OPERATING INSTRUCTIONS

LINEAR SWITCHING POWER SUPPLY

DPS-4005PFC

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The DPS-4005 is a programmable switching power supply with high precision, high analyticity and it also with LCD to display output voltage, power settings and limits.

With its continuously-adjustable voltage and current settings, this power supply can be used universally in school, work, hobby and other applications. An electronic current limiter protects the power supply from overload and short circuit at its output; a fan controlled by a temperature circuit protects the power supply from thermal overload. During such an overload (short circuit or overload) the output is regulated down, i.e. the voltage is reduced. Only when the short circuit has been remedied is the output released.

The set values can be read by the illuminated multiple-line LCD display. The voltage, current or power setting is adjusted by means of an encoder wheel in 1V, 100mA, 10mA and 1W steps respectively. Therefore exact adjustment of the output voltage and the current limit and maximum output power is possible.

1.   SPECIFICATION
1.1 Input voltage: 220VAC±10%
1.2 Power frequency: 50Hz
1.3 Current consumption: approx. 295W
1.4 Output voltage: 0 to 40VDC, 10mV resolution
1.5 Output current: approx. 0 to 5.1A max.
1.6 Power output: approx. 204W max.
1.7 Voltage   stability   with   100%   load   swing:

$<$/=approx. 5×10^{-3}+10mV

1.8 Current stability with 100% load swing: $<$/=approx. 5×10^{-3}+5mA

1.9 Voltage stability with ±10% AC voltage change: $<$/=approx. 5×10^{-4}

1.10 Current stability with ±10% AC voltage change: $<$/=approx. 5×10^{-4}

1.11 Ripple at nominal load: < approx. 10mVrms 100mVp-p

1.12 Digital display: multi-line LCD background lighting
  Accuracy of voltage display: 0.1%±2digits, 10mV resolution
  Accuracy of current display: 0.5%±4digits, 1mA resolution

1.13 AC fuse: slow-blow 6.3A/250V

1.14 Operating time: 8hours continuously

1.15 Dimensions (WxHxL): approx. 270x135x300mm

1.16 Weight: approx. 3kg

1.17 Environmental conditions
  a. Operating temperature: 0　to 40
  b. Relative humidity: 80% max.
  c. Storage temperature: -20　to +60

2.　OPERATING INSTRUCTIONS

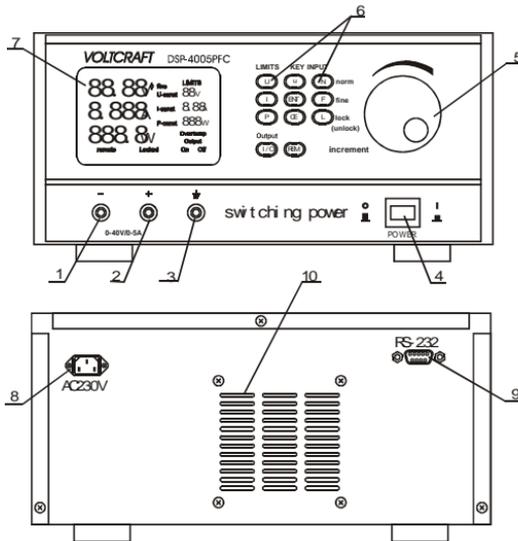**2.1 Description of front/rear panel controls**

1)　4mm safety sockets negative connection "-" (blue).

2)　4mm safety sockets positive connection "+" (red).

3)　4mm safety sockets earth connection (yellow).

4)　AC "POWER" switch: switching the power supply on ("1") and off ("0").

5)　Encoder wheel for changing the U (voltage), I (current) and P (power) parameter settings.

6) Keypad for actual operation of the switching power supply.

7) Backlit LCD display with indication of the output voltage (U), current (I), power (P) settings and indication of the U, I and P limits. Additionally, indication of OUTPUT On or Off and keypad locked or unlocked.

8) AC power socket

9) RS-232C interface (with optocoupler) for connection to a PC.

10) Cooling fan.

