

# Controllable DC- & AC- Power supply units

For plant engineering,  
research and development



DCP520/60C bipolar power supply unit  
+25 V, +20 A continuous current  
+60 A peak current

**programmable - high-precision**  
**extremely fast - EMI-free**  
**bipolar & unipolar**  
**10 W to 12 kW**



# SERVOWATT power supply units are completely different !

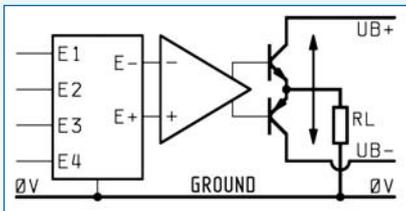
## Installing power supply units for plant and systems

These power supply units are mainly installed in control units for machines, plant and systems; unlike laboratory power supply units, they do not need a costly protective housing, extensive displays or switches and controllers.

## Controllable power supply units

They are precisely the opposite of a "constant" unit with a big capacitor at the output which just permanently supplies the same current or the same constant voltage.

With up to four control inputs, they offer a maximum of convenience for ideally fulfilling all possible control engineering tasks, for adding or subtracting control signals or for working as an independent servo system. Extremely fast and precise control systems for power, acceleration, speed, temperature and generally all physical parameters and their processes can be stabilised and independently controlled in this simple manner.

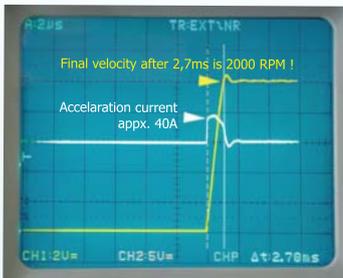


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## Linear output stages make our power supply units extremely fast and highly precise.



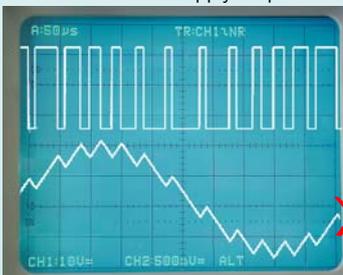
We do precisely the opposite of a "normal", slow power supply unit. They work internally with large amplification and bandwidth to achieve speed and precision simultaneously. In standard devices with 500 watts it is possible to alter the output voltage by up to

5 volt per microsecond, which corresponds to frequencies up to 30 kHz.

## Linear output stages don't produce any interferences

These output stages work flexibly and basically produce no interference in the power supply unit. Adjacent systems are not disrupted by external signal components, pulse needles, harmonics or noise.

PWM-Power Supply output



Power supply units with a linear output stage



## Choosing the right power supply unit: choice of polarity

Depending on the polarity of the output voltage in relation to the main ground, we differentiate with all our power supply units between three device categories: positive, negative and bipolar versions equivalent to 1 and 4 quadrants.

Unipolar power supply units can only supply energy in one direction.

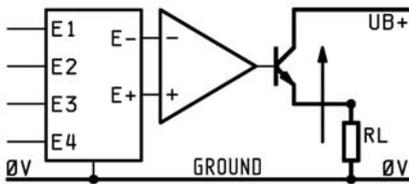
Bipolar power supply units, on the other hand, can take back energy and therefore very quickly dissipate currents and voltages! This is especially important for loads with capacitances and inductors because these loads have an energy-storing effect.

**Tailor-made power supply units • This is our standard**

*servowatt*

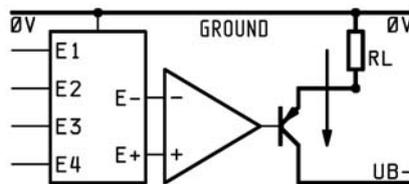
Depending on the polarity of the output voltage in relation to the main ground, we distinguish with our power supply units between three device categories: positive, negative and bipolar versions.

