated.

- Setting range: from appr. 0,1% to 100%

- Setting resolution:  $\pm 1 \times 10^{-4}$

- Reproducibility:  $\pm 1 \times 10^{-3}$

- Residual ripple:  $< 1 \times 10^{-4}$ pp  
typ.  $5 \times 10^{-5}$ pp

- Deviation: for  $\pm 10\%$  mains voltage variation:  $< \pm 1 \times 10^{-5}$

for no load / full load:  $< \pm 2 \times 10^{-4}$

over 8 hours under constant conditions:  $< \pm 1 \times 10^{-4}$

within the temperature range:  $< \pm 1,5 \times 10^{-4} / K$

- Recovery time:

Voltage control:  
 $< 1$  ms for load changes from 10% to 100% or from 100% to 10%.

Current control:  
 $< 10$  ms for load changes causing an output change of less than 10% of the rated voltage

- Setting time at nominal load:  $< 100$  ms to 500 ms, depending on type, for output voltage changes from 10% to 90% or 90% to 10%.

- Discharging time constant for output without load: appr. 1 to 10 sec. (depending on type).

### Options

- Analog programming
- Analog programming, floating
- Computer interface IEEE 488 and RS 232
- DVM with higher resolution
- Polarity reversal switch, up to 65 kV.
- Lower ripple
- Higher stability

For more information on our options please see pages 60 and 61. Also, some options may contain changes of the description of the unit.

Types see next pages

**We also supply units with higher voltages up to 200 kV with polarity reversal !**

**High voltage power supplies with higher power and higher voltage ratings please see from page 42 on, series HCH.**

# High voltage power supplies

## Series HCN from 3,5 kV to 20 kV / 14 W to 4200 W

Type	Voltage	Current	Width	Height	Depth	Weight
HCN 14 - 3500	0 - 3500 V	0 - 4 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	3 kg
HCN 35 - 3500	0 - 3500 V	0 - 10 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
HCN 140 - 3500	0 - 3500 V	0 - 40 mA	19" / 443 mm	3 HU / 133 mm	350 mm	6 kg
HCN 350 - 3500	0 - 3500 V	0 - 100 mA	19" / 443 mm	3 HU / 133 mm	350 mm	7 kg
HCN 700 - 3500	0 - 3500 V	0 - 200 mA	19" / 443 mm	3 HU / 133 mm	550 mm	11 kg
HCN 1400 - 3500	0 - 3500 V	0 - 400 mA	19" / 443 mm	4 HU / 177 mm	550 mm	21 kg
HCN 2800 - 3500 3)	0 - 3500 V	0 - 800 mA	19" / 443 mm	8 HU / 355 mm	550 mm	35 kg
HCN 4200 - 3500 3)	0 - 3500 V	0 - 1,2 A	19" / 443 mm	8 HU / 355 mm	650 mm	50 kg
HCN 14 - 6500	0 - 6500 V	0 - 2 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
HCN 35 - 6500	0 - 6500 V	0 - 5 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
HCN 140 - 6500	0 - 6500 V	0 - 20 mA	19" / 443 mm	3 HU / 133 mm	350 mm	6 kg
HCN 350 - 6500	0 - 6500 V	0 - 50 mA	19" / 443 mm	3 HU / 133 mm	350 mm	7 kg
HCN 700 - 6500	0 - 6500 V	0 - 100 mA	19" / 443 mm	3 HU / 133 mm	550 mm	11 kg
HCN 1400 - 6500	0 - 6500 V	0 - 200 mA	19" / 443 mm	4 HU / 177 mm	550 mm	21 kg
HCN 2800 - 6500 3)	0 - 6500 V	0 - 400 mA	19" / 443 mm	8 HU / 355 mm	550 mm	35 kg
HCN 4200 - 6500 3)	0 - 6500 V	0 - 600 mA	19" / 443 mm	8 HU / 355 mm	650 mm	50 kg
HCN 14 - 12500	0 - 12500 V	0 - 1 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
HCN 35 - 12500	0 - 12500 V	0 - 2,5 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
HCN 140 - 12500	0 - 12500 V	0 - 10 mA	19" / 443 mm	3 HU / 133 mm	350 mm	12 kg
HCN 350 - 12500	0 - 12500 V	0 - 25 mA	19" / 443 mm	3 HU / 133 mm	350 mm	14 kg
HCN 700 - 12500	0 - 12500 V	0 - 50 mA	19" / 443 mm	3 HU / 133 mm	550 mm	16 kg
HCN 1400 - 12500	0 - 12500 V	0 - 100 mA	19" / 443 mm	4 HU / 177 mm	550 mm	23 kg
HCN 2800 - 12500 3)	0 - 12500 V	0 - 200 mA	19" / 443 mm	8 HU / 355 mm	550 mm	35 kg
HCN 4200 - 12500 3)	0 - 12500 V	0 - 300 mA	19" / 443 mm	9 HU / 399 mm	650 mm	50 kg
HCN 14 - 20000	0 - 20000 V	0 - 0,6 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	4 kg
HCN 35 - 20000	0 - 20000 V	0 - 1,5 mA	½19" / 222 mm	3 HU / 133 mm	350 mm	5 kg
HCN 140 - 20000	0 - 20000 V	0 - 6 mA	19" / 443 mm	3 HU / 133 mm	350 mm	13 kg
HCN 350 - 20000	0 - 20000 V	0 - 15 mA	19" / 443 mm	3 HU / 133 mm	350 mm	14 kg
HCN 700 - 20000	0 - 20000 V	0 - 30 mA	19" / 443 mm	3 HU / 133 mm	550 mm	19 kg
HCN 1400 - 20000	0 - 20000 V	0 - 60 mA	19" / 443 mm	4 HU / 177 mm	550 mm	25 kg
HCN 2800 - 20000 3)	0 - 20000 V	0 - 120 mA	19" / 443 mm	8 HU / 355 mm	550 mm	50 kg
HCN 4200 - 20000 3)	0 - 20000 V	0 - 200 mA	19" / 443 mm	9 HU / 399 mm	650 mm	60 kg

3) Mains connection three-phase

Other power or voltage ratings are available on request



# High voltage power supplies

## Series HCN from 35 kV to 150 kV / 35 W to 4200 W

Type	Voltage	Current	Width	Height	Depth	Weight
HCN 35 - 35000	0 - 35000 V	0 - 1 mA	19" / 443 mm	3 HU / 133 mm	350 mm	15 kg
HCN 140 - 35000	0 - 35000 V	0 - 4 mA	19" / 443 mm	3 HU / 133 mm	450 mm	17 kg
HCN 350 - 35000	0 - 35000 V	0 - 10 mA	19" / 443 mm	4 HU / 177 mm	450 mm	22 kg
HCN 700 - 35000	0 - 35000 V	0 - 20 mA	19" / 443 mm	6 HU / 266 mm	450 mm	30 kg
HCN 1400 - 35000	0 - 35000 V	0 - 40 mA	19" / 443 mm	7 HU / 310 mm	550 mm	45 kg
HCN 2800 - 35000 3)	0 - 35000 V	0 - 80 mA	19" / 443 mm	9 HU / 399 mm	650 mm	60 kg
HCN 4200 - 35000 3)	0 - 35000 V	0 - 120 mA	19" / 443 mm	11 HU / 487 mm	650 mm	90 kg
HCN 35 - 65000	0 - 65000 V	0 - 0,5 mA	19" / 443 mm	*3 HU / 221 mm	**350 mm	17 kg
HCN 140 - 65000	0 - 65000 V	0 - 2 mA	19" / 443 mm	*5 HU / 221 mm	**450 mm	50 kg
HCN 350 - 65000	0 - 65000 V	0 - 5 mA	19" / 443 mm	*5 HU / 221 mm	**450 mm	55 kg
HCN 700 - 65000	0 - 65000 V	0 - 10 mA	19" / 443 mm	*8 HU / 355 mm	550 mm	65 kg
HCN 1400 - 65000	0 - 65000 V	0 - 20 mA	19" / 443 mm	*9 HU / 399 mm	550 mm	70 kg
HCN 2800 - 65000 3)	0 - 65000 V	0 - 40 mA	19" / 443 mm	*9 HU / 399 mm	650 mm	80 kg
HCN 140 - 100000	0 - 100000 V	0 - 1 mA	19" / 443 mm	5 HU / 221 mm	550 mm	60 kg
HCN 350 - 100000	0 - 100000 V	0 - 3 mA	19" / 443 mm	8 HU / 355 mm	550 mm	68 kg
HCN 700 - 100000	0 - 100000 V	0 - 6 mA	19" / 443 mm	8 HU / 355 mm	550 mm	73 kg
HCN 1400 - 100000	0 - 100000 V	0 - 12 mA	19" / 443 mm	11 HU / 487 mm	750 mm	90 kg
HCN 140 - 150000	0 - 150000 V	0 - 0,5 mA	19" / 443 mm	10 HU / 444 mm	750 mm	110 kg
HCN 350 - 150000	0 - 150000 V	0 - 2 mA	19" / 443 mm	10 HU / 444 mm	750 mm	130 kg
HCN 700 - 150000	0 - 150000 V	0 - 4 mA	19" / 443 mm	10 HU / 444 mm	750 mm	140 kg

3) Mains connection three-phase

All units up to 65 kV are available with polarity reversal switch. For units without polarity reversal switch, please indicate the output polarity.

\*) With the option polarity reversal switch these units are 2 HU / 90 mm higher.

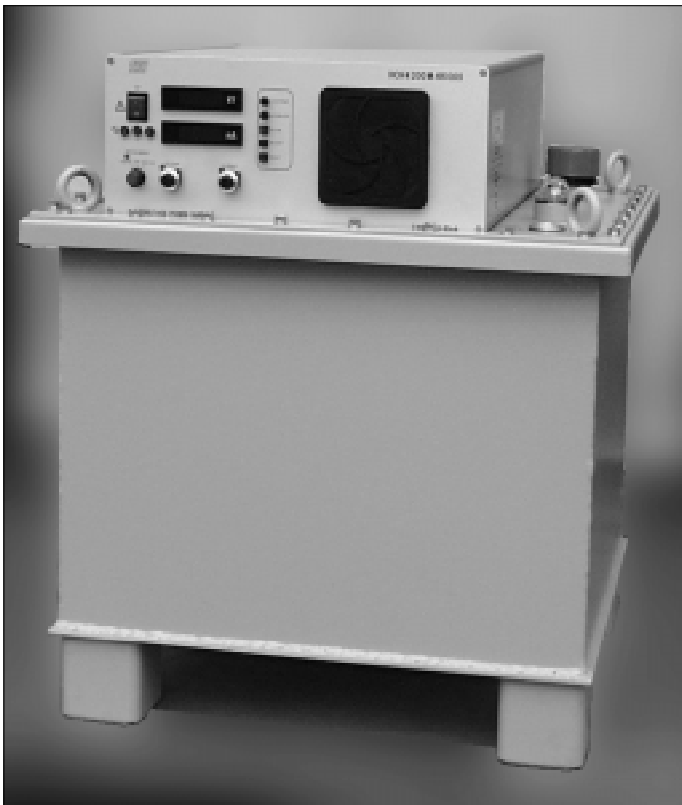
\*\*) With the option polarity reversal switch these units are 550 mm deep.

For units with higher voltage and higher power see series HCH page 43.

# High power units

## Design examples

**HCV 30550M - 150000**  
customer specific power supply  
according to the series HCH  
150000 V / 30 kW



**HCH 4200 - 65000**  
65000 V / 60 mA

The high power units of the HCH series are from 35 kV nominal voltage on, isolated in oil. The power part and the oil container are one unit resp. integrated in a 19" cabinet. At higher voltages and higher power, the power part is a 19" cabinet, the oil container is a separate unit.

**HCH 50000 - 20000**  
20000 V / 2,5 A



# High power units

## Series HCH from 650 V to 200 kV / 350 W to 50 kW

### Function

The rectified line voltage maintains a square wave generator of constant frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For the regulation the square wave voltage is pulse width modulated.

### Features

- Low weight
- Efficiency appr. 90%
- In units up to 20 kV nominal voltage the HV-components are isolated in air. From 35 kV on the isolation is with oil.
- Short-circuit and flashover proof
- Unlimited operation with rated current in a short-circuit condition
- Unlimited operation with nominal power
- Voltage and current regulation with automatic, sharp transition
- Control mode indicated by LEDs
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- 3½ digit DVM for current and voltage
- Standard starting current limitation
- Suitable for capacitive loads
- Interlock

### Design

- Depending on voltage and power we supply three versions. See page 42 and especially on the following pages.

### Outputs

- HV outputs are located on the rear or on the HV-container
- Mating HV-connectors are included, from 65 kV on, an assembled 10 m cable is included.

### Technical Data

- Mains connection: up to 1400 W nominal power 230 V ±10% 47 Hz to 63 Hz from 2800 W on 400 V ±10% 47 Hz to 63 Hz three-phase
- Ambient temperature: 0 - 40°C
- Output polarity: positive or negative, the polarity must be indicated when ordering. As an option, all units are available with polarity reversal
- Output isolation: The "0V" terminal is connected to earth, but may be disconnected as needed. The "0V" terminal than is earthy and may float with respect to earth up to ±50 V.