2.2 Description of keypad input

U tting voltage limit

I tting current limit
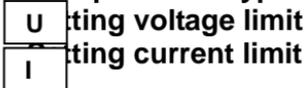
P tting power limit

ENT h input by the "LIMITS" keypad is completed with the "ENT" key.

CE y values incorrectly entered by the LIMITS" keypad can be reset with the "CE" key.

u Exiting setting limits but not change the preset upper limit.

N The size of each setting step can be changed using the "N" key.

F If the "N" key is pressed, the "fine" symbol disappears from the display. If the "F" key is pressed, the symbol "fine" appears in the display.

L Pressing the "L" key locks/blocks all keys and the encoder wheel against inadvertent adjustment. Locking is indicated by the "locked" symbol in the bottom line of the display. If the "L" key is pressed again (> approx. 2s), then the operating elements are released again (unlocked).

I/O The output of the power supply is switched on or off by a relay with the "I/O" key. In the process, the status "On" of "Off" is indicated at the bottom right of the display. On switching the power supply on, the output is always in witched-off status.

REM The "REM" key enables the power

supply to be almost entirely controllable from the PC, other than the power switch. After pressing the "REM" key, the symbol "remote" appears at the bottom left in the display. After pressing "REM" once more (approx. 2s), the operating elements are released again and communication to the PC interrupted.

2.3 Operating

Connect the AC power cable to the AC power socket, ensure that it is firmly seated. Then plug the earthed power plug into an earthed AC power socket.

2.3.1   Setting the limits

The voltage "U", current "I" and power "P" output values are each limited to a maximum. This upper limit can be varied downwards. Setting the limits is carried out using the left-hand row of keys as follows:

2.3.1.1 Voltage limit

Press the "U" key in the "LIMITS" field until the symbol "U-const" flashes. The voltage limit can now be adjusted in 1V steps using the encoder wheel. The voltage upper limit will be set at "40V". To complete the input, press the "ENT" key. An inadvertently wrongly-set limit setting can be erased/reset with the "CE" key. As a result of this, the previously-set value will be indicated and the setting menu exited. "U-const" will no longer flash. During operation (output On), the voltage output

can also be adjusted up to the set limit.

2.3.1.2 Current limit

Press the "I" key in the "LIMITS" field until the symbol "I-const" flashes. The current limit can now be adjusted in 10mA ("fine") or 100mA ("norm", coarse) steps using the encoder wheel. The current upper limit will be set at "5.1A". To complete the input, press the "ENT" key. An inadvertently wrongly-set limit setting can be erased/reset with the "CE" key. As a result of this, the previously-set value will be indicated and the setting menu exited. "I-const" will no longer flash.

2.3.1.3 Power limit

Press the "P" key in the "LIMITS" field until the symbol "P-const" flashes. The power limit can now be adjusted in 1W steps using the encoder wheel. The power upper limit will be set at "204W". To complete the input, press the "ENT" key. An inadvertently wrongly-set limit setting can be erased/reset with the "CE" key. As a result of this, the previously-set value will be indicated and the setting menu exited. "P-const" will no longer flash.

2.3.2 key locking

Pressing the "L" key locks/blocks all keys and the encoder wheel against inadvertent adjustment. Only the "POWER" switch remains active. Locking is indicated by the "locked" symbol in the bottom line of the display. If the "L" key is pressed again, then the operating elements are released again

(unlocked).

2.3.3   PC connection

A serial RS-232C interface is incorporated on the rear of the case. With the appropriate interface cable and optional software, communication with a PC is therefore possible.

The "REM" key enables the power supply to be almost entirely controllable from the PC, other than the power switch. After pressing the "REM" key, the symbol "remote" appears at the bottom left in the display. Thereupon, as with "L", all operating elements (except POWER) are locked against direct input. After pressing "REM" once more, the symbol "remote" disappears from the display, the operating elements are released again and communication to the PC interrupted.

3.   RECTIFICATION OF FAULTS

The following describes how some faults can be resolved by the user relatively easily:

| Problem	Possible solution
No display	Is the instrument switched on? Is the AC power plug making good contact both in the instrument and in the AC power socket? Is the AC fuse OK?
No input possible	"REM" or "L" key pressed; see under section 2.3.2 or 2.3.3.