## Positive unipolar 1-quadrant operation



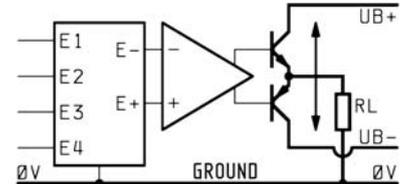
This is the most frequently used **DC power supply** unit with a positive output voltage in relation to the ground. Our circuit design even allows external control of the voltage right down to zero, even with full current.

## Negative unipolar 1-quadrant operation



There are also applications which require negative voltage in relation to the main ground. These **DC power supply** units can also be controlled by any potentials from above or below zero volts/main ground.

## Bipolar power supply unit for 4-quadrant operation



For applications which require both a positive and a negative output voltage, we offer a third version: a **controllable AC/DC power supply** unit with limit frequencies up to 100 kHz.

## Our power supply units can be controlled externally

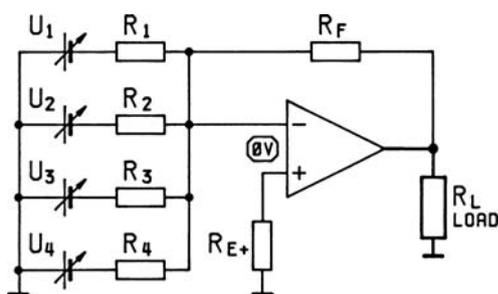
With up to four control inputs, they offer a maximum of convenience for ideally fulfilling all possible control engineering tasks: The E1, E2, E3 and E4 control inputs can be used as set/nominal or actual value inputs.

It is important that the control signals can have a positive or negative potential regardless of the polarity of the output voltage in relation to the main ground.

Any voltages or currents (e.g. 0-20 mA or 4-20 mA) can be used as control signals.

One of many possible circuits

### Inverting summer circuit



$$U_A = -R_F (U_1/R_1 + U_2/R_2 + U_3/R_3 + U_4/R_4)$$

The analogue controller at the control input ensures speed and precision.

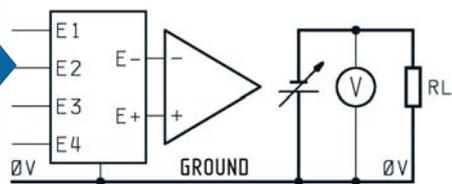
### Convincing technical data:

- **Small input bias currents**, typically 3,0 nA
- **Very high internal amplification** better than 20.000.000 V/V
- **Small offset temperature drift** typically < +/- 0,2 µV/K
- **Offset adjustment** extremely precise: Typical range +/- 1,0 mV
- **High power bandwidth**, typically 25kHz versions up to 100kHz also available
- **High slew-rate, typically 5V/µs** versions up to 40V/µs also available
- **Very high input impedance** typically 100M Ohms (differential)
- **High common mode rejection voltage** typically 135dB at 10Hz
- **Excellent linearity**
- **Zero Ohm impedance at output**
- **Continuous short-circuit operation permissible**
- **Linear power output 25 W to 2 kW**, (PWM from 300 W to 12 kW)

## 2. Function selection on controllable power supply units

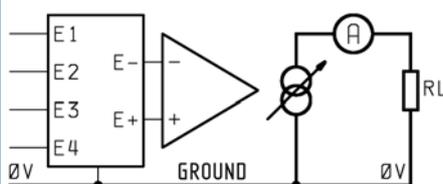
We distinguish between control types: Voltage control is the default. We offer our customers two further externally controllable functions: Current and servo control.

### Voltage controller



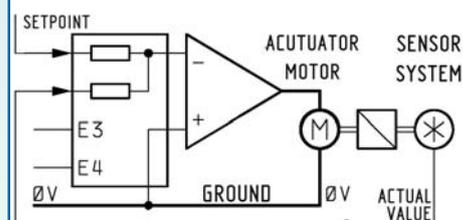
As a **voltage controller** with an output impedance of zero Ohms, the output current is always constant and independent of the load so that the voltage adapts to the load.

### Current controller



As a **power source**, it is precisely the reverse, the output impedance is infinite, the impressed current always remains constant and the voltage adapts to the load.