All further data apply for voltage and current regulation and refer to the rated value, if not otherwise stated.

- Setting range: from appr. 1% to 100%
- Setting resolution: ±1 x 10<sup>-4</sup>
- Reproducibility: ±2 x 10<sup>-3</sup>
- Residual ripple: <2 x 10<sup>-3</sup>pp +50 mVpp
- Deviation: for ±10% mains voltage variation: <±1 x 10<sup>-4</sup> for no load / full load: <5 x 10<sup>-4</sup> over 8 hours under constant conditions: <±2 x 10<sup>-4</sup> within the temperature range: <±1,5 x 10<sup>-4</sup> / K
- Recovery time: Voltage control: <1 ms for load changes from 10% to 100% or from 100% to 10%. Current control: <10 ms for load changes causing an output change of less than 10% of the rated voltage

- Setting time at nominal load: <100 ms (depending on type) for output voltage changes from 10% to 90% or 90% to 10%.
- Discharging time constant for output without load: approx. 1 to 10 sec. (depending on type).

### Options

- Analog programming
- Analog programming, floating
- Computer interface IEEE 488 and RS 232
- DVM with higher resolution
- Polarity reversal
- Lower ripple
- Higher stability
- Shorter setting time

For more information on our options please see pages 60 and 61. Also, some options may contain changes of the description of the unit.

**High voltage power supplies with lower power please see series MCL/MCN from page 30/32 on and series HCL/HCN and from page 36/38 on.**

## Series HCH from 650 V to 1250 V / 10 kW to 50 kW

Type	Voltage	Current	Width	Height	Depth	Weight
HCH 10000 - 650 3)	0 - 650 V	0 - 15 A	19" / 600 mm	18 HU / 1100 mm	650 mm	120 kg
HCH 15000 - 650 3)	0 - 650 V	0 - 22,5 A	19" / 600 mm	27 HU / 1500 mm	650 mm	170 kg
HCH 20000 - 650 3)	0 - 650 V	0 - 30 A	19" / 600 mm	31 HU / 1700 mm	650 mm	240 kg
HCH 30000 - 650 3)	0 - 650 V	0 - 45 A	19" / 600 mm	37 HU / 2000 mm	800 mm	300 kg
HCH 40000 - 650 3)	0 - 650 V	0 - 60 A	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg
HCH 50000 - 650 3)	0 - 650 V	0 - 75 A	19" / 600 mm	37 HU / 2000 mm	800 mm	420 kg
HCH 10000 - 1250 3)	0 - 1250 V	0 - 8 A	19" / 600 mm	18 HU / 1100 mm	650 mm	120 kg
HCH 15000 - 1250 3)	0 - 1250 V	0 - 12 A	19" / 600 mm	27 HU / 1500 mm	650 mm	170 kg
HCH 20000 - 1250 3)	0 - 1250 V	0 - 16 A	19" / 600 mm	31 HU / 1700 mm	650 mm	240 kg
HCH 30000 - 1250 3)	0 - 1250 V	0 - 24 A	19" / 600 mm	37 HU / 2000 mm	800 mm	300 kg
HCH 40000 - 1250 3)	0 - 1250 V	0 - 32 A	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg
HCH 50000 - 1250 3)	0 - 1250 V	0 - 40 A	19" / 600 mm	37 HU / 2000 mm	800 mm	420 kg

3) Mains connection three-phase

**Continuation next page**

# High power units

## Series HCH from 2 kV to 35 kV / 10 kW to 50 kW

Type	Voltage	Current	Width	Height	Depth	Weight
HCH 10000 - 2000 3)	0 - 2000 V	0 - 5 A	19" / 600 mm	18 HU / 1100 mm	650 mm	120 kg
HCH 15000 - 2000 3)	0 - 2000 V	0 - 7,5 A	19" / 600 mm	27 HU / 1500 mm	650 mm	170 kg
HCH 20000 - 2000 3)	0 - 2000 V	0 - 10 A	19" / 600 mm	31 HU / 1700 mm	650 mm	240 kg
HCH 30000 - 2000 3)	0 - 2000 V	0 - 15 A	19" / 600 mm	37 HU / 2000 mm	800 mm	300 kg
HCH 40000 - 2000 3)	0 - 2000 V	0 - 20 A	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg
HCH 50000 - 2000 3)	0 - 2000 V	0 - 25 A	19" / 600 mm	37 HU / 2000 mm	800 mm	420 kg
HCH 10000 - 3500 3)	0 - 3500 V	0 - 3 A	19" / 600 mm	18 HU / 1100 mm	650 mm	120 kg
HCH 15000 - 3500 3)	0 - 3500 V	0 - 4 A	19" / 600 mm	27 HU / 1500 mm	650 mm	170 kg
HCH 20000 - 3500 3)	0 - 3500 V	0 - 6 A	19" / 600 mm	31 HU / 1700 mm	650 mm	240 kg
HCH 30000 - 3500 3)	0 - 3500 V	0 - 8 A	19" / 600 mm	37 HU / 2000 mm	800 mm	300 kg
HCH 40000 - 3500 3)	0 - 3500 V	0 - 12 A	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg
HCH 50000 - 3500 3)	0 - 3500 V	0 - 15 A	19" / 600 mm	37 HU / 2000 mm	800 mm	420 kg
HCH 10000 - 6500 3)	0 - 6500 V	0 - 1,5 A	19" / 600 mm	18 HU / 1100 mm	650 mm	120 kg
HCH 15000 - 6500 3)	0 - 6500 V	0 - 2 A	19" / 600 mm	27 HU / 1500 mm	650 mm	170 kg
HCH 20000 - 6500 3)	0 - 6500 V	0 - 3 A	19" / 600 mm	31 HU / 1700 mm	650 mm	240 kg
HCH 30000 - 6500 3)	0 - 6500 V	0 - 4 A	19" / 600 mm	37 HU / 2000 mm	800 mm	300 kg
HCH 40000 - 6500 3)	0 - 6500 V	0 - 6 A	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg
HCH 50000 - 6500 3)	0 - 6500 V	0 - 7,5 A	19" / 600 mm	37 HU / 2000 mm	800 mm	420 kg
HCH 10000 - 12500 3)	0 - 12500 V	0 - 0,8 A	19" / 600 mm	18 HU / 1100 mm	650 mm	120 kg
HCH 15000 - 12500 3)	0 - 12500 V	0 - 1,2 A	19" / 600 mm	27 HU / 1500 mm	650 mm	170 kg
HCH 20000 - 12500 3)	0 - 12500 V	0 - 1,6 A	19" / 600 mm	31 HU / 1700 mm	650 mm	240 kg
HCH 30000 - 12500 3)	0 - 12500 V	0 - 2,4 A	19" / 600 mm	37 HU / 2000 mm	800 mm	300 kg
HCH 40000 - 12500 3)	0 - 12500 V	0 - 3,2 A	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg
HCH 50000 - 12500 3)	0 - 12500 V	0 - 4 A	2x19" / 1200 mm	37 HU / 2000 mm	800 mm	480 kg
HCH 10000 - 20000 3)	0 - 20000 V	0 - 0,5 A	19" / 600 mm	27 HU / 1500 mm	650 mm	120 kg
HCH 15000 - 20000 3)	0 - 20000 V	0 - 0,75 A	19" / 600 mm	31 HU / 1700 mm	650 mm	170 kg
HCH 20000 - 20000 3)	0 - 20000 V	0 - 1 A	19" / 600 mm	37 HU / 2000 mm	800 mm	240 kg
HCH 30000 - 20000 3)	0 - 20000 V	0 - 1,5 A	19" / 600 mm	37 HU / 2000 mm	800 mm	300 kg
HCH 40000 - 20000 3)	0 - 20000 V	0 - 2 A	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg
HCH 50000 - 20000 3)	0 - 20000 V	0 - 2,5 A	2x19" / 1200 mm	37 HU / 2000 mm	800 mm	480 kg
HCH 10000 - 35000 3)	0 - 35000 V	0 - 0,3 A	19" / 600 mm	37 HU / 2000 mm	800 mm	390 kg
HCH 15000 - 35000 3)	0 - 35000 V	0 - 0,4 A	19" / 600 mm	37 HU / 2000 mm	800 mm	420 kg
HCH 20000 - 35000 3)	0 - 35000 V	0 - 0,6 A	19" / 600 mm	37 HU / 2000 mm	800 mm	450 kg
HCH 30000 - 35000 3)	0 - 35000 V	0 - 0,8 A	2x19" / 1200 mm	37 HU / 2000 mm	800 mm	640 kg
HCH 40000 - 35000 3)	0 - 35000 V	0 - 1,2 A	2x19" / 1200 mm	37 HU / 2000 mm	800 mm	720 kg
HCH 50000 - 35000 3)	0 - 35000 V	0 - 1,5 A	2x19" / 1200 mm	37 HU / 2000 mm	800 mm	790 kg

3) Mains connection three-phase

High voltage power supplies for lower power please see series MCL / MCN and HCL / HCN, on pages 30/32 and 36/38.

# High power units

## Series HCH from 65 kV to 200 kV / 350 W to 50 kW

Type	Voltage	Current	Width	Height	Depth	Weight
HCH 4200 - 65000 3)	0 - 65000 V	0 - 60 mA	700 mm*	750 mm*	630 mm*	240 kg
HCH 10000 - 65000 3)	0 - 65000 V	0 - 150 mA	19" / 600 mm	37 HU / 2000 mm	800 mm	460 kg
HCH 15000 - 65000 3)	0 - 65000 V	0 - 200 mA	19" / 600 mm	37 HU / 2000 mm	800 mm	480 kg
HCH 20000 - 65000 3)	0 - 65000 V	0 - 300 mA	19" / 600 mm	37 HU / 2000 mm	800 mm	500 kg
HCH 30000 - 65000 3)	0 - 65000 V	0 - 400 mA	19" / 600 mm	27 HU / 1500 mm	650 mm**	170/430 kg
HCH 40000 - 65000 3)	0 - 65000 V	0 - 600 mA	19" / 600 mm	31 HU / 1700 mm	650 mm**	200/470 kg
HCH 50000 - 65000 3)	0 - 65000 V	0 - 750 mA	19" / 600 mm	37 HU / 2000 mm	800 mm**	250/500 kg
HCH 2800 - 100000 3)	0 - 100000 V	0 - 25 mA	800 mm*	1200 mm*	760 mm*	550 kg
HCH 4200 - 100000 3)	0 - 100000 V	0 - 40 mA	800 mm*	1200 mm*	760 mm*	550 kg
HCH 10000 - 100000 3)	0 - 100000 V	0 - 100 mA	19" / 600 mm	37 HU / 2000 mm	800 mm	500 kg
HCH 15000 - 100000 3)	0 - 100000 V	0 - 150 mA	19" / 600 mm	37 HU / 2000 mm	800 mm	520 kg
HCH 20000 - 100000 3)	0 - 100000 V	0 - 200 mA	19" / 600 mm	37 HU / 2000 mm	800 mm	545 kg
HCH 30000 - 100000 3)	0 - 100000 V	0 - 300 mA	19" / 600 mm	27 HU / 1500 mm	650 mm**	170/500 kg
HCH 40000 - 100000 3)	0 - 100000 V	0 - 400 mA	19" / 600 mm	31 HU / 2000 mm	650 mm**	200/550 kg
HCH 50000 - 100000 3)	0 - 100000 V	0 - 500 mA	19" / 600 mm	37 HU / 1700 mm	800 mm**	250/600 kg
HCH 1400 - 150000	0 - 150000 V	0 - 8 mA	800 mm*	1400 mm*	760 mm*	760 kg
HCH 2800 - 150000 3)	0 - 150000 V	0 - 15 mA	800 mm*	1400 mm*	760 mm*	760 kg
HCH 4200 - 150000 3)	0 - 150000 V	0 - 25 mA	800 mm*	1400 mm*	760 mm*	760 kg
HCH 10000 - 150000 3)	0 - 150000 V	0 - 60 mA	19" / 600 mm	18 HU / 1100 mm	650 mm**	100/600 kg
HCH 15000 - 150000 3)	0 - 150000 V	0 - 100 mA	19" / 600 mm	18 HU / 1100 mm	650 mm**	115/600 kg
HCH 20000 - 150000 3)	0 - 150000 V	0 - 130 mA	19" / 600 mm	27 HU / 1500 mm	650 mm**	150/680 kg
HCH 30000 - 150000 3)	0 - 150000 V	0 - 200 mA	19" / 600 mm	31 HU / 1700 mm	650 mm**	170/680 kg
HCH 40000 - 150000 3)	0 - 150000 V	0 - 250 mA	19" / 600 mm	31 HU / 1700 mm	800 mm**	200/680 kg
HCH 50000 - 150000 3)	0 - 150000 V	0 - 300 mA	19" / 600 mm	37 HU / 2000 mm	800 mm**	250/680 kg
HCH 350 - 200000	0 - 200000 V	0 - 1,5 mA	955 mm*	1700 mm*	780 mm*	910 kg
HCH 700 - 200000	0 - 200000 V	0 - 3 mA	955 mm*	1650 mm*	760 mm*	910 kg
HCH 1400 - 200000	0 - 200000 V	0 - 6 mA	955 mm*	1650 mm*	850 mm*	960 kg
HCH 2800 - 200000 3)	0 - 200000 V	0 - 12 mA	955 mm*	1650 mm*	850 mm*	960 kg
HCH 4200 - 200000 3)	0 - 200000 V	0 - 20 mA	955 mm*	1830 mm*	850 mm*	1000 kg
HCH 10000 - 200000 3)	0 - 200000 V	0 - 50 mA	19" / 600 mm	18 HU / 1100 mm	650 mm**	100/650 kg
HCH 15000 - 200000 3)	0 - 200000 V	0 - 75 mA	19" / 600 mm	18 HU / 1100 mm	650 mm**	115/650 kg
HCH 20000 - 200000 3)	0 - 200000 V	0 - 100 mA	19" / 600 mm	27 HU / 1500 mm	650 mm**	150/750 kg
HCH 30000 - 200000 3)	0 - 200000 V	0 - 150 mA	19" / 600 mm	31 HU / 1700 mm	650 mm**	170/750 kg
HCH 40000 - 200000 3)	0 - 200000 V	0 - 200 mA	19" / 600 mm	31 HU / 1700 mm	650 mm**	200/850 kg
HCH 50000 - 200000 3)	0 - 200000 V	0 - 250 mA	19" / 600 mm	37 HU / 2000 mm	800 mm**	250/850 kg

3) Mains connection three-phase

\*) The dimensions and weights are valid for the HV-container with the power part mounted on the top, they are non-binding guidelines.

