DP-S Series User's Manual

By DSC-Electronics Germany • Georgstraße 36 • 53111 Bonn

1. Connection

Our devices are pre-configured to the power grid chosen with order (if not specified otherwise, our devices are manufactured for the EU power grid 230V 50Hz / 400V 50Hz). Subsequent adjustment after delivery is not possible. Connecting the device to an unsuitable power source will void any warranty.

1 Phase / EU Power Grid	
Voltage (Recommended)	230V ± 10% AC
Voltage (Max.)	250V AC
Frequency	50Hz - 60Hz
Circuit breaker minimum requirements	The maximum current of the device shall be determined as follows: I = (maximum power of the device / 230) + 2
1 Phase / American Power Grid	
Voltage (Recommended)	115V ± 10% AC
Voltage (Max.)	130V AC
Frequency	50Hz - 60Hz
Circuit breaker minimum requirements	The maximum current of the device shall be determined as follows: I = (maximum power of the device / 115) + 4

3 Phase / EU Power Grid (TN-S Network)	
Voltage (Recommended)	380V - 410V
Voltage (Max.)	430V
Frequency	50Hz
Circuit breaker Minimum requirements	The maximum phase current of the device shall be determined as follows: I = ((maximum power of the device / 400) / 1,73) + 2

2. General

Please read through and understand this Operation Manual before operating the product. After reading always keep the manual nearby so that you may refer to it as needed. When moving the product to another location, be sure to bring the manual as well.

Calibration

Before shipment, the instrument has been calibrated carefully in our factory. The calibration procedures and standards are compliant to the national regulations and standards for electronic calibration. If you have requested a certificate with your order, this is enclosed with your device. With ordered off-site calibration (DaKKS) the calibration was not performed in-house, please refer to the laboratory calibration protocol for details.

Warranty

We guarantee that the instrument has undergone a strict quality test before shipment and has passed all prescribed functional tests. We provide our customers with a warranty period of three years from receipt of the device. During the warranty period, all repairs, as well as spare parts are always free of charge. The warranty is void in the case of defects which have been caused by user's fault, or in case of unauthorized opening.

2.1 Safety Instructions

This chapter contains important safety instructions that you must follow when operating the instrument and when keeping it in storage. Read the following before any operation to insure your safety and to keep the device in a proper condition.

Safety Symbols

The following safety symbols may appear in this manual or on the instrument:

	**WARNING**	Identifies conditions or practices that could result in injury or loss of life.
	**CAUTION**	Identifies conditions or practices that could result in damage to the instrument or to other properties.
	**DANGER**	High Voltage
	**ATTENTION**	Refer to the Manual
		Protective Earth (PE)
		Earth (Ground)

2.2 Safety Guidelines

Please follow the safety guidelines when using and putting the device into operation in order to prevent safety risks and to ensure the correct operation of the product.

- **Before connecting the device to the local power supply, make sure that the device is switched off.**
- **Check if the product is compatible with the local power supply before connecting it.**
- **Be careful on the correct earthing of the device (PE connection)**
- **Do not use the product in humid environments**
- **Do not touch the output terminals of the product with unprotected hands while it is switched on.**
- **Do not use the device in extremely dusty rooms**
- **Do not use the device outside the parameters specified in the data sheet**

2.3 Unpacking and Examination

Our products are delivered carefully packed in cardboard boxes or in wooden crates, depending on place of destination and the type of the device (dimensions, weight). We pay attention to the environmental compatibility of the upholstery and packaging materials used and ask you to dispose the filling material correctly if present.

Please unpack the device and check the packaging as well as the product for transport damage. Should you notice any damage to the packaging or the device, we ask you to log it with photos and inform us immediately.

ATTENTION: If the device has been delivered in a wooden box, please do not dispose it as it can be used for eventual return transport for service procedures. Also the packaging material of smaller devices can be stored in order to be used if necessary for a return transport.