### Servo controller



As a **servo controller**, the control voltage is compared to the signal supplied by a sensor of the parameter to be stabilised, e.g. a speed.

Contrary to a normal control signal in relation to the zero potential of the main ground, the power supply unit can also be controlled as a **differential amplifier** by two potentials which are not related to the main ground.

We then define your desired power supply unit function by means of a programming PCB between the control inputs and the E+ and E- differential inputs.



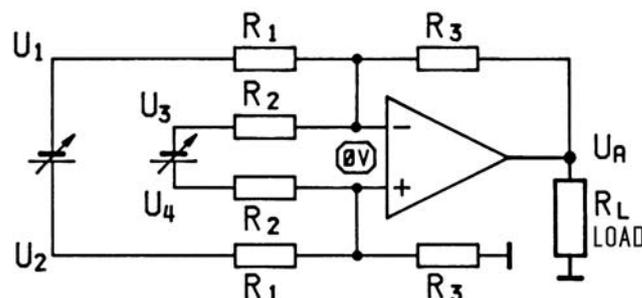
For instance it is possible to compensate the voltage drop in long control cables to the load by means of additional sense-cables.

Furthermore, the control signals can be integrated and differentiated to achieve specific properties such as high-pass and low-pass filtering.

All these special control options turn these power supply units into real supply all-rounders.

One of many possible circuits

### Summing amplifier with differential inputs



$$U_A = (U_2 - U_1) R_3 / R_1 + (U_4 - U_3) R_3 / R_2$$

### 3. Selection of device version by design

Three device versions are available which all basically offer the same functionality. The chassis versions are designed for higher power ratings, whilst the 19-inch PCBs and the VM series are intended for smaller power ratings.

#### Chassis versions



#### DCP-Series

**120 bis 4.000 W**  
+ -10V bis +70V

Complete AC-DC power supply unit  
Ready for connection with integrated  
power adaptor, fan and heat sink

#### 19 inch euroboards

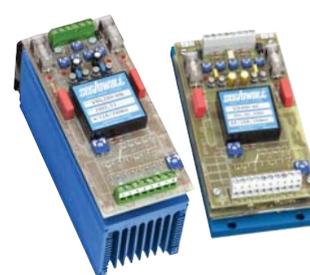


#### DCE-Series

**10 bis 800 W**

+ -10V bis +70V  
19" power supply unit for  
connection to a separate  
power supply

#### Mini power supply units



#### VM-Series

**10 bis 400 W**

+ -10V bis +70V  
Value-for-money power supply units  
with/without heat sink and  
power supply as flange version