4. CAUTION

4.1 The use of repairing fuses or the bridging if fuse holders is not permitted. Remove the defective fuse and replace it with an intact one of the same type and nominal current rating.

4.2 Power supply ventilation holes should not be covered! The instrument is to be placed onto a hard, non-inflammable base, so that cooling air can enter unhindered. The cooling of the unit occurs predominantly through convection.

4.3 The AC power cable should connected to power supply with safety earthing to ensure safe operation.

5. OPERATING OF RS-232C INTERFACE

With the RS-232C interface, the power supply can communicate with the PC.

5.1 Description of RS-232C connector
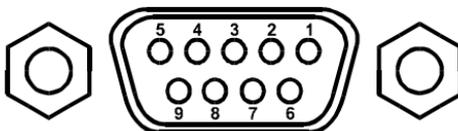
Pin 1: Empty
Pin 2: Transferring data (TxD)   (OUTPUT)
Pin 3: Receiving data (RxD)   (INPUT)
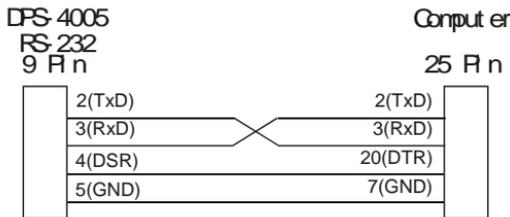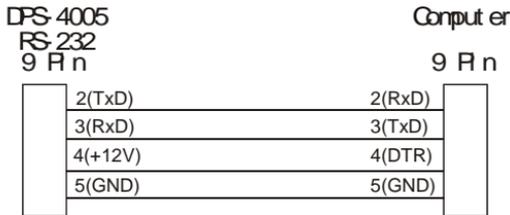Pin 4: +12V   (INPUT)
Pin 5: GND
Pin 6: Empty
Pin 7: Empty
Pin 8: Empty

Pin 9: Empty
Connection between DPS-4005 and the PC:

DPS-4005 RS-232 9 Pin	Computer 9 Pin
2(TxD)	2(RxD)
3(RxD)	3(TxD)
4(+12V)	4(DTR)
5(GND)	5(GND)

DPS-4005 RS-232 9 Pin	Computer 25 Pin
2(TxD)	2(TxD)
3(RxD)	3(RxD)
4(DSR)	20(DTR)
5(GND)	7(GND)

5.2 Operating of PC interface
5.2.1   Install the software
  Insert Disk1 in drive A, click SETUP twice and it will tell you how to install the software.
5.2.2 Connect the power supply with the PC by the special cable, install the application software, then run the software and it should appear the following interface:

Indication on the PC is complete same as the distribution of front panel and LCD display on the power supply. Operating of the PC is same as the power supply, except that click the "L" key three times to release the operating elements (unlocked). In additional, it increases an increment window on the PC, and the step of up/down can be set in the window.

NOTE: As imitating a catch plate, the increment value should be an integer.

5.2.3 Operating instruction

   a. Run the software, the communication port will default as COM2, if COM2 is not exist or has been occupied, the PC will indicate an error massage and change the communication port will change to COM1 at the same time.

   b. If the program do not receive any data within

10s, it will flash "Communication Failure" below the PC interface. The user should check: 1> if the power supply switched on or 2> if the communication port connected correctly.

NOTE: In operating, when the power supply do not have any current output, the software will waiting for about 10 seconds and then auto adjust to 0.000A.

c. In operating, the user can obverse and change the using COM through the COMMPORT menu on the PC interface, the COM not exist or has been occupied should not be selected.

5.3 Requirement of RS-232C communication

5.3.1   communication baud rate=1200BPS

5.3.2   The power supply transfers its internal data to the PC without interruption.

5.3.3   Each instruction string starts from EBH, 90H. The instruction from the PC is ineffective before it receipt the "REM" information.