3. Product Description

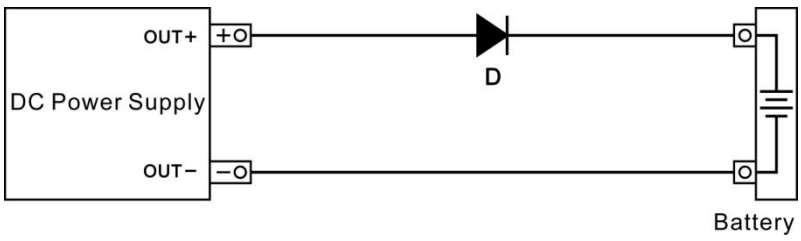
The DP-S power supply can supply voltage and current in constant voltage (CV) or constant current (CC) mode within the rated output range. This allows continuous switching from constant current to constant voltage modes in response to the load change.

In CV mode, a regulated output voltage is provided. The output voltage remains constant as the load increases while the output current changes in response to load changes, until the preset current limit point is reached. At this point, the output current becomes constant and the output voltage drops in proportion to the further increases in load (CC mode). The mode is indicated by the front panel LED indicators.

Similarly in CC mode switching from CC to CV mode automatically occurs from a decrease of the load. A regulated output current is provided. The output current remains constant as the load decreases while the output voltage changes in response to the load changes.

3.1 Batteries and capacitive loads (Only important for power supplies without the [R1] option)

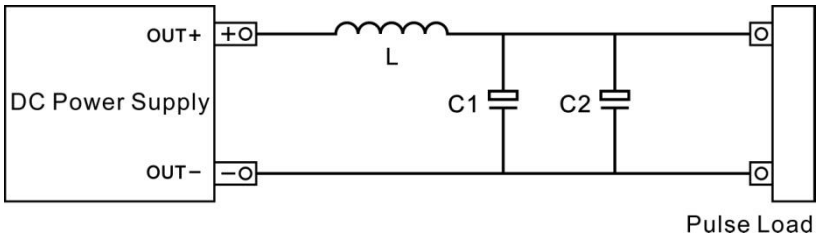
If using the DP-S for charging a battery or with large capacitive loads, it is required to connect a diode between the power supply and the load.



3.2 Pulsed Load

If the peak current of a pulse load such as motor, bulb, DC-DC or DC-AC converter module is nearly the rated current of the power supply, it can cause voltage drop or instability to the output.

A basic solution is to connect an inductor in serial between the power supply and the load. If the pulse circuit has a small pulse width or low peak current, another solution is to additionally connect a capacitor with large capacity. A reference for choosing the capacity of a capacitor is: 1000uF capacity to 1A current.