\*\*\*) The dimensions are valid for the power part, the HV-container is placed in a separate oil-filled HV-container.

The weight consists of the power part / The HV oil container.

**On request we also supply units with higher power and voltages up to 300 kV !**

# Bipolar high voltage power supplies continuous zero crossing



## Design example

### HCB 7 - 6500

$\pm 6500 \text{ V} / \pm 1 \text{ mA}$

#### Function

Bipolar HV power supplies consist of 2 switchmode controlled HV sources, which are connected to the output. The operation is contermoving, and the output can be adjusted with continuous zero crossing.

#### Features

- Light-weight
- In units with 6,5 kV and higher the HV-components are moulded in (removable) silicon resin.
- Unlimited operation with rated current in a short-circuit condition
- Unlimited operation with nominal power
- Voltage regulation and current limitation with automatic, sharp transition
- Control mode indicated by LED
- Voltage adjustment with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- 3½ digit DVM for voltage and current

- 4- quadrant operation possible
- Suitable for capacitive and resistive loads

#### Design

- 19" table-top case
- 19" rack-adapters see page 56

#### Outputs

- All units have the output on the front panel
- Mating HV-connectors are included

#### Technical Data

- Mains connection: 230 V  $\pm 10\%$  47 Hz to 63 Hz
- Ambient temperature: 0°C to +40°C
- Output isolation: The "0V" terminal is connected to earth, but may be disconnected as needed. The "0V" terminal than is earthy and may float with respect to earth up to  $\pm 300 \text{ V}$ .

All further data apply for voltage regulation and refer to the rated value, if not otherwise stated.

- Setting range: -100% ... 0 ... +100%
- Setting resolution:  $\pm 1 \times 10^{-4}$
- Reproducibility:  $\pm 1 \times 10^{-3}$
- Residual ripple:  $< 3 \times 10^{-4} \text{ pp} + 50 \text{ mVpp}$  typ.  $2 \times 10^{-4} \text{ pp}$
- Deviation: for  $\pm 10\%$  mains voltage variation:  $< \pm 1 \times 10^{-5}$   
for no load / full load:  $< \pm 2 \times 10^{-4}$   
over 8 hours under constant conditions:  $< \pm 1 \times 10^{-4}$   
within the temperature range:  $< \pm 1,5 \times 10^{-4} / \text{K}$
- Recovery time voltage control:  $< 1 \text{ ms}$  for load changes from 10% to 100% or from 100% to 10%.

- Setting time at nominal load: approx. 200 ms for output voltage changes from 10% to 90% or 90% to 10%.
- Discharging time constant for output without load: approx. 1 to 10 sec. (depending on type).

#### Options

- Analog programming
- Analog programming, floating
- Computer interface IEEE 488 and RS 232
- DVM with higher resolution
- Lower ripple
- Higher stability
- Shorter setting time

For more information on our options please see pages 60 and 61. Also, some options may contain changes of the description of the unit.

For bipolar power supplies with low voltage see series NLB page 18

## Bipolar high voltage power supplies

Series HCB from  $\pm 1250$  V to  $\pm 20000$  V / 1,4 W to 200 W

Type	Voltage	Current	Width	Height	Depth	Weight
HCB 1,4 - 1250	0... $\pm$ 1250 V	$\pm$ 1 mA	19" / 443 mm	3 HU / 133 mm	350 mm	6 kg
HCB 14 - 1250	0... $\pm$ 1250 V	$\pm$ 10 mA	19" / 443 mm	3 HU / 133 mm	350 mm	7 kg
HCB 2 - 2000	0... $\pm$ 2000 V	$\pm$ 1 mA	19" / 443 mm	3 HU / 133 mm	350 mm	6 kg
HCB 20 - 2000	0... $\pm$ 2000 V	$\pm$ 10 mA	19" / 443 mm	3 HU / 133 mm	350 mm	9 kg
HCB 3,5 - 3500	0... $\pm$ 3500 V	$\pm$ 1 mA	19" / 443 mm	3 HU / 133 mm	350 mm	7 kg
HCB 35 - 3500	0... $\pm$ 3500 V	$\pm$ 10 mA	19" / 443 mm	3 HU / 133 mm	450 mm	10 kg
HCB 7 - 6500	0... $\pm$ 6500 V	$\pm$ 1 mA	19" / 443 mm	3 HU / 133 mm	350 mm	10 kg
HCB 70 - 6500	0... $\pm$ 6500 V	$\pm$ 10 mA	19" / 443 mm	3 HU / 133 mm	550 mm	15 kg
HCB 14 - 12500	0... $\pm$ 12500 V	$\pm$ 1 mA	19" / 443 mm	3 HU / 133 mm	350 mm	30 kg
HCB 140 - 12500	0... $\pm$ 12500 V	$\pm$ 10 mA	19" / 443 mm	6 HU / 266 mm	550 mm	42 kg
HCB 20 - 20000	0... $\pm$ 20000 V	$\pm$ 1 mA	19" / 443 mm	6 HU / 266 mm	550 mm	35 kg
HCB 200 - 20000	0... $\pm$ 20000 V	$\pm$ 10 mA	19" / 443 mm	6 HU / 266 mm	550 mm	45 kg

We also supply other power and voltage ratings !

## Double high voltage power supplies

Series HCD from 1250 V to 100 kV / 14 W to 350 W



Design example

**HCD 350 - 20000**

2 x 20 kV / 2 x 15 mA

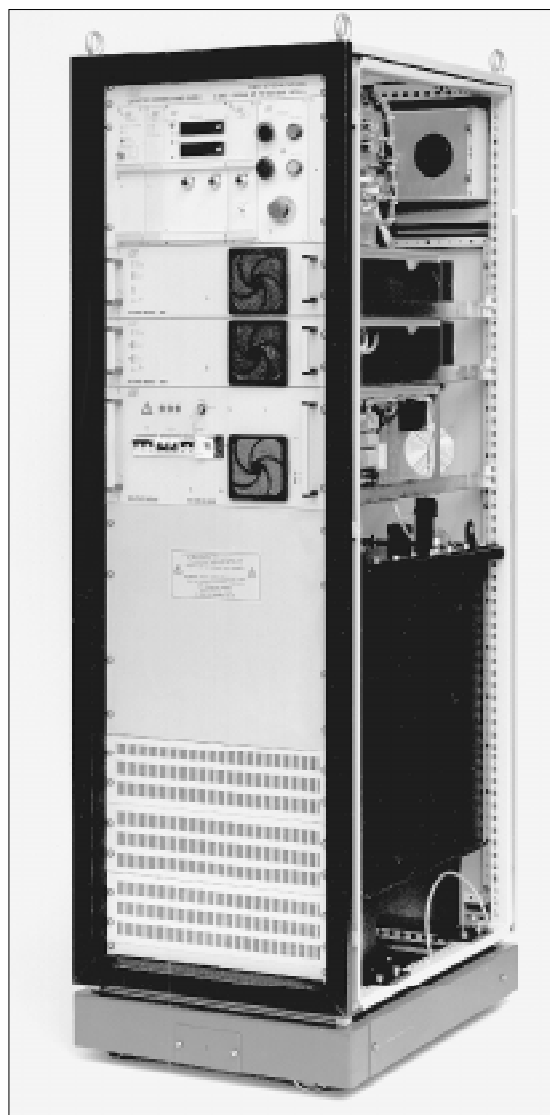
On request we supply according to the data of the HCN series double HV power supplies. Double power supplies have two outputs with a common centre. The positive and the negative voltage are symmetrically adjusted by one common potentiometer.

# Capacitor charging power supplies

Design examples



**HCK 200 - 12500**  
12500 V / 200 J/s



**HCK 6750M - 30000**  
30000 V / 6750 J/s  
Special version



This series has been primarily designed for periodical charging of capacitors

**HCK 5000 - 12500**  
12500 V / 5000 J/s



# Capacitor charging power supplies

## Series HCK from 2000 V to 65000 V / 100 J/s to 20000 J/s

### Function

The rectified line voltage maintains a square wave generator of constant frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For the regulation the square wave voltage is pulse width modulated.

### Features

- Efficiency appr. 90%
- In units with 20 kV and higher the HV-components are moulded in (removable) silicon resin, from 35 kV / 5000 J/s on HV-components are isolated in oil.
- The charging voltage is continuously adjustable
- **Charging with adjustable constant current, without overshoot**
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- **Suitable for continuous or compensation charging**
- **No external protection resistor is required**
- Permanent short-circuit proof
- 3½ digit DVM for charging current and output voltage
- Preselection for the output voltage with display
- The charging process is either permanent or controlled via a potential free input.

- End of charge signal, when the final voltage is reached.
  - on a LED on the front panel
  - on a potentialfree interface for an external control
- Suitable for capacitive loads, also with resistive parts
- The nominal current can be permanently supplied at max. voltage.

### Design

- Up to 2500 J/s nominal power 19" table-top case, higher power in 19" racks (depending on type) with oil isolated, external HV-container.
- 19" rack-adapters for table-top see page 52

### Outputs

- For units up to 20 kV nominal voltage the output is on the front panel, from 35 kV nominal voltage on, on the rear or on the HV-container
- Mating HV-connectors are included, from 35 kV on, assembled with 3 m cable, from 65 kV >5000 J/s on with 10 m cable.

### Technical Data

- Mains connection:
  - up to 800 J/s nominal power 230 V  $\pm 10\%$  47 Hz to 63 Hz;
  - from 1600 J/s nominal power on 400 V  $\pm 10\%$  47 Hz to 63 Hz three-phase
- Ambient temperature: 0°C to +40°C

- Output polarity:
  - Positive or negative. The polarity has to be indicated when placing an order.
- **Charging power:**

**The specified max. charging power will be supplied for charging between "0" and the rated voltage. If the capacitor is discharged only partly, a considerable higher charging power can be supplied!**

- Setting range for the charging voltage:
  - from appr. 1% to 100%
- Setting resolution:
  - $\pm 1 \times 10^{-4}$
- Reproducibility of the charging voltage with respect to the rated value:

for  $\pm 10\%$  mains voltage variation:  
 $< \pm 1 \times 10^{-4}$

over 8 hours under constant conditions:  
 $< \pm 1 \times 10^{-3}$

within the temperature range:  
 $< \pm 2 \times 10^{-4} / K$

for a repetition frequency of <10 Hz:  $< \pm 1 \times 10^{-3}$

for a repetition frequency of >10 Hz:  $< \pm 1 \times 10^{-2}$

- Repetition frequency:
  - max. 100 Hz
- Residual ripple of the charging current:
  - approx. 10%pp (20 / 40 kHz)

### Options

- Analog programming
- Analog programming, floating
- Computer interface
  - IEEE 488 and RS 232
- Polarity reversal switch available up to 1600 J/s, for higher power on request.
- Dump switch for the output and the load
- Higher repetition frequency
- Built-in or separate complete discharge circuit for pulse operation.