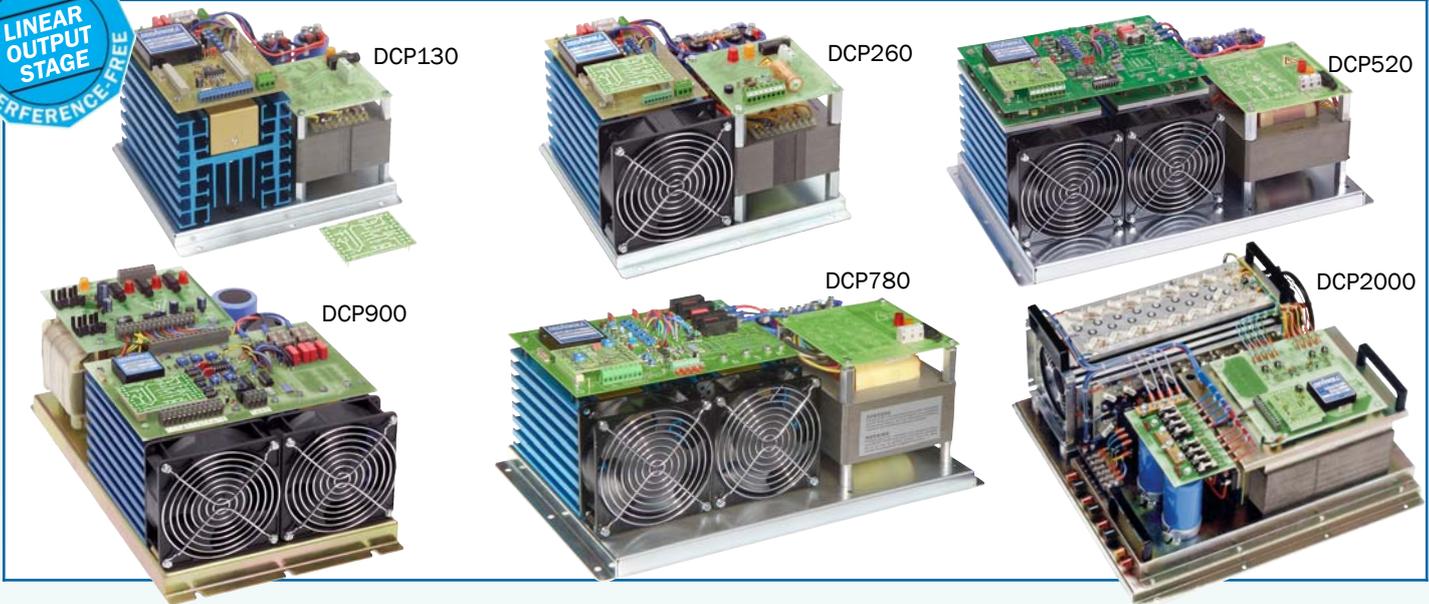
DCP-Typ	Ua/V	Ia/A	Pa/W
DCP- 130/30	25	5	125
DCP- 260/30	25	10	250
DCP- 390/30	25	15	325
DCP- 520/30	25	20	500
DCP- 780/30	25	30	750
DCP- 900/30	25	36	900
DCP- 2000/30	25	80	2000
DCP- 130/60	50	2,5	125
DCP- 260/60	50	5	250
DCP- 390/60	50	7,5	375
DCP- 520/60	50	10	500
DCP- 780/60	50	15	750
DCP- 900/60	50	18	900
DCP- 2000/60	50	40	2000
DCP- 4000/60	50	80	4000

DCE-Typ	Ua/V	Ia/A	Pa/W
DCE- 10/30	25	0,4	10
DCE- 25/30	25	1	25
DCE- 50/30	25	2	50
DCE- 100L/30	25	4	100
DCE- 200L/30	25	8	200
DCE- 400L/30	25	16	400
DCE- 800L/30	25	32	800
DCE- 25/60	50	0,5	25
DCE- 50/60	50	1	50
DCE- 100L/60	50	2	100
DCE- 200L/60	50	4	200
DCE- 400L/60	50	8	400
DCE- 800L/60	50	16	800
Customized versions and special versions upon request			

VM-Typ	Ua/V	Ia/A	Pa/W
VM 10/24	24	0,4	10
VM 25/24	24	1	24
VM 50/24	24	2	48
VM 100/24	24	4	96
VM 200/24	24	8	192
VM 200L/24	24	8	192
VM 400/24	24	16	384
VM 400L/24	24	16	384
VM 25/48	48	0,5	24
VM 50/48	48	1	48
VM 100/48	48	2	96
VM 200/48	48	4	192
VM 200L/48	48	4	192
VM 400/48	48	8	384
VM 400L/48	48	8	384
VM 260/60*	50	5	250



## DCP series: ready-to-connect chassis versions



## VM series: compact power supply units



## DCE series: 19 inch plug-in power supply units



For all cases with higher power requirement we offer PWM power supplies with L / C filtered output

## PWM high-performance power supply units up to 12kW with L/C filter



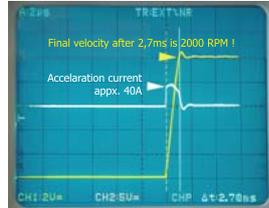
# Power supply units with a linear output stage offer many advantages



Linear output stages do not offer the highest degree of efficiency. This clean solution does, however, offer many advantages which cannot be achieved otherwise. In today's measuring technology alone, such small signals are processed that all sources of interference are generally completely unwanted.