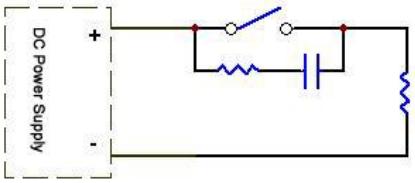


3.3 Inductive loads (Only important for power supplies without the [R1] option)

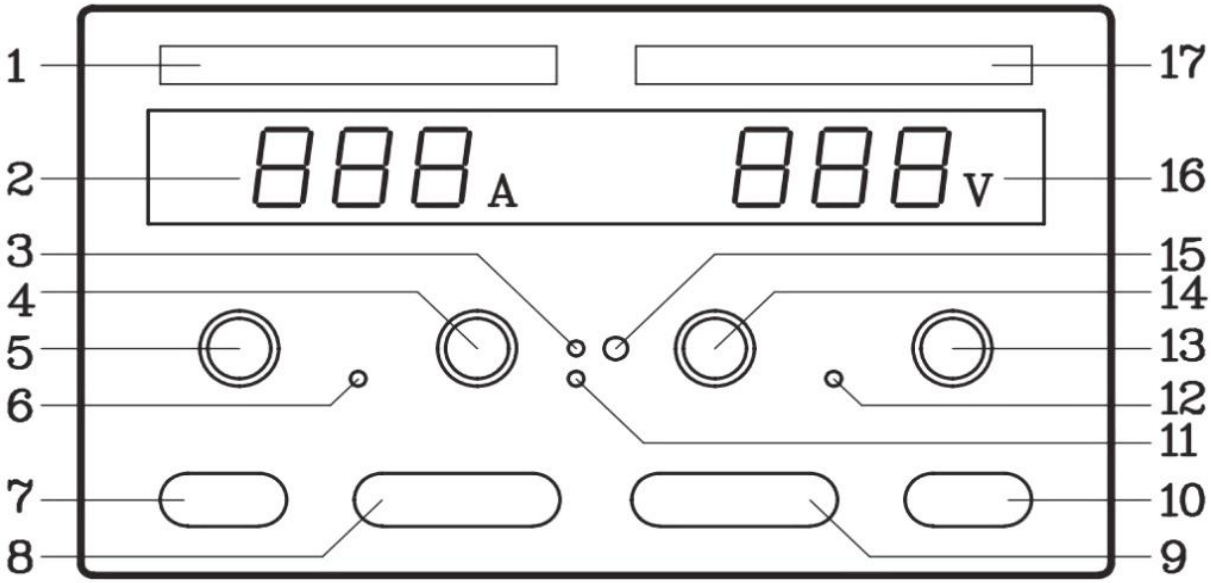
If the power supply is connected to a highly inductive load it can cause reverse polarity current to the power supply output which can damage the power supply and/or lead to unstable operation. A solution is to connect a free-wheeling circuit (diode and resistor) in parallel to the load.

3.4 Mechanical Switches

If a mechanic switch is used to connect or disconnect the power supply output, electric discharge will occur during switching. This may cause instability to the output. To prevent such situations, connect a RC circuit to the switch contact point.



4. Front Panel



No.	Name	Description
1	Label	DSC-Electronics Logo
2	Ammeter	Displays the output current.
3	OTP indicator	The indicator lights on if the Over Temperature Protection is activated, or the device is in „CoolDown" mode. Switch off the output and let the device cool down for 15 minutes.
4	Current set	Coarse regulation of the output current.
5	Current fine set	Fine regulation of the output current.
6	CC indicator	The indicator lights on if the power supply is under constant current operation mode.
7	Power switch	Press to power on/off the power supply.
8	Connection 1	External In-/Output
9	Connection 2	Optional: Secondary output
10	Output ON/OFF	Output ON/OFF switch.
11	OVP indicator	The indicator lights on if the Over Voltage Protection is activated.
12	CV indicator	The indicator lights on if the power supply is under constant voltage operation mode.
13	Voltage set	Coarse regulation of output voltage.
14	Voltage fine set	Fine regulation of output voltage.
15	OVP setting knob	Used to set the value of over voltage protection. Leave at max. or set it with a small screwdriver if needed.

5. Operation

Always check that the output is switched off and the capacitors are discharged before connecting the load to the power supply. The load can be connected either after or before the power supply is switched on - but always before the output is switched on!

Caution: Always check if the "Power ON/OFF" and the "Output ON/OFF" buttons are in position OFF before connecting the device into the local power grid. Also please check if the "Output ON/OFF" button is in the OFF position before powering the device on. Connection of the device to the power grid with enabled output and/or "Power ON/OFF" button in the ON position can damage the power supply.

Caution: Power supplies of the DP-S series are equipped with a discharge circuit on the output side, which discharges the filter capacitors after switching off the output. For this reason, high-capacitive loads are always to be separated by a diode from the power supply, otherwise the discharge circuit can be overloaded.

5.1 Over Voltage Protection (OVP)

1. Connect the power supply to local power source.
2. Press the power switch [7] to turn on the power supply.
3. Switch on the output by pressing Output ON/OFF [10].
4. Tune the over voltage setting knob [15] and current knob [4] clockwise to the maximum.
5. Tune voltage knob [13, 14] to the necessary value of OVP.
6. Tune the over voltage knob [15] anti-clockwise until the OVP indicator [11] lights on. Now the power supply shuts down output.
7. Switch OFF the power supply [7]. The OVP is now set.