**To optimize the output stage we ask for detailed information about the connected discharging circuit and its repetition frequency.**

**See also page 65 "Formulas"**

**Types see next pages**

# Capacitor charging power supplies

## Series HCK from 2 kV to 12,5 kV / 100 J/s to 20000 J/s

Type	Voltage	Charging Current	Power max.	Width	Height	Depth	Weight
HCK 100 - 2000	0 - 2000 V	0 - 100 mA	100 J/s	19" / 443 mm	3 HU / 133 mm	350 mm	6 kg
HCK 200 - 2000	0 - 2000 V	0 - 200 mA	200 J/s	19" / 443 mm	3 HU / 133 mm	350 mm	7 kg
HCK 400 - 2000	0 - 2000 V	0 - 400 mA	400 J/s	19" / 443 mm	3 HU / 133 mm	550 mm	11 kg
HCK 800 - 2000	0 - 2000 V	0 - 800 mA	800 J/s	19" / 443 mm	4 HU / 177 mm	550 mm	21 kg
HCK 1600 - 2000 3)	0 - 2000 V	0 - 1,6 A	1600 J/s	19" / 443 mm	8 HU / 355 mm	550 mm	35 kg
HCK 2500 - 2000 3)	0 - 2000 V	0 - 2,5 A	2500 J/s	19" / 443 mm	8 HU / 355 mm	650 mm	50 kg
HCK 5000 - 2000 3)	0 - 2000 V	0 - 5 A	5000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	120 kg
HCK 10000 - 2000 3)	0 - 2000 V	0 - 10 A	10000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	240 kg
HCK 20000 - 2000 3)	0 - 2000 V	0 - 20 A	20000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg
HCK 100 - 3500	0 - 3500 V	0 - 50 mA	100 J/s	19" / 443 mm	3 HU / 133 mm	350 mm	6 kg
HCK 200 - 3500	0 - 3500 V	0 - 100 mA	200 J/s	19" / 443 mm	3 HU / 133 mm	350 mm	7 kg
HCK 400 - 3500	0 - 3500 V	0 - 200 mA	400 J/s	19" / 443 mm	3 HU / 133 mm	550 mm	11 kg
HCK 800 - 3500	0 - 3500 V	0 - 400 mA	800 J/s	19" / 443 mm	4 HU / 177 mm	550 mm	21 kg
HCK 1600 - 3500 3)	0 - 3500 V	0 - 800 mA	1600 J/s	19" / 443 mm	8 HU / 355 mm	550 mm	35 kg
HCK 2500 - 3500 3)	0 - 3500 V	0 - 1,4 A	2500 J/s	19" / 443 mm	8 HU / 355 mm	650 mm	50 kg
HCK 5000 - 3500 3)	0 - 3500 V	0 - 2,8 A	5000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	120 kg
HCK 10000 - 3500 3)	0 - 3500 V	0 - 5,7 A	10000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	240 kg
HCK 20000 - 3500 3)	0 - 3500 V	0 - 11 A	20000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg
HCK 100 - 6500	0 - 6500 V	0 - 30 mA	100 J/s	19" / 443 mm	3 HU / 133 mm	350 mm	6 kg
HCK 200 - 6500	0 - 6500 V	0 - 60 mA	200 J/s	19" / 443 mm	3 HU / 133 mm	350 mm	7 kg
HCK 400 - 6500	0 - 6500 V	0 - 120 mA	400 J/s	19" / 443 mm	3 HU / 133 mm	550 mm	11 kg
HCK 800 - 6500	0 - 6500 V	0 - 250 mA	800 J/s	19" / 443 mm	4 HU / 177 mm	550 mm	21 kg
HCK 1600 - 6500 3)	0 - 6500 V	0 - 500 mA	1600 J/s	19" / 443 mm	8 HU / 355 mm	550 mm	35 kg
HCK 2500 - 6500 3)	0 - 6500 V	0 - 750 mA	2500 J/s	19" / 443 mm	8 HU / 355 mm	650 mm	50 kg
HCK 5000 - 6500 3)	0 - 6500 V	0 - 1,5 A	5000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	120 kg
HCK 10000 - 6500 3)	0 - 6500 V	0 - 3 A	10000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	240 kg
HCK 20000 - 6500 3)	0 - 6500 V	0 - 6 A	20000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg
HCK 100 - 12500	0 - 12500 V	0 - 15 mA	100 J/s	19" / 443 mm	3 HU / 133 mm	350 mm	6 kg
HCK 200 - 12500	0 - 12500 V	0 - 30 mA	200 J/s	19" / 443 mm	3 HU / 133 mm	350 mm	7 kg
HCK 400 - 12500	0 - 12500 V	0 - 60 mA	400 J/s	19" / 443 mm	3 HU / 133 mm	550 mm	11 kg
HCK 800 - 12500	0 - 12500 V	0 - 120 mA	800 J/s	19" / 443 mm	4 HU / 177 mm	550 mm	21 kg
HCK 1600 - 12500 3)	0 - 12500 V	0 - 250 mA	1600 J/s	19" / 443 mm	8 HU / 355 mm	550 mm	35 kg
HCK 2500 - 12500 3)	0 - 12500 V	0 - 400 mA	2500 J/s	19" / 443 mm	9 HU / 399 mm	650 mm	50 kg
HCK 5000 - 12500 3)	0 - 12500 V	0 - 800 mA	5000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	120 kg
HCK 10000 - 12500 3)	0 - 12500 V	0 - 1,5 A	10000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	240 kg
HCK 20000 - 12500 3)	0 - 12500 V	0 - 3 A	20000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg

3) Mains connection three-phase

# Capacitor charging power supplies

## Series HCK from 20 kV to 65 kV / 100 J/s to 20000 J/s

Type	Voltage	Charging Current	Power max.	Width	Height	Depth	Weight
HCK 100 - 20000	0 - 20000 V	0 - 10 mA	100 J/s	19" / 443 mm	3 HU / 133 mm	350 mm	6 kg
HCK 200 - 20000	0 - 20000 V	0 - 20 mA	200 J/s	19" / 443 mm	3 HU / 133 mm	350 mm	7 kg
HCK 400 - 20000	0 - 20000 V	0 - 40 mA	400 J/s	19" / 433 mm	3 HU / 133 mm	550 mm	20 kg
HCK 800 - 20000	0 - 20000 V	0 - 80 mA	800 J/s	19" / 443 mm	4 HU / 177 mm	550 mm	25 kg
HCK 1600 - 20000 3)	0 - 20000 V	0 - 160 mA	1600 J/s	19" / 443 mm	8 HU / 355 mm	550 mm	35 kg
HCK 2500 - 20000 3)	0 - 20000 V	0 - 250 mA	2500 J/s	19" / 443 mm	9 HU / 399 mm	650 mm	50 kg
HCK 5000 - 20000 3)	0 - 20000 V	0 - 500 mA	5000 J/s	19" / 600 mm	27 HU / 1500 mm	650 mm	120 kg
HCK 10000 - 20000 3)	0 - 20000 V	0 - 1 A	10000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	240 kg
HCK 20000 - 20000 3)	0 - 20000 V	0 - 2 A	20000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	360 kg
HCK 100 - 35000	0 - 35000 V	0 - 5 mA	100 J/s	19" / 443 mm	3 HU / 133 mm	450 mm	18 kg
HCK 200 - 35000	0 - 35000 V	0 - 10 mA	200 J/s	19" / 443 mm	3 HU / 177 mm	450 mm	21 kg
HCK 400 - 35000	0 - 35000 V	0 - 20 mA	400 J/s	19" / 433 mm	3 HU / 133 mm	550 mm	30 kg
HCK 800 - 35000	0 - 35000 V	0 - 40 mA	800 J/s	19" / 443 mm	7 HU / 310 mm	550 mm	45 kg
HCK 1600 - 35000 3)	0 - 35000 V	0 - 80 mA	1600 J/s	19" / 443 mm	8 HU / 355 mm	550 mm	60 kg
HCK 2500 - 35000 3)	0 - 35000 V	0 - 140 mA	2500 J/s	19" / 443 mm	11 HU / 487 mm	650 mm	90 kg
HCK 5000 - 35000 3)	0 - 35000 V	0 - 280 mA	5000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	390 kg
HCK 10000 - 35000 3)	0 - 35000 V	0 - 570 mA	10000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	450 kg
HCK 20000 - 35000 3)	0 - 35000 V	0 - 1,1 A	20000 J/s	2x19" / 1200 mm	37 HU / 2000 mm	800 mm	720 kg
HCK 100 - 65000	0 - 65000 V	0 - 3 mA	100 J/s	19" / 443 mm	5 HU / 221 mm*	450 mm**	45 kg
HCK 200 - 65000	0 - 65000 V	0 - 6 mA	200 J/s	19" / 443 mm	5 HU / 221 mm*	450 mm**	50 kg
HCK 400 - 65000	0 - 65000 V	0 - 12 mA	400 J/s	19" / 433 mm	8 HU / 355 mm*	550 mm	55 kg
HCK 800 - 65000	0 - 65000 V	0 - 25 mA	800 J/s	19" / 443 mm	9 HU / 399 mm*	550 mm	60 kg
HCK 1600 - 65000 3)	0 - 65000 V	0 - 50 mA	1600 J/s	19" / 443 mm	9 HU / 399 mm*	550 mm	80 kg
HCK 2500 - 65000 3)	0 - 65000 V	0 - 75 mA	2500 J/s	19" / 443 mm	11 HU / 487 mm*	650 mm	120 kg
HCK 5000 - 65000 3)	0 - 65000 V	0 - 150 mA	5000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	460 kg
HCK 10000 - 65000 3)	0 - 65000 V	0 - 300 mA	10000 J/s	19" / 600 mm	37 HU / 2000 mm	800 mm	500 kg
HCK 20000 - 65000 3)	0 - 65000 V	0 - 600 mA	20000 J/s	2x19" / 1200 mm	31 HU / 1700 mm	650 mm***	200/470 kg

3) Mains connection three-phase

All capacitor charging power supplies are available with polarity reversal switch. Please specify the output polarity, when ordering without polarity switch

\*) With the option polarity reversal switch these units are 2 HU / 90 mm higher.

\*\*) With the option polarity reversal switch these units are 550 mm deep.

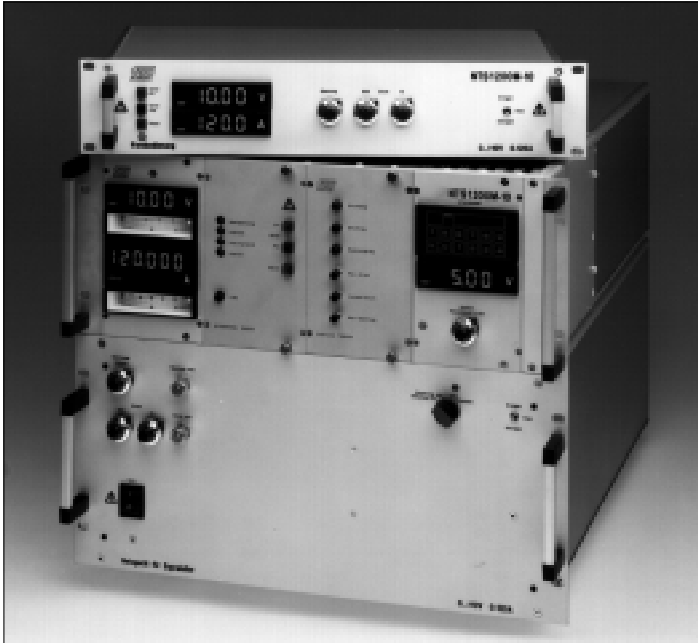
\*\*\*) The dimensions are valid for the power part. The weight consists of the power part / the oil container

**These capacitor charging power supplies are also available in the low voltage range from 100 V on and in the high voltage rang up to 200 kV.**

**The series HCK is also suitable for capacitor conditioning**

# Power supplies for super conducting magnets

Design examples



## NTS 1200M - 10

10 V / 120 A

### Features:

Separate remote control plug-in unit

5½ digits current display

Quench monitoring

Fast de-energization

Digital current limit presetting

Digital limit value comparator

Computer interface

## NTS 20000M - 10

10 V / 2000 A

### Features:

Quench detector

Fast de-energization

Automatic load disconnecting switch  
for fast de-energization at quench

800 kJ de-energization resistor

Water cooling

Computer interface



Current sources for super conducting magnets are always designed and built according to customer specifications.

# Power supplies for super conducting magnets

## Series NTS, up to 65 V, up to 10000 A

### Function

Series regulated with a set of parallel transistors and a preregulation with phase controlled thyristors, in a way that the power lost on the transistors is kept as low as possible. Thus, the final control element always has a low power dissipation in energizing and stationary constant current mode.

In de-energizing mode, the transistor stage is working as a current sink. The power is dissipated by air or water cooling.

### Features

- High efficiency
- Short circuit proof and unlimited operation with full current in short circuit condition
- Sensor terminals for the compensation of the voltage drop on the power lines. By presetting the voltage, a linear current ramp can be reached.
- Energizing and de-energizing voltage can be preset with one potentiometer.
- Constant voltage operation for linear up and down control.
- Linear de-energizing with reverse voltage up to the nominal height of the output voltage (2-quadrant operation)
- 3½ digits DVM for current and voltage
- Individual, adaption to all operation and control modes.