## Extremely fast control

Virtually time lag-free reaction in control circuits



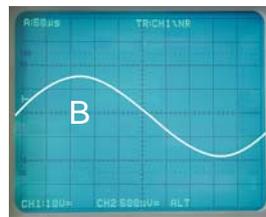
Highly dynamic controls demand a time lag-free reaction from voltage and current controllers. In this highly dynamic servo system, the moving coil DC motor accelerates precisely from zero to 2000 rpm in just 2.7ms!

## Linear control

Infinite resolution  
Without residual ripple



PWM-Power Supply ❌



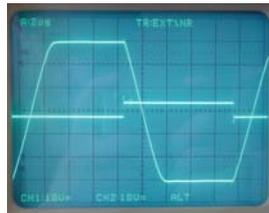
Linear-Power Supply ✅

**Figure A:** Filtered PWM signal. Dynamic control processes demand output stages without a retarding filter at the output.

**Figure B:** Only a linear output stage can supply infinite resolution and high precision.

## High power bandwidth

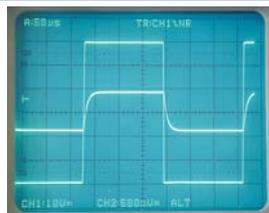
Standard devices typically with 25 kHz  
Special devices up to 500 kHz



Real-time controllers demand a high power bandwidth equivalent to a high output stage voltage fluctuation rate (slew rate).  
Photo: Frequency 55 kHz, slew rate  $\pm 20V/\mu s$ , output  $\pm 30V / 4A$

## EMC immunity

No impulse interference,  
harmonics or noise  
in the system



These linear output stages work flexibly and basically produce no interference. Adjacent systems are not disrupted by external signal components, pulse needles, harmonic overtones or noise.

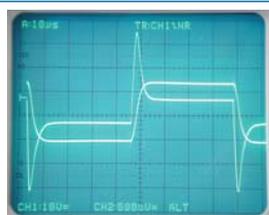
**Distortion-free bipolar control through zero and therefore the highest dynamic precision**



The precise management of current and voltage demands control through zero without dead zones and dead time. In the illustration, current and voltage constantly go through zero. The consumer therefore remains actively managed in the zero range.

## Short-circuit-proof output stages

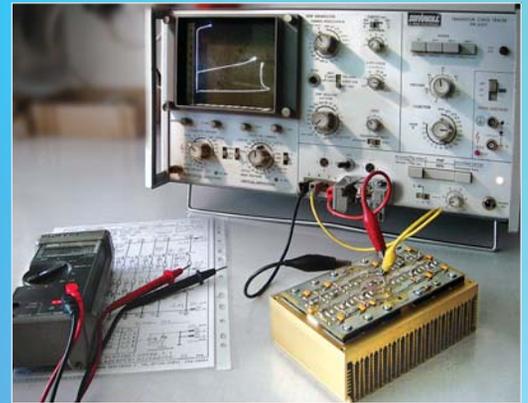
Exemplary reliability for Demanding applications



Transistors with up to an 8-fold (!) total dissipation loss value guarantee the high reliability of the output stages. Our 4-quadrant operation requires continuous short-circuit operation.

10 kHz Sinus  
High-power oscillator

Module test  
with the microscope



## Quality - The basis of trust

### Quality without compromises:

The characteristic tracer gives the most reliable indication of the semi-conductors' inner workings. The output stages are tested according to a number of criteria:

Maximum voltage, saturation voltage, current amplification, leakage current and insulation voltage.



DCP 520/60C final check before shipping

## Realising projects with SERVOWATT power sources

### ESO project successfully completed!

International research project at the VLT giant telescope in North Chile: success is also the sum total of many correct decisions and developments in a chain of suppliers.

**Customer-orientation and zero defect quality in this chain are absolutely imperative for SERVOWATT.**



The mirror of the Halfmann Siderostat in the European Observatory in northern Chile is precisely positioned from our power supply VM260/60.

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