NOTE: If no special OVP setting is required, leave the adjustment at its maximum point (Max. Output voltage +5%)

5.2 CV Constant Voltage Mode

1. Connect the power supply to local power source.
2. Press the power switch [7] to turn on the power supply.
3. Switch on the output by pressing Output ON/OFF button [10].
4. Set the Current Knobs [4, 5] clockwise to the maximum.
5. Tune knobs [13, 14] to the necessary voltage value.
6. Switch off the output by pressing Output ON/OFF button [10].
7. Connect the load to output terminals [18, 19].
8. Switch on the output [10]. The power supply can be used now.

The CV indicator [12] will light on, which means the output voltage is constant, while the output current changes according to load capacity.

5.3 CC Constant Current Mode

1. Connect the power supply to local power source.
2. Press the power switch [7] to turn on the power supply.
3. Switch on the output by pressing Output ON [10].
4. Tune the over voltage setting knob [15] clockwise to the maximum.
5. Tune voltage knob [13] to the desired max. value.
6. Tune current knob [4, 5] to the minimum.
7. Switch off the output by pressing Output ON/OFF [10].
8. Use a test lead to short the two main terminals [18, 19].
9. Switch on the output by pressing Output ON [10].
10. Tune current knobs [4, 5] to the necessary current value.
11. Switch off the output by pressing Output ON/OFF [10].
12. Connect the load to output terminals [18, 19].
13. Switch on the output by pressing Output ON [10].

The CC indicator [6] will light on, which means the output current is constant, while the output voltage changes according to load capacity. If the CC indicator [6] is not on, increase the load capacity, change the constant current value or raise the max. voltage to reach a constant current.

NOTE: While the outputs of the power supply are shorted, a slight humming may be heard. This is normal and not a sign of malfunction.

5.4. Optional: *External Voltage and Current Control (analog)*

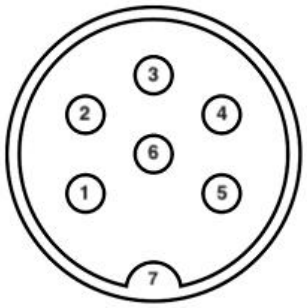
The external voltage and current regulation can be addressed via the female DIN-6 connector on the front. For further information regarding the pinout please check the illustrations at the end of this manual.

5.5 Optional: *External Output On/Off Control & Interlock*

Input for controlling the status of the output of the laboratory power supply (on / off), switchable as "Interlock" or external control. This input is configured as a two pin connection, a „true" state is triggered by shorting the two pins and a „false" state is triggered by removing any connection between the two pins of the input.

This option can be configured as either an interlock input, which disables the output of the power supply if the state is false, or as an external output status control which enables or disables the output of the power supply depending on the control signal state (true = on/false = off) if the „Output On/Off" switch of the power supply is always in the ON position.

6. Optional: *Analog Control Pinout*



Pin 1: External U control (5V, 10V, 4-20mA)
Pin 2: External I control (5V, 10V, 4-20mA)
Pin 3: Signal GND
Pin 4: -
Pin 5: External output On/Off control & Interlock (loop)
Pin 6: External output On/Off control & Interlock (loop)
Pin 7: Earth (PE)

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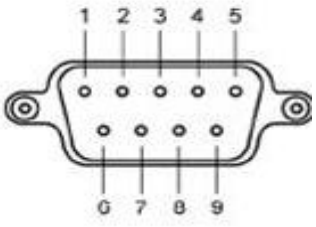
7 Interface Definition

7.1 Interface Definition of RS232

Pin out of the RS232 interface is given as below.