### Design

- Up to 200 A or appr. 2,5 kW table-top cases or plug-in units.
- Units with higher current or power are supplied as 19" cabinets with castors. The side walls can be removed, the rear door can be locked.
- All cabinets have removable crane-eyes.
- Racks with 600 mm width and larger are suitable for fork lift transport.
- Cooling:  
Up to approx. 1000 A or approx. 5 kW de-energizing power, air cooling, for higher currents or higher power, water cooling with thermostatic valves for the control of the water flow, (depending on the power).

### Outputs:

- Up to 100 A, clamps on the rear. For higher currents the outputs are bolts or copper bars.

### Technical Data

- Mains connection:  
Units up to approx. 200 A output current or approx. 1000 W:  
  
230 V  $\pm 10\%$  47 Hz to 53 Hz  
  
Units with higher current or power:  
  
400 V  $\pm 10\%$  47 Hz to 53 Hz three-phase
- Ambient temperature:  
0°C to +40°C

- Output isolation:  
The output is floating.
- Operating voltage with respect to earth:  
for air cooled units max.  $\pm 300$  V DC,  
for water cooled units max.  $\pm 100$  V DC

All further technical data are approximate values and will be adjusted to the individual requirements.

- Setting current range :  
0,1% to 100%
- Setting voltage range :  
- 100% to +100%
- Setting resolution:  
 $\pm 1 \times 10^{-4}$  to  $\pm 1 \times 10^{-6}$
- Residual voltage ripple:  
appr.  $1 \times 10^{-3}$ pp
- Residual current ripple:  
 $\pm 1 \times 10^{-4}$  to  $\pm 1 \times 10^{-6}$  depending on the load inductance
- Deviation:  
for  $\pm 10\%$  mains voltage variation:  
 $< \pm 1 \times 10^{-5}$   
  
for no load / full load:  
 $< 2 \times 10^{-4}$   
  
over 8 hours under constant conditions:  
 $< \pm 1 \times 10^{-4}$  to  $\pm 1 \times 10^{-5}$   
  
within the temperature range:  
 $< 1 \times 10^{-4}$  to  $\pm 5 \times 10^{-6}$  /K
- Run-up times:  
from 1 sec to 100 h

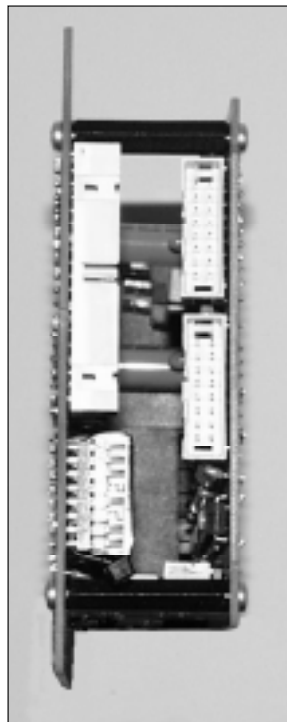
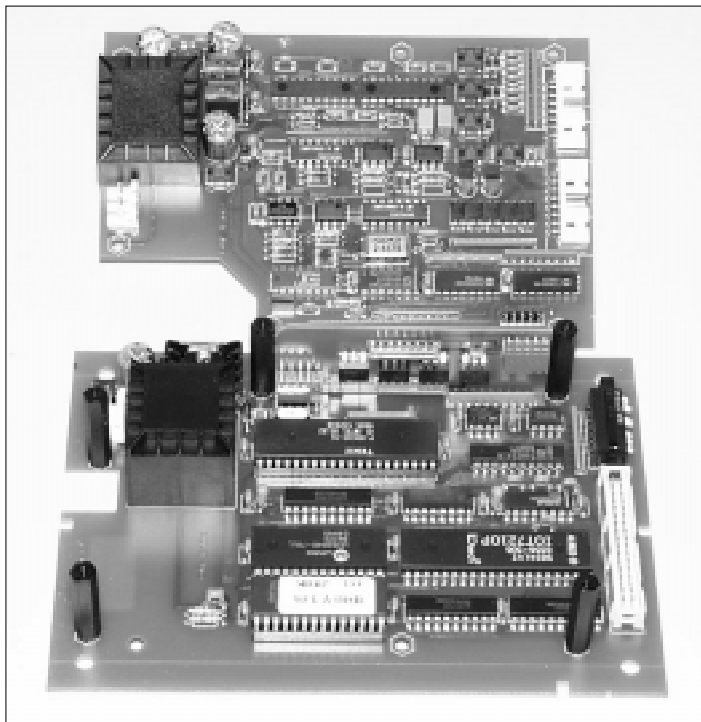
### Options

- Current control by electronic sweep with digital control; rise and fall times are adjustable manually or via computer interface.
- Current limit digital setting manually or via computer interface, resolution up to  $1 \times 10^{-5}$  for external setting
- High speed turn-off input with adjustable threshold
- Quench detector to monitor the magnet
- Fast de-energizing at quench or mains failure:  
  
A DC conductor or a semiconductor switch disconnects the power supply from the magnet. De-energizing takes place with a power resistor, actuated at quench or by an external contact.
- Higher stability
- Analog programming
- Analog programming, floating
- IEEE 488 / RS232 interface
- DVM with higher resolution
- Water cooling

**We don't specify a range of standard types in this series, since every unit is designed and built according to each particular application.**

# Computer interface

## IEEE-488.2 / RS 232, 16 bit



**PROBUS IV**  
EURO size 21 HP,  
matching the HCE series

The computer interfaces are a sandwich construction. As an option, they are available with each F.u.G.- power supply.

**A an option integrated into the power supply the interfaces are IEEE 488 or RS 232.**

A switch selection is available against surcharge.

The interfaces are available as stand-alone units for power supplies with analog programming, "PROBUS IV" corresponding to series HCN7E or HCE (pages 24 and 26), please indicate with the order.

The cassettes have their own mains input 230 V. All inputs and outputs are on the rear.

**The terminals for IEEE 488 and RS 232 are switch selectable.**

The programming terminal (15pol. SubD) is standardized to 0 - 10 V and fits each power supply with a corresponding analog programming.

**Computer interfaces are available for all F.u.G. - power supplies (built-in or add-on)**

**Programming of set values for voltage and current**

**Read out of voltage and current values**

**Status report ; On/Off-command**

**With the PROBUS IV also third-party products with analog programming can be controlled**

# Computer interface

## IEEE-488.2 / RS-232, 16 bit

### Function

The general-purpose microprocessor controlled talker and listener interface Probus IV allows the unproblematic connection of F.u.G. power supplies to an IEEE-488 or RS-232 interface. Voltage and current of the connected power supply can be set and read back simultaneously. In addition, an ON-command and status reports of the unit can be transmitted. An optocoupler gives the potential isolation between the analog part and the bus-input.

### Features

- Intelligent, microprocessor controlled interface technology
- Unproblematic connection to an IEEE-488 or RS-232 interface
- Uncoded text programming
- Resolution 16 bit plus polarity indication
- Software calibration
- Standardized bipolar analog inputs and outputs (0 to  $\pm 10$  V)
- high stability and accuracy
- Programmable service-Request
- 2 msec response time
- Up to 100 programmings per /s
- Up to 100 measurements per /s

### Design

- The stand-alone units have inputs and outputs which are compatible with the analog programming of F.u.G. power supplies.
- The digital inputs are switch-selectable from IEEE-488 to RS-232

Integrated into the power supply, the interface is either IEEE-488 or RS-232, it is not selectable. Switch selecting available against surcharge.

### Technical Data

- Mains connection stand-alone unit :  
230 V  $\pm 10\%$  47 Hz to 63 Hz
- Ambient temperature:  
0°C to 40°C
- **Isolation:**  
Three versions are available, which have to be selected according to the model of the power supply and the voltage:
  - a) Isolation max. 600 V DC with respect to the unit output, 30 V DC with respect to ground, for all NTN, NLN NYN, as well as MCA up to 400 V. For HCN, HCD, HCB and MCA ..3000, if they are operated "floating".
  - b) Isolation max. 2 kV DC with respect to the unit output, 30 V DC with respect to ground, for all units with 2 kV output isolation. These are the MCN ..650 to 2000, MCA ..750 and 1500, as well as corresponding special versions.
  - c) Interfaces with fibre optic isolation for higher voltages on request.

- Analog outputs:  
2 x 0 to  $\pm 10$  V, max. 1 mA, short circuit proof
- Internal resistance:  
200 Ohm
- Analog inputs:  
2 x 0 to 10 V DC  
Input resistance >1 GOhm
- Setting time:  
<3 msec
- Data transfer time:  
appr. 1,5 - 20 msec, depending on computer and program
- IEEE-488 mode:  
Standard: IEEE-488.2  
Connector: 24pol

### Interface functions:

- AH1, SH1, L4, T6, SR1, RLO, PPO, CD1, DTO, CO, E2
- RS-232 mode:  
Standard: RS-232, 3-wire Interface, half or full duplex operation  
Connector: SubD, 25 contacts  
Baud rate: selectable 1200, 2400, 4800, 9600 baud
- Resolution:  
16 bit, binary plus polarity sign ( $< \pm 1,5 \times 10^{-5}$  or 150  $\mu$ V)
- Accuracy:  
 $\pm 1 \times 10^{-4}$
- Temperature coefficient:  
 $< \pm 2 \times 10^{-5} /K$

### Important:

The specified data refer to the rated value of the outputs and inputs of the interface.

The data of the connected unit (accuracy, stability and setting time) have to be considered.

The previous available 14bit version has been taken from the delivery program.

Fast setting times are achieved with linear controlled units like the series NLN or NLB.

### Programmable functions

Listener (IEEE-488) or data receive (RS-232)

### operation:

- Voltage set value
- Current set value
- Voltage actual value
- Current actual value
- Service request / mask
- Power supply output ON / OFF

- Trigger for set values and measurement

- Polarity (option)

- Calibration

Talker (IEEE-488) or Data transmit (RS-232)

Operation:

Programmable integration time

Measuring resolution depending on the integration time:

8 bit at 6 msec

16 bit at 60 msec

18 bit at 800 msec

### Delivery range

- **Built-in interfaces:**  
Operating instructions with programming example and demo floppy disc (also for programming under Windows),
- **Stand-alone units:**  
An additional mains cable and a mating connector for the analog output are supplied.

**Fix integrated into the power supply we deliver also other types of interfaces**

# High voltage isolating transformers

## Series HTS, 50 kV, 100 VA to 3000 VA

### Function

High voltage isolating transformers are used from the mains supply with high voltage potential. The primary winding is earthy.

### Features

- Compact size
- Moulded in artificial resin
- Low capacity
- Double screened

### Technical data

- Input voltage: 230 V 47 - 63 Hz
- Output voltage: 230 V 47 - 63 Hz
- Isolation: primary / sekundary 50 kV DC
- Test voltage: 75 kV DC for 1 min.
- Test voltage between primary winding, primary screen and core: 2,5 kV AC
- Test voltage between secondary winding and secondary screen: 2,5 kV AC

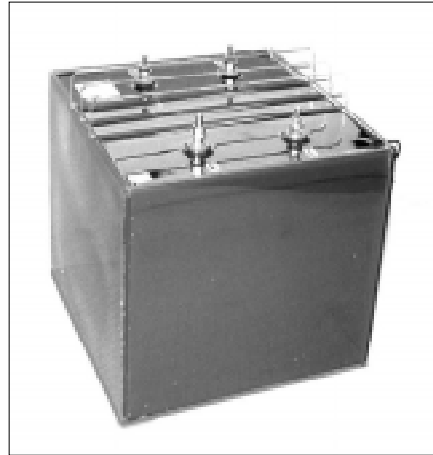
### Design

- Mechanics: Core and windings are completely moulded in artificial resin with isolating cross pieces between the connections. Attachment at the bottom with 4 x M8 female thread
- Connection: primary and secondary on M6 thread pins, screens on isolated wire on the top.

### Special designs

- Different voltages
- Other isolating voltages
- Higher power
- Three-phase version
- Built-in case

Picture:  
HTS 500 - 50  
Power 500 VA  
Isolation 50 kV DC



### Design Example

#### HTS 2000-50

Power 2 kVA  
Voltage 230 V / 230 V  
Isolation voltage 50 kV DC

Type	Power	Dimensions L x W x H	Weight
HTS 100 - 50	100 VA	165 x 160 x 220 mm	15 kg
HTS 500 - 50	500 VA	210 x 200 x 230 mm	21 kg
HTS 1000 - 50	1000 VA	210 x 200 x 240 mm	25 kg
HTS 2000 - 50	2000 VA	252 x 252 x 260 mm	40 kg
HTS 3000 - 50	3000 VA	252 x 250 x 270 mm	43 kg

## 19" Rack-adapter

All F.u.G. table-top power supplies can also be mounted in a 19" rack

19" rack-adapters can be supplied as retrofit set.

For repeat orders of 19" rack-adapters please implicitly indicate the height of the front panel!