5.3.4   The power supply transfers 15bytes to the PC in each instruction string.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EBH	90H	U_H	U_L	I_H	I_L	P_H	P_L	LMV_H	LMV_L	LMI_H	LMI_L	LMP_H	LMP_L	SFLG

LMP_H, LMP_L, P_H, P_L are BCD code, and others are binary code.

**Action/statue of each bit of SFLG is described in the following table:**

bit	0	Empty	
bit	1	REM	0: controlled by the power supply (dark) 1: controlled by the PC (illuminate)
Bit	2	ON/OFF	0: output off (OFF illuminate) 1: output on (ON illuminate)
bit	3	Overtemp	0: non overtemp (blanking) 1: overtemp protect (illuminate)
bit	4	P-const	0: power setting (flash) 1: non (illuminate)
bit	5	I-const	0: current setting (flash) 1: non
bit	6	U-const	0: voltage setting (flash) 1: non
bit	7	Fine	0: coarse step (blanking) 1: fine step (illuminate)

5.3.5   The PC transfers 4bytes to the power supply in each instruction string.
   a. EBH 90H 0AAH   key code: transfer the string when press a key.
   b. EBH 90H 055H   data code: transfer the string when increase a data.
   c. EBH 90H 0CCH   data code: transfer the string when decrease a data.

All the key codes are as follows:

Key	U	u	N	I	ENT	F	P	CE	I/O
Code	00H	01H	02H	04H	05H	06H	08H	09H	0CH
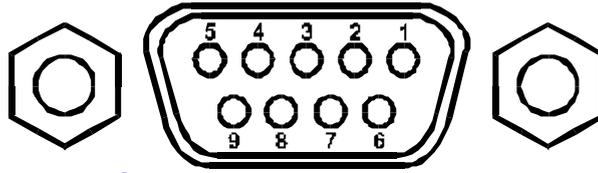
Pin1: **No connection**

Pin2: **Send data (TxD) brown color　　(output)**

Pin3: **receive data (RxD) red color　　　(Input)**

Pin4: **+ 12 V　　　orange color　　　(input)**

Pin5: **Ground (GND) black color**

Pin6: **No connection**

Pin7: **No connection**

Pin8: **No connection**

Pin9: **No connection**

5. 2　RS-232C connection to PC

? 2
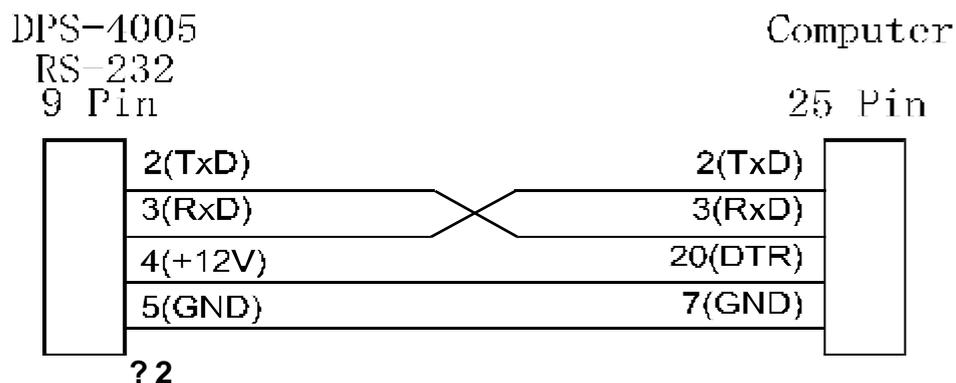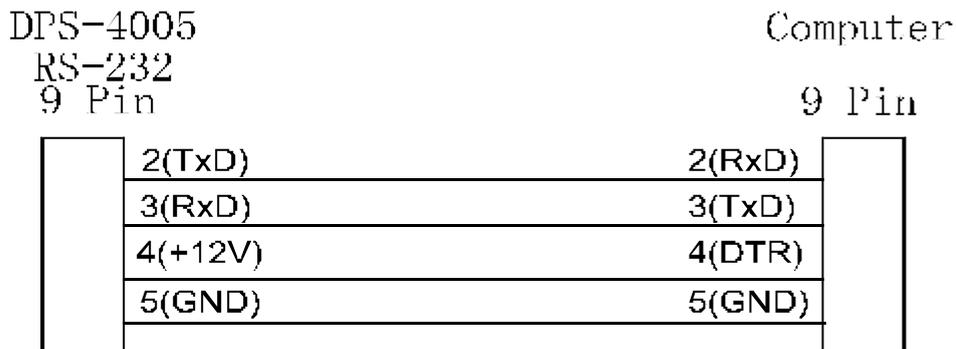
5. 3 RS-232C communication protocol