Connector illustration:



Pin out definition:

Pin	Pin out definition	Pin out function
1	NC	Blank
2	TXD	Send data
3	RXD	Receive data
4	NC	Blank
5	GND	Ground
6	NC	Blank
7	NC	Blank
8	NC	Blank
9	NC	Blank

8. Protocol (ModBus)

The data frame consists of four parts: device address, function code, data, error check.
To ensure reliability during communication, the time interval between each data frame shall be more than 3.5 times of a single byte character transmission time. For example, if the baud rate is 9600, the time interval between each data frame is more than 11*3.5/9600=0.004s.

The power supply uses Bidirectional asynchronous communication, with 1 start bit, 8 data bits and 1 stop bit. It supports four baud rates: 9600, 19200, 38400 and 57600.

8.1 Function Code

The following function codes (ModBus) are supported by the device:

Function code	Description
0x03	Read holding register(s), read data addressing by byte
0x06	Write single register, write data addressing by byte

8.2 Error Check

The power supply uses the Cyclic Redundancy Check (CRC16) checksum to prevent data corruption.

8.3 Complete Command Frame

Read Holding Register:

Request frame	**Data length**	**Value**
Address	1	1~250
Function code	1	0x03
Start address	2	0 ... 0x9999
Register number	2	n=1-4
Check code	2	
Reply frame	**Data length**	**Value**
Address	1	1 ... 250
Function code	1	0x03
Byte number	1	2*n
Data	2*n	
Check code	2	
Exception frame	**Data length**	**Value**
Address	1	1 ... 250

Function code	1	0x83
Exception code	1	1~5
Check code	2	

Example:
The power supply is a 36V 6A model, communication address: 250
We read the power supply's output voltage VS, register address of VS is: 0x0010
Send request: FA 03 00 10 00 01 90 44
Sample reply: FA 03 02 0E 10 58 3C
0E 10 is the read back voltage value.
HEX 0E 10 = Decimal value 3600, hence the output voltage is 36.00V.

Write Register:

Request frame	**Data length**	**Value**
Address	1	1 ... 250
Function code	1	0x06
Register address	2	0~0x9999
Data	2	
Check code	2	
Reply frame	**Data length**	**Value**
Address	1	1 ... 250
Function code	1	0x06
Register address	2	0 ... 0x9999
Data	2	0 ... 0xFFFF
Check code	2	
Exception frame	**Data length**	**Value**
Address	1	1 ... 250
Function code	1	0x86
Exception code	1	1 ... 5
Check code	2	

Example:
The power supply is a 36V 6A model, communication address: 250
We set the output voltage to 10V, register address of VSET is: 0x0030
Send request: FA 06 00 30 03 E8 9C F0
Normal reply: FA 06 00 30 03 E8 9C F0
HEX 03E8 = Decimal value 1000, hence the voltage is set to 10.00V.

Register Address Assignments

Name	Address	Byte	Attribute	Description
OUTPUT	0x0001	2	W/R	OUTPUT ON=0x0001 OUTPUT OFF=0x0000
PS	0x0002	2	R	Protection status =0x0001 Normal=0x0000
Model	0x0003	2	R	Model number register, u16 type
DP	0x0005	2	R	Decimal point number of V_A_W, read by bit
VS	0x0010	2	R	Voltage register
IS	0x0011	2	R	Current register
PSH	0x0012	2	R	Power register, high byte
PSL	0x0013	2	R	Power register, low byte
OVSET	0x0020	2	W/R	OVP register
OPSETH	0x0022	2	W/R	OPP register, high byte
OPSETL	0x0023	2	W/R	OPP register, low byte

VSET	0x0030	2	W/R	Setting voltage register
ISET	0x0031	2	W/R	Setting current register
ADD	0x9999	2	W/R	Address register

8.4 Frequently Used Functions

Voltage setup:

Operation	Register Name	Value	Description
Write Register	VSET	0~0xFFFF	Required

Current setup:

Operation	Register Name	Value	Description
Write Register	ISET	0~0xFFFF	Required

Enable output:

Operation	Register Name	Value	Description
Write Register	OUTPUT	0x0001	Required

Disable output:

Operation	Register Name	Value	Description
Write Register	OUTPUT	0x0000	Required