Indication in HU or mm.  
(1 HU = 44,5 mm or 1.75")

Available designs as on the right shown

19" rack-adapter for a 19" table-top unit, different heights



19" rack-adapter for a 1/2 19" table-top unit, with a 1/2 19" dummy plate



19" rack-adapter for two 1/2 19" table-top units, with connecting elements





# High voltage cables / connectors

## Nominal voltages 10 kV to 200 kV

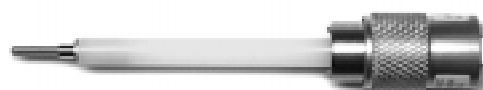
Type	Construction	Operating Voltage	Mating Connector Operating Voltage
<b>RG 58</b> Capacitance / m 101 pF Impedance 50 Ohm Ambient temp. -50°C...+80°C Bending radius 10 cm repeated 2,5 cm single max. 10 A Amps	<p>0,9 mm 3 mm 4 mm 5 mm Ø</p>	max.  <b>10 kV DC</b>	<b>SHV</b> 6,5 kV
<b>130660</b> Capacitance / m 82,7 pF Impedance no value Ambient temp. -5°C...+85°C Bending radius 11 cm repeated 3 cm single max. 4 A Amps	<p>0,75 mm 4 mm 4,4 mm 5,5 mm Ø</p>	max.  <b>30 kV DC</b>	<b>HS 21</b> <b>F 3415</b> 20 kV
<b>RG 11</b> Capacitance / m 68 pF Impedance 75 Ohm Ambient temp. -50°C...+80°C Bending radius 20 cm repeated 5 cm single max. 6 A Amps	<p>1 mm 7 mm 8 mm 10 mm Ø</p>	max.  <b>50 kV DC</b>	<b>F 3430</b> 35 kV
<b>C 2124</b> Capacitance / m 99 pF Impedance 61 Ohm Ambient temp. -50°C...+60°C Bending radius 15,2 cm Amps max. 27 A	<p>1,5 mm 9,4 mm 10,6 mm 11,2 mm Ø</p>	max.  <b>100 kV DC</b>	<b>HVS 65</b> 65 kV <b>HVS 100</b> 100 kV
<b>C 2121</b> Capacitance / m 95 pF Impedance 59 Ohm Ambient temp. -50°C...+60°C Bending radius 21,6 cm Amps max. 30 A	<p>2,3 mm 12,4 mm 14,0 mm 15,9 mm Ø</p>	max.  <b>150 kV DC</b>	<b>Special plug,</b> <b>only available</b> <b>complete with</b> <b>cable</b>
<b>C 2134</b> Capacitance / m 102 pF Impedance 64 Ohm Ambient temp. -50°C...+60°C Bending radius 25,4 cm Amps max. 55 A	<p>2,3 mm 19,3 mm 20 mm 21,6 mm Ø</p>	max.  <b>200 kV DC</b>	<b>Special plug,</b> <b>only available</b> <b>complete with</b> <b>cable</b>

All power supplies from 650 V on include mating HV-connectors. From 65 kV output voltage on the connectors are supplied complete with a 3 m cable (a 10 m cable for HCH and HCK >5000 J/s).

Connectors for voltages from 65 kV on are only available complete with the corresponding cable. For repeat orders please indicate the type of the power supply and its serial number, for which the connector must fit.

Special cables for capacitor charging power supplies are available on request

Power Supply Model	Plug Type	Qty	Material Number	Mating Cable	Remarks
	included in the delivery				
MYN 7000-650	SHV Cable Jack	2	03 01 04 11 05	RG 58	
MYN 7000-1250 to MYN 14000-1250	SHV Cable Jack	2	03 01 04 11 05	RG 58	
MYN 7000-2000 to MYN 21000-2000	SHV Cable Jack	2	03 01 04 11 05	RG 58	
HYN 7000-3500 to HYN 35000-3500	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HYN 7000-6500 to HYN 70000-6500	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HYN 7000-12500 to HYN 50000-12500	F 3415 AG 6,2	1	03 01 04 03 56	130 660	
HYN 7000-20000 to HYN 50000-20000	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	
HCN 7E-1250 to HCN 7E-6500	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HCN 7E-12500 and HCN 7E-20000	F 3415 AG 6,2	1	03 01 04 03 56	130 660	
HCN 7E-35000	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	
HCE 7-1250 to HCE 7-6500	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HCE 7-12500 and HCE 7-20000	F 3415 AG 6,2	1	03 01 04 03 56	130 660	
HCE 7-35000	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	
HCE 35-1250 to HCE 35-6500	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HCE 35-12500 and HCE 35-20000	F 3415 AG 6,2	1	03 01 04 03 56	130 660	
HCE 35-35000	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	
MCA 750-1500 to MCA 3000-1500	SHV Cable Jack	2	03 01 04 11 05	RG 58	
MCA 750-3000 to MCA 3000-3000	SHV Cable Jack	1	03 01 04 11 05	RG 58	
MCL 14-650 to MCL 350-650	SHV Cable Jack	2	03 01 04 11 05	RG 58	
MCL 14-1250 to MCL 350-1250	SHV Cable Jack	2	03 01 04 11 05	RG 58	
MCL 14-2000 to MCL 350-2000	SHV Cable Jack	2	03 01 04 11 05	RG 58	
MCN 14-650 to MCN 4200-650	SHV Cable Jack	2	03 01 04 11 05	RG 58	
MCN 14-1250 to MCN 4200-1250	SHV Cable Jack	2	03 01 04 11 05	RG 58	
MCN 14-2000 to MCN 4200-2000	SHV Cable Jack	2	03 01 04 11 05	RG 58	
HCL 14-3500 to HCL 350-3500	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HCL 14-6500 to HCL 350-6500	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HCL 14-12500 to HCL 350-12500	HS21	1	03 01 04 04 25	130 660	
HCL 14-20000 to HCL 350-20000	HS21	1	03 01 04 04 25	130 660	
HCL 35-35000 to HCL 350-35000	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	



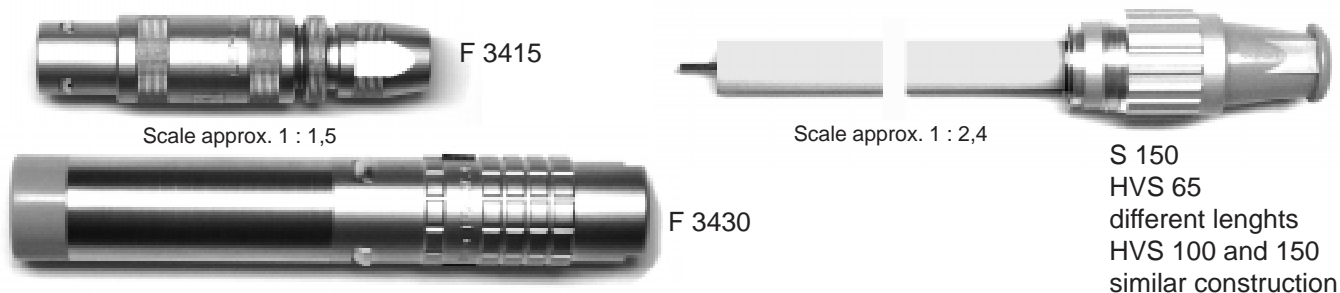
Scale approx. 1 : 1,5

**Informations to cables you will find on page 57**

Power Supply Model	Plug Type	Qty	Material Number	Mating Cable	Remarks
	included in the delivery				
HCN 14-3500 to HCN 4200-3500	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HCN 14-6500 to HCN 4200-6500	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HCN 14-12500 to HCN 4200-12500	F 3415 AG 6,2	1	03 01 04 03 56	130 660	
HCN 14-20000 to HCN 35-20000	F 3415 AG 6,2	1	03 01 04 03 56	130 660	
HCN 140-20000 to HCN 4200-20000	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	
HCN 35-35000 to HCN 4200-35000	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	
HCN 35-65000 to HCN 2800-65000	HVS 65	1	03 01 04 05 70	C 2124	including 3m cable
HCN 140-100000 to HCN 1400-100000	HVS 100	1	03 01 04 06 05	C 2124	including 3m cable
HCN 140-150000 to HCN 700-150000	HVS 150	1	03 01 04 06 55	C 2121	including 3m cable
HCH all models from 650V to 6500V max. 10A	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HCH all models 12500V	F 3415 AG 6,2	1	03 01 04 03 56	130 660	
HCH all models 20000V and 35000V	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	
HCH all models 65000V	HVS 65	1	03 01 04 05 70	C 2124	including 10m cable
HCH all models 100000V	HVS 100	1	03 01 04 06 05	C 2124	including 10m cable
HCH higher voltages	To be defined	1	xx	xx	
HCB 1,4-1250 to HCB 70-6500	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HCB 14-12500 to HCB 140-12500	F 3415 AG 6,2	1	03 01 04 03 56	130 660	
HCB 20-20000 to HCB 200-20000	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	
HCK 100-2000 to HCK 10000-2000	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HCK 20000-2000	To be defined	1	xx	xx	
HCK 100-3500 to HCK 10000-3500	SHV Cable Jack	1	03 01 04 11 05	RG 58	
HCK 20000-3500	To be defined	1	xx	xx	
HCK 100-6500 to HCK 10000-6500	F 3415 AG 6,2	1	03 01 04 03 56	130 660	
HCK 20000-6500	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	
HCK all models 12500V	F 3415 AG 6,2	1	03 01 04 03 56	130 660	
HCK all models 20000V	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	
HCK all models 35000V	S 150 Teflon	1	03 01 04 05 56	C 2032 SNJ	
HCK all models 65000V	HVS 65 Teflon	1	03 01 04 05 69	C 2184	incl. 3m cable (>5kJ 10m)

These informations refer only to models in the catalogue, they are not valid for special models.

**At units not mentioned here, no output connectors will be included in the delivery.**



**Power supplies up to 650V and max. 20A have, if not otherwise stated, 4mm safety connectors SLB.  
Power supplies for higher currents have output clamps or rails.**

# Options, Modifications

## Analog programming \*)

- With this option voltage and current of the power supply can be set by analog voltages (0-10V) or by external potentiometers.
- The actual values, monitor outputs are standardized (0-10V) and available on the programming terminal.
- Furthermore an "ON"-command (enable) input and status report outputs are provided on this terminal.
- Internal to external programming mode switch selectable on the front panel.
- The "0V" of the programming voltage is connected to one output pole:
- at NTN, NLN and NYN units to the positive pole,
- at HCN, HCH, HCK, MYN, HYN, and HCB units to the earthy pole,
- at MCN and MCA units from 650 V resp. 750 V on the "0V" of the programming voltage is connected to one output pole, which than is earthed.

When ordering this option, the output polarity of the power supply has to be indicated.

- This option is also available as a retrofit set for all standard units (at HCN7E and HCE series it is standard).

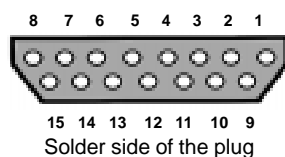
\*) This option is also available as a retrofit set.

## Functions and pin configuration:

### 15pol. SubD

- 1) Status report current control mode
- 2) Status report voltage control mode
- 3) Monitor output / actual value of current
- 4) Slider of the voltage potentiometer on the front panel \*\*)
- 5) Slider of the current potentiometer on the front panel \*\*)
- 6) 0V, reference for digital signals
- 7) not used, at HCL with option polarity reversal, input for remote control  
**open = positive connection to 6) = negative**
- 8) Input: voltage set value
- 9) 0V, reference for analog signals
- 10) + 10 V reference voltage
- 11) Monitor output / actual value of voltage
- 12) P.S. output ON / OFF
- 13) not used
- 14) not used
- 15) Input: current set value

\*\*) Not available with floating analog programming



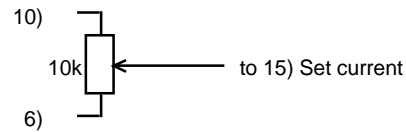
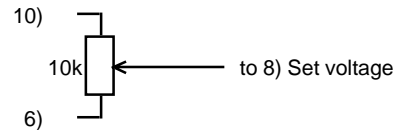
## Examples for programming

### Pin No.

#### For external programming voltage

- 8) Set value voltage 0 - 10 V corresponds to 0 - nominal voltage
- 9) 0V programming voltage
- 15) Set value current 0 - 10 V corresponds to 0 - nominal current
- 9) 0V programming voltage
- 12) Floating contact to 6) = Unit ON

#### Using the internal reference voltage for the programming



#### Set the value to the maximum

- 8) A connection to 10) sets the voltage to the nominal value, applicable if operating only in CC mode
- 15) A connection to 10) sets the current to the nominal value, applicable if operating only in CV mode

#### Keeping one front panel potentiometer for adjusting the value (not possible with floating analog programming)

- 4) Connection to 8) = Setting the voltage remains on the front panel
- 5) Connection to 15) = Setting the current remains on the front panel

#### Monitor outputs

- 3) 0 - 10 V corresponds to 0 - nominal voltage (reference to Pin 6)
- 11) 0 - 10 V corresponds to 0 - nominal current (reference to Pin 6)

#### Status reports

- 1) e.g. for transistor triggering, ON = unit in CC mode
- 2) e.g. for transistor triggering, ON = unit in CV mode

#### Important remarks:

An external analog programming requires implicitly a programming of the both inputs 8) **and** 15), as well as the ON-command on 12).