5. 3. 1 communication bit rate= 1200 digit/second

5 . 3 . 2 DSP always send inner data and display status to pc as the speed of 1200 digit/second

5 . 3 . 3 Every dictate cluster begining as EBH, 90H. PC input is useless till push down REM key on DSP-4005.

5 .3.4 DPS-4005 send dictate date to PC with 15 byte per cluster, 8 digit/byte dictate format as follows

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EBH	90H	U_H	U_L	I_H	I_L	P_H	P_L	$LM V_H$	$LM V_L$	LMI_H	LMI_L	$LM P_H$	$LM P_L$	SFLG

(detail inscription)

No.3&No.4 byte is binary code for display output voltage; No.3 byte is high 8 digit and No.4 byte is low 8 digit for output voltage. For exsample: output voltage is 35.38V then U_H =09H U_L =EAH

No.5 & No.6 byte is binary code for display output current; No.5 byte is high 8 digit and No.4 byte is low 8 digit for output current. For example: output current is 4.546A then I_H=11H I_L=C2H

No.7 & No.8 byte is binary code for display output power; No.7 byte is high 8 digit and No.8 byte is low 8 digit for output power. For example: output power is 158.6W then P_H=15 P_L=86

No.9 & No.10 byte is binary code for display upper limit of output voltage (display 4 digit); No.9 byte is high 8 digit and No.10 byte is low 8 digit for upper limit of output voltage. For example: upper limit of output voltage is 32.00V then LMV_H=0CH LMV_L=80H

No.11 No.12 byte is binary code for display upper limit of output current(display 4 digit); No.11 byte is high 8 digit and No.12 byte is low 8 digit for upper limit of output current. For example: upper limit of output current is 3.560A then LMI$_H$=0DH LMI$_L$=E8H

No.13 & No.14 byte is binary code for display upper limit of output power(display 4 digit); No.13 byte is high 8 digit and No.14 byte is low 8 digit for upper limit of output power. For example: upper limit of output voltage is 204.0W then LMP$_H$=20 LMP$_L$=40

Each SFLG byte indicate LCD display status as follows:

Bit	0	blank	
Bit	1	REM	0 power supply control(off) 1 : PC control (on)
Bit	2	ON/OFF	0: output off (off light) 1: output on (ON light)
bit	3	Overtemp	0: no overtemp (off) 1: overtemp protection (on)
bit	4	P-const	0: power setting (flash) 1: No (light)
bit	5	I-const	0: Current setting (flash) 1: No (light)
bit	6	U-const	0: Voltage setting (flash) 1: No (light)
bit	7	fine	0: coarse adj. (off) 1: fine adj (on)

Other byte is binary code.

5. 3. 5

PC send 4 byte/cluster dictate to DPS-4005 .

5 . 3 . 5 . 1   **PC send dictate of panel key to DPS-4005.**

        Dictate format

EBH	90H	AAH	(key code)

all key code as follows

Key name	U	u	N	I	ENT	F	P	CE	I/O
Key code	00H	01H	02H	04H	05H	06H	08H	09H	0CH

5. 3. 5. 2

PC send dictate to DPS-4005 for increase voltage and setting upper limit.

        dictate format

EBH	90H	55H	code

example: increase 1 step: code=01H

increase 15 step: code=0FH

5. 3. 5. 3

PC send dictate to DPS-4005 for reduce voltage and setting upper limit.

        dictate format

EBH	90H	CCH	code

Example: reduce 1 step: code=01H

reduce 15 step: code=0FH