## Analog programming, floating

- Same function as described above, but inputs and outputs are isolated from the power supply outputs.

Details see page 61

**Customer specific units with different mechanics, different data, customer defined interface or extended features are still available, even for a qty. of one.**

### Analog programming, floating

Three versions are available, which have to be selected according to the model of the power supply and the voltage:

- Isolation max. 600 V DC with respect to the unit output, 30 V DC with respect to ground, for all NTN, NLN NYN, NCA, as well as MCA up to 400 V. For HCN, HCD, HCB and MCA ..3000, if they are operated floating
- Isolation max. 2 kV DC with respect to the unit output, 30 V DC with respect to ground, for all units with 2 kV output isolation, these are MCN ..650 to 2000, MCA ..750 and 1500, as well as corresponding special versions.
- On request we deliver an **isolation with fibre optic** up to 200 kV. Mechanics fitting to the unit.

- Accuracy, linearity and stability refer to the nominal value (+10 V):  $<\pm 5 \times 10^{-4}$

Temperature coefficient :  $<\pm 1,5 \times 10^{-4} / K$

- This option can only be supplied with a new unit, no retrofit set is available.

### Connectors

Programming terminals are always located on the rear of the unit, mating connectors are included.

Please note: If using other connectors, for a floating operation, they must have together with the cable the necessary dielectric strength with respect to earth.

### Digital programming

- See computer interfaces page 54

### Polarity reversal switch

- With this manual operated switch the output polarity of HV power supplies can be changed

- The switch is available for all HCL, HCN, HCH, HCK and HYN units

- For HCN** up to a nominal voltage of 65 kV  
**For HCK** up to a nominal voltage of 65 kV, but only up to 1600 J/s  
**For HCH** from 35 kV/10 kW; 65 kV/4,2 kW; 100 kV/2,8 kW; 150 kV/1,4 kW; 200 kV all.  
For here not mentioned ranges a polarity reversal is not available or only after consultation.

At HCL and HCH the polarity reversal can be remote controlled in combination with analog programming or computer interface.

- Changing the polarity is only allowed in "0" voltage condition
- For HCN units up to 35 kV a retrofit in the factory is possible

### Polarity reversal switch remote controlled

- For special applications other remote controlled version are available, please consult the factory.

### DVM with higher resolution

- Instead of the standard DVM with a display of max.1999, DVM with higher resolution can be offered:

- 4½ digits DVM, resolution max. 19999
- 6 digits DVM, resolution max. 999999
- The display is always in volts or amps (or kV and mA) with fixed decimal points matching the corresponding nominal value

- 4½ digits DVM can be installed on all standard units

A retrofit at the factory is available

- 6 digits DVM can only be installed in new units in combination with a higher stability

At MCL and HCL units the 4½ digits displays are standard

### Higher stability

We can build power supplies with a much better long term stability and lower temperature coefficient. Using components with a better specification and lower temperature coefficient the following data can be reached:

#### Voltage and/or current regulation

- Stability over 8 hours under constant conditions:  $<\pm 1 \times 10^{-5}$   
Temperature coefficient:  $<\pm 1 \times 10^{-5} / K$  within the specified temperature range

- Stability and temperature coefficient are measured and recorded over a 8 hour period.

- For certain units we can deliver even a higher stability upon request

- These options can be incorporated only in new units. A later modification is not possible.

This option is not available with the series HCN 7E, HCE, MCL and HCL.

### Lower output ripple

On several series a lower ripple can be achieved. This option can be supplied only with new units. A later modification is not possible.

- For series MCN and HCN with a nominal power up to 35 W:  
A residual ripple of  $<1 \times 10^{-5} pp + 10 \text{ mVpp}$
- For series MCN and HCN with a nominal power from 140 W to 700 W:  
A residual ripple of  $<1 \times 10^{-5} pp + 20 \text{ mVpp}$
- For series HCN with a nominal power of 1400 W and higher:  
A residual ripple of  $<1 \times 10^{-5} pp + 100 \text{ mVpp}$
- For series HCH, on request

- A lower ripple is also available for several types of the series NYN, MYN and HYN

### Preset value with higher resolution

- Additional 10-turn potentiometer for fine-tuning of current and/or voltage, with an adjusting range of appr. 1%, resolution  $<5 \times 10^{-6}$
- If the reproducibility of the adjustment must be better, a decade switch (up to 5 decades) or in a combination with a fine-tune potentiometer can be provided.

### Further possibilities

Depending on the series or the type several special options can be chosen

- Power regulation with display and adjustment
- Internal impedance with display and adjustment
- Other mains voltages and/or frequencies
- Inrush current limitation
- Extended temperature range
- Remote control unit with displays
- Overvoltage and overcurrent monitoring resp. switch-off

- Interlock loop to monitor the load. Mains disconnection, but no forced discharging of output and load

- Active pull-down regulation
- Fast discharging of the output
- Electronic sweep for set value control

- Higher output isolation

- HV isolated units up to 200 kV
- Output on the rear

Other features on request

# Examples for customer specific power supplies



## Power supply for beam squirt

**NLV 27M-400**  
 $\pm 400 \text{ V} / 1 \text{ mA}$   
Multiple power supply  
5 double outputs  
with countermoving  
voltages

## Bipolar Power supply

**NLB 4640M-290**  
 $\pm 290 \text{ V} / \pm 16 \text{ A}$   
4 quadrant  
power supply  
fast controllable



## Isolation test unit

**HCN 35M-50000**  
 $50 \text{ kV} / 0,6 \text{ mA}$   
High resolution  
current ranges



## Multiple high voltage source

**HCV 57M-20000**  
19 voltage sources,  
11 different voltages  
from  $6 \text{ V}$  to  $20 \text{ kV}$

## Linear controlled power supply

**NLN 3000M-10**  
 $10 \text{ V} / 300 \text{ A}$   
fast rise and fall times

**We develop and  
produce also  
according to your  
requirements !**



# Examples for customer specific power supplies

Continuation



## High voltage power supply

**HCN 300M-60000**

60 kV / 5 mA  
High resolution voltage measurement.  
Terminal for 2nd external measuring resistor



## Medium voltage power supply

**MCN 4000M-2000**

2000 V / 2 A  
Highly stable current source with analog instruments



## Capacitor charging power supply

**HCK 9000M-120000**

120 kV / 150 mA  
Charging power 9000 J/s  
built-in discharging switch

## Low voltage power supply

**NCN 10000M-55**

55 V / 200 A  
Fast controllable with step-down converter, selectable rise times, adjustable internal resistor



## Electronic load

**NTL 6000M-50**

50 V / 120 A  
absolutely linear controlled fast regulation  
1 Hz to 1 kHz



# Technical Appendix

## Definitions for terms used in the catalogue

### Absolute accuracy

The stated data refer to the deviation of the DVM or the monitors of the analog programming with respect to the actual values. They are independent from the stability data of the individual series.

### For all families with standard data the following absolute values apply:

for all nominal voltages:  
 $\leq \pm 0,2\%$  of the nominal value

for all nominal currents within the range  $\geq 5$  mA to  $\leq 200$  A:  
 $\leq \pm 0,2\%$  of the nominal value

for all nominal currents outside this range:  
 $\leq \pm 0,5\%$  of the nominal value

additional failure of the DVM:  
 $\leq \pm 2$  Digits

### Active pull-down control

Available as an option for NLN series: Power transistors, parallel to the output, acting as current sink.

### Ambient temperature

See temperature range.

### Analog programming

The standard analog programming allows an adjustment of voltage and current by an external DC voltage of 0 - 10 V, as well as the read-out of the actual values on monitor terminals, standardized to 0 - 10 V, see options page 60.

### Analog programming, floating

Function as above, but isolated from the power supply up to 2 kV DC, see options page 60.

### Autoranging

Power supply with fixed power limitation. Within this power limitation, results are a wide, automatic adapted operating range.

### Bipolar

Bipolar power supplies can be adjusted from plus to minus with continuous zero crossing.

### CE sign

All F.u.G. power supplies have a CE label, a guarantee for the correlation with the current EMC and safety standards:

Safety:  
EN 61010 ( $\underline{\underline{=}}$  VDE 0411)

EMC:  
EN 50081-1 and EN 50082-1 single-phase mains connection  
EN 50081-2 and EN 50082-2 two- and three-phase mains connection

### Certificate of calibration

All F.u.G. power supplies are calibrated at the factory. The certificate of calibration confirms the compliance of the output data with the catalogue data, such as:

- Indication on the DVM
- Monitor voltages\*)
- Computer output data\*)
- Reference voltage\*)
- Linear coherence between control voltage and output value\*)

\*) Options

### Charging current

F.u.G. capacitor charging power supplies are operating with constant current. It is adjustable to each value up to the nominal value.

### Charging power

Power specification for capacitor charging power supplies. The data are in J/s and are valid for charging from "0" to the nominal voltage.

### Chopper controlled

Switch mode power supply with Pulse Wide Modulation.

### Current control

Standard power supplies can be operated in constant voltage or constant current. The switchover occurs automatically with a sharp transition.

### Current limitation

When a power supply operates with constant voltage, the current potentiometer can be used for setting the current limitation. At HCN7E.. the value is fixed.

### Deviation

a) Deviation of the output voltage (or output current when specified) for  $\pm 10\%$  variation of the line voltage.

This data always refers to the nominal value and is valid for constant operating conditions.

b) Deviation of the output voltage (or output current when specified) over a period of 8 hours. This data always refers to the nominal value and is valid for constant operating conditions.

c) Deviation of the output voltage at load changes from full load to no load.

This data always refers to the nominal value and is valid for constant operating conditions.

**Constant conditions** means, that in each case, all other conditions like load, ambient temperature and mains voltage are constant.

### DIN EN ISO 9001

Since 1994 F.u.G. is following this quality assurance system. All supplied units have been tested and recorded in our test department, maintaining the assured characteristics, using calibrated measuring instruments.

### Discharge time constant

This data always relates on the output under "0" load. It is the time which the output voltage has to fall down to  $1\tau$  (37%) of the adjusted voltage, after the output has been switched off.

### Double power supply

The positive and the negative output are symmetrically controlled by one common potentiometer.

### Double stabilized

The units are transistor controlled and have a thyristor prestabilisation.

### Dumpswitch

Fast discharging switch for a controlled discharge of internal and external capacitors.

### Efficiency

We state no defined values for efficiency, because they are depending on the operating point of the power supply.

### EMC

**Electro Magnetic Compatibility**

### EURO-size

Widespread size of plug-in cases, 3 HU

### Fast de-energizing

Option for super conductor supplies for controlled de-energizing of super conducting coils/magnets at quench.

### Final charging voltage

Preset voltage for capacitor charging power supplies up to which shall be charged.

### Floating

So indicated terminals have no DC connection to other parts of the unit or to ground. The respective permissible potential difference is indicated.

### IMS-size

Elder size of plug-in cases, 4 HU

### Interlock

Loop for load monitoring. Mains disconnection, but no forced discharging of output and load.

### Light flux regulation

Lamp ballast units have a terminal for the connection of photoelements to control the light flux of the lamp.

### Linear controlled

Full transistor regulation, without pre-stabilization.

### Mains connection

Stated are the mains voltage, the permissible tolerance  $\pm 10\%$ , the line frequency range, as well as the type of line connection, e.g. single phase, two-phase or three-phase. The connections N (neutral) and PE (protection earthing) are always necessary.

### Nominal current

Maximum available current.



# Technical Appendix

## Continuation

### Nominal power

Maximum available power from the power supply. No higher power is available, not even for a short time.

### Nominal voltage

Maximum adjustable voltage

### Output isolation

On units where the "0V" terminal (or generally one output terminal) is not firmly connected to earth, or may be disconnected, it is indicated up to which voltage the terminal may float with respect to earth. Attention! For equal output terminals (Except the cassettes HCN7E and HCE) for all low and medium voltage power supplies up to 2 kV the value is valid for both terminals.

### Polarity reversal

For HV power supplies a polarity reversal switch is available as an option. For further information see page 61, options.

### Power limitation

As a standard only the series MCA has a fixed adjusted power limitation. All other series can be operated with nominal voltage and nominal current.

### Power control

Adjustable power regulation see page 61, options.

### PROBUS

F.u.G. - name for a stand alone computer interface with analog output.

### Quench

Leaving the super conducting condition at super conducting coils/magnets.

### Quench detector

Circuit to detect a quench.

### Rack-adapter

Accessories to mount table-top units into a 19" rack.

### Recovery time

This regulation time is stated independent for voltage and current. For voltage control it is the time, which the power supply needs to come back to the adjusted voltage after a load variation from 10% to 100% or from 100% to 10%.

For current control it is the time, which the power supply needs to come back to the adjusted current after a load variation, when the output voltage does not change more than 10% of the nominal voltage.

### Regulations

See standards

### Repetition frequency

This frequency corresponds to the repetitive charge and discharge of capacitor charging power supplies. It influences the final charging voltage.

### Reproducibility

Accuracy of an adjusted value, which can be set again at a later time (under equal conditions). It always refers to the nominal value.

### Residual Ripple

If not otherwise stated the residual voltage ripple is mentioned. It always refers to the nominal value, independent of the adjusted value. The frequency of the ripple is the frequency of the rectifier and its harmonics, at chopper controlled units also 20/40 kHz. For capacitor charging power supplies the value of the charging current is mentioned.

### Safety

See under CE.

### Sense terminal

At low voltage power supplies sense lines can be connected to these terminals to compensate voltage drop on the load lines. The nominal output voltage always refers to the output terminals and does not consider a voltage drop on the load lines. The compensation of the voltage drop on the load lines is 5% of the nominal voltage, but min. 1V and has to be considered choosing the nominal voltage.

### Setting range

Adjustable range within an output value.

### Setting resolution

Smallest possible steps for the adjustment of voltage or current, always referring to the nominal value.

### Setting time

Time which the output needs to follow a set command.

### Stability

See deviation

### Standards

The design and production of the power supplies follows the latest standards for EMC and safety, see CE.

### Temperature coefficient (TC)

In addition to the value for longtime stability, we mention also the drift of an output value depending on the variation of the ambient temperature, but otherwise constant conditions. The data are per Kelvin and are only valid within the confirmed temperature range. The TC always corresponds to the nominal value. With the option "higher stability" also the TC improves.

### Temperature range

All data in the catalogue are valid for an ambient temperature of 0 - 40°C.

### Trigger input

Capacitor charging power supplies have a potential isolated input to control the charging cycle.

### Unipolar

Units with only one polarity, no regulation across zero.

### Voltage control

Standard power supplies can be operated in constant voltage or constant current. The switchover occurs automatically with a sharp transition.

### Warm-up time

Stability data are only valid after a certain warm-up time (> 30 min.).

### 2-quadrant operation

The unit operates as current source and current sink within one polarity ranges.

### 4-quadrant operation

The unit operates as current source and current sink within the positive and the negative polarity range.

## Formulas

### Valid for capacitor charging power supplies:

Necessary charging power in Joule / sec.

$$W = \frac{C \cdot V^2 \cdot f}{2} \quad [\text{J/s}]$$

or

$$W = \frac{C \cdot V^2}{2 t} \quad [\text{J/s}]$$

The formulas are valid for fast and total discharging.

The first numeral in the model number refers to the charging power in J/s, the second one is the nominal output voltage.

e.g.  
HCK 800-20000  
Charging power 800 J/s  
Voltage 20000 V

This correspond to an output power of 1600 W.

With an order for capacitor charging power supplies we ask for the load capacity, the repetition frequency of the discharges and whether it comes to oscillating discharges.

### Valid for super conductor power supplies:

Energy stored in the coil.

$$W = \frac{I^2 \cdot L}{2} \quad [\text{Ws}]$$

Important for the design of a discharging circuit (dumpswitch)

### Informations to efficiency and the required mains fuses.

Single-phase power supplies are not noted here, if a 16 A fuse is sufficient.

Series	Power Class	Voltage Range	Efficiency	Mains Fuses
NTN	4200W	6,5V to 20V	typ. 70-80%	25A
NTN	4200W	35V to 350V	typ. 90%	25A
NTN	7000W	6,5V to 20V	typ. 70-80%	25A
NTN	7000W	35V to 350V	typ. 90%	25A
NTN	10500W	6,5V to 20V	typ. 70-80%	32A
NTN	10500W	35V bis 350V	typ. 90%	32A
NTN	14000W	6,5V to 20V	typ. 70-80%	32A
NTN	14000W	35V to 350V	typ. 90%	32A
NTN	21000W	6,5V to 20V	typ. 70-80%	50A
NTN	21000W	35V to 350V	typ. 90%	63A
NTN	28000W	6,5V to 20V	typ. 70-80%	80A
NTN	28000W	35V to 350V	typ. 90%	100A
NTN	35000W	6,5V to 20V	typ. 70-80%	80A
NTN	35000W	35V to 350V	typ. 90%	80A
NTN	50000W	6,5V to 20V	typ. 70-80%	160A
NTN	50000W	35V to 350V	typ. 90%	160A
NYN / MYN / HYN	7000W	all		20A
NYN / MYN / HYN	10500W	all		25A
NYN / MYN / HYN	14000W	all		50A
NYN / MYN / HYN	21000W	all		50A
NYN / MYN / HYN	28000W	all	typ. 86-93%	63A
NYN / MYN / HYN	35000W	all		80A
NYN / MYN / HYN	50000W	all		100A
NYN / MYN / HYN	70000W	all		160A
NYN / MYN / HYN	100000W	all		200A
MCA	3000W	all		10A
MCN	2800W	all		6A
MCN	4200W	all		10A
HCN	2800W	all		6A
HCN	4200W	all		10A
HCH	10000W	all		32A
HCH	15000W	all		50A
HCH	20000W	all	typ. 85%	63A
HCH	30000W	all		100A
HCH	40000W	all		125A
HCH	50000W	all		160A
HCK	1600W	all		10A
HCK	2500W	all		16A
HCK	5000W	all		32A
HCK	10000W	all		63A
HCK	20000W	all		125A

The stated efficiencies are average values and valid only for the indicated voltage range.  
The values are valid for the maximum power, for lower loads variations are possible.

### All technical data

in this catalogue correspond to the date of printing and have been found accurate to the best of our knowledge. Nevertheless mistakes and printing errors are out of our obligation. Statements are for more precise descriptions of the models, but not assured features according to German § 459 BGB, if they are not especially called as such.

### Changes

Technical improvements or adaptations to modified standards are reserved.

### Photos

in this catalogue are design examples, but not binding upon the supplied design.

**During the term of this catalogue the design of the 19" rack cabinets will be modified.**

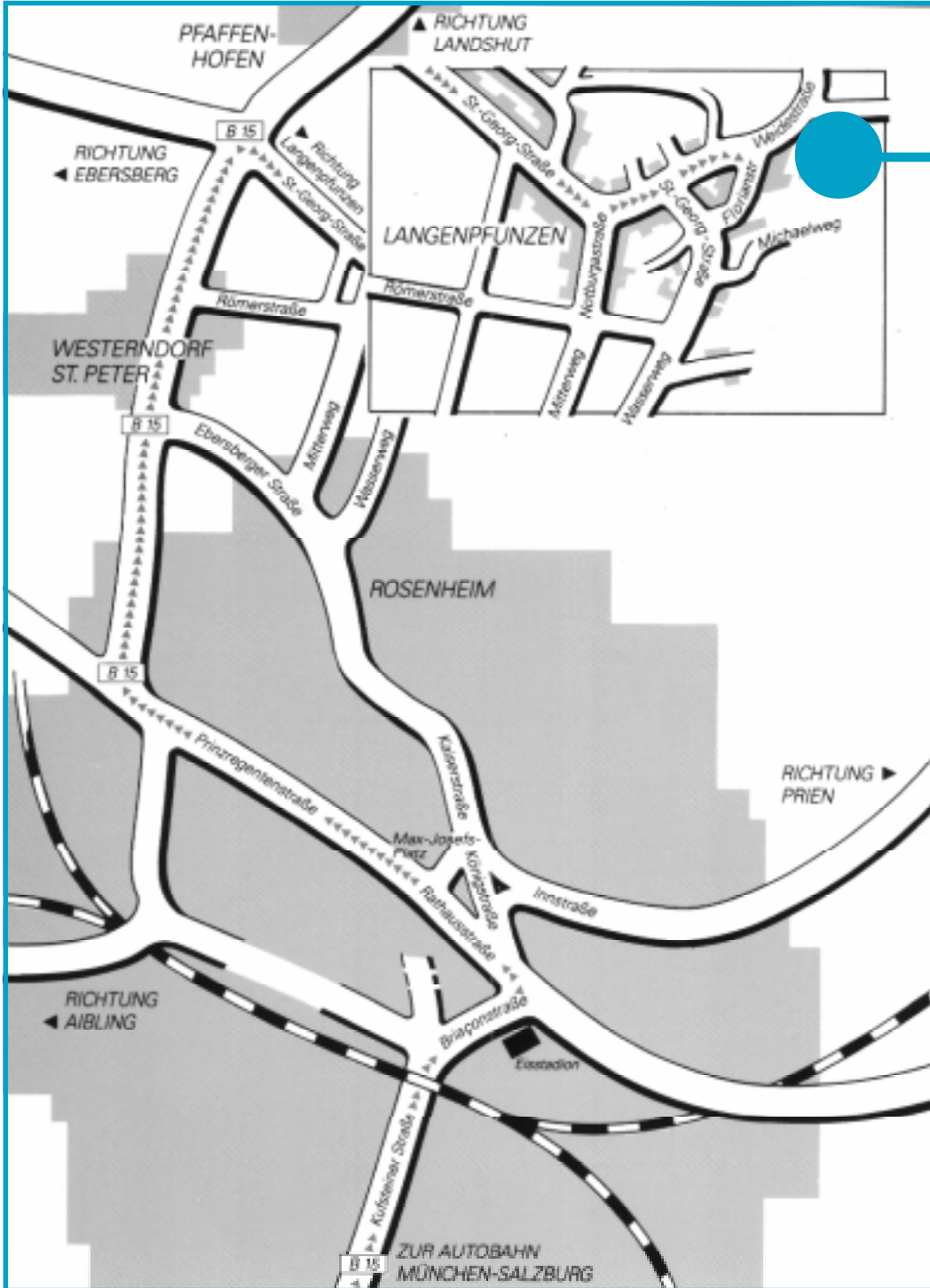
### Warranty

For all our power supplies we provide a 2 years warranty, according to our General Conditions of Delivery.

### Delivery conditions

according to our General Conditions of Delivery and Payment, see price list.

# How to find us !



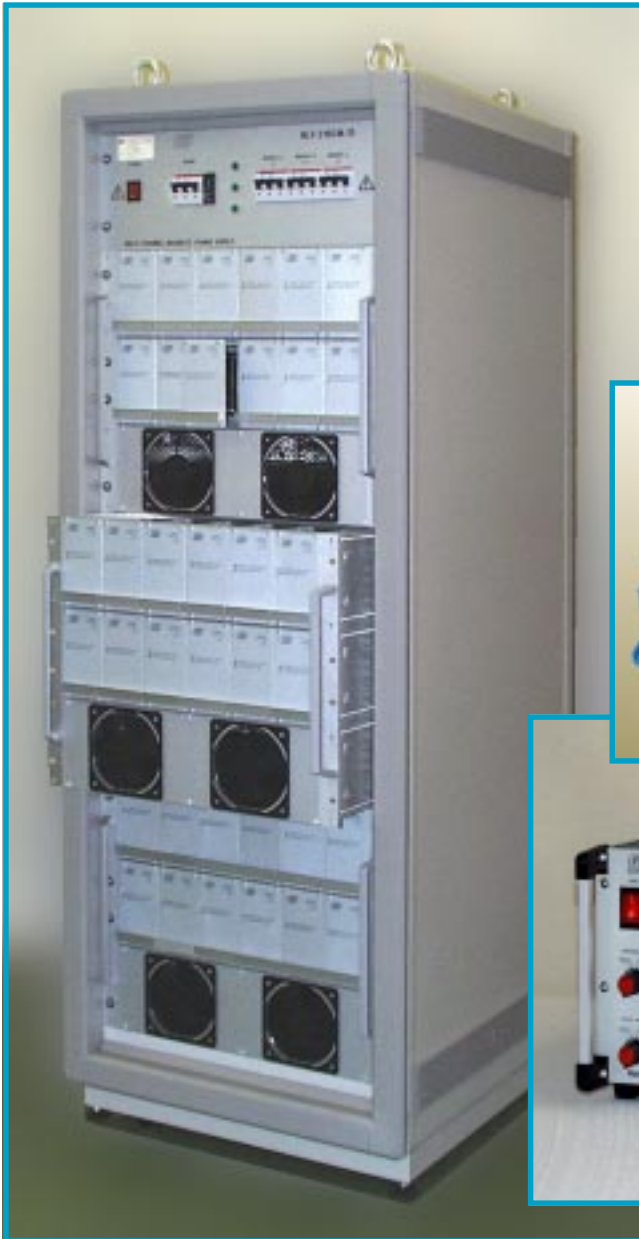
Motorway München - Salzburg  
Exit Rosenheim,  
follow B15,  
through Rosenheim  
direction Landshut,  
after Westerndorf St. Peter  
turn right to Langenpfunzen.

**F.u.G. Elektronik GmbH ; Florianstr. 2 ; D-83024 Rosenheim**  
District Langenpfunzen

**F.u.G. Elektronik GmbH - Florianstr. 2 - D 83024 Rosenheim - GERMANY**



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## F.u.G. Elektronik GmbH

Florianstr. 2, D-83024 Rosenheim

Tel.: +49(0)8031 2851-0 ; Fax: +49(0)8031 81099

GERMANY

eMail: [info@fug-elektronik.de](mailto:info@fug-elektronik.de)

Internet: <http://www.fug-elektronik.de>