DC POWER SUPPLY
PS-4000-ABOS/100V-40A
USER MANUAL

User Manual Reference: MU-RC2096-EN-00

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MANUAL UPDATES

This document is the user manual. It describes how to start and stop the power supply and messages or indications that may appear on the equipment (touch screen).

DOCUMENT	REVISION	DATE	MODIFIED PAGES	MODIFICATION
MU-RC2096-EN	00	30/03/2017	All	Initial Version.

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LIST OF ILLUSTRATIONS

1. PREAMBLE

1.1 Legal notices

No part of this document may be photocopied, reproduced, or translated to another language without the prior agreement and written consent PUISSANCE +.

1.2 Warranty

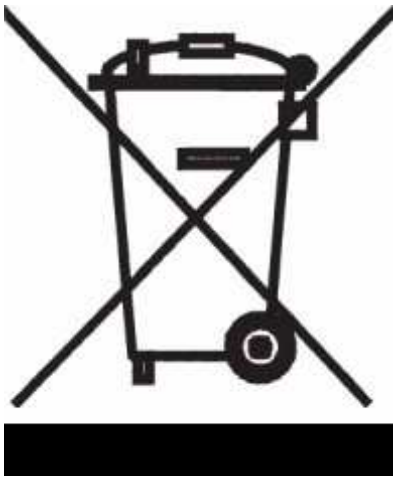
The material contained in this document is provided “as is,” and is subject to being changed, without notice, in future editions.

PUISSANCE + is not responsible if the instrument is used in a dangerous manner, either alone or in conjunction with other equipment. High voltages are present in the instrument making it dangerous if used in conditions not specified by PUISSANCE +. Safety symbols affixed to the instrument indicate these dangerous voltages.

1.3 Waste Electrical and Electronic Equipment (WEEE)

The product label (see below) indicates that you must not discard this electrical/electronic product in domestic household waste.

At the end of their life cycle, you have to eliminate any equipment intended for destruction correctly in order to avoid all attack against the Environment and Human Health. Contact the local authority for advice on recycling.



2. SAFETY

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings or instructions elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. PUISSANCE + assumes no liability for the customer's failure to comply with these requirements.

2.1 General

Do not use this product in any manner not specified by PUISSANCE +. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

CAUTION: The perforated panels must be protected by a device to prevent falling object indoors during transport.

2.2 Before applying power

Verify that all safety precautions are taken. Make all connections to the unit before applying power. Note the instrument's external markings described paragraph 2.8 Safety symbols

2.3 Ground the instrument

A general terminal mechanical ground is available at the rear of the instrument to perform, for example, a separate wiring of earth in a bay.

2.4 Fuse

WARNING: The power supply contains an internal fuse that is not accessible to customers. In case of problems, please contact customer support.

2.5 Do not remove the instrument cover

Only qualified, service-trained personnel who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover.

2.6 Do not modify the instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to PUISSANCE + for service and repair to ensure that safety features are maintained.

2.7 In case of damage

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

2.8 Safety symbols

A set of labels affixed on the instrument summarizes and reminds the safety instructions to be obeyed when working on the bench. To make formatting of this document easier, the scale of the labels shown herein differs from that of the real labels.

2.8.1 Connection to the mechanical earth

The symbol below indicates that it is not necessary to connect the instrument to the ground because the leakage current is lower than 0.5 mA.

2.8.2 Electrical shock danger/hazard

The symbol is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

2.8.3 General warning

This symbol indicates that the user must refer to the manual or caution information to avoid personal injury or damage the product.

3. PRESENTATION

3.1 General

The PS-4000-ABOS/100V-40A is a DC power supply developed by the Company PUISSANCE +.

The product is based on linear regulation products, with programmable voltage and/or current, and high electrical performance to meet the requirements of the equipment incorporated into automatic test systems.

Moreover, to ensure a maximum safety, the product is provided with different protections including severe conditions (temperature high environment, short circuit at the output, etc.):

- Protection of transistors by limiting the power dissipated through an ultra-fast electronics detector.
- Thermal protection against overheating of the power electronics thermal protector.
- AC protection switch / thermal-magnetic circuit breaker.

The power supply PS-4000-ABOS/100V-40A is equipped with a user interface on a graphic touch screen positioned on the front panel for control and adjustment levels of voltages, as well as the functions of management.

This generator is equipped with a forced ventilation low noise for extracting the heat generated internally by the various components. The rotational speed of the fans can be controlled through the user interface. The direction of ventilation is oriented to evacuate hot air from the front to the rear of the rack.

The power supply can be used in:

- Local control:
  The control with graphics and touch screen device disposed in front panel gives access to all control functions and the display of measurements.
- Remote control:
  The control device includes an Ethernet TCP/IP and a RS232 interfaces for drive using the supervision PC.

3.2 Hardware description

3.2.1 Mechanical description

The power supply PS-4000-ABOS/100V-40A is integrated in a rectangular frame with the following characteristics:

- Total height: 354.5 mm (8 U),
- Total width: 483 mm,
- Depth: 600 mm (excluding connectors and handles),
- Weight: 104 kg,
- Lower cover, 2 mm steel-sheet,
- Upper cover, electro galvanized steel-sheet, 1.5 mm thick,
- Front panel: painted RAL7035, aluminum,
- Rear panel: treatment SURTEC650, aluminum.

3.2.2 Front face description

The front face of the power supply includes various interfaces allowing the user to visualise the status of the power supply and to access to the various manual controls.

For this, it includes:

- a TFT 5.6 inch touchscreen (PL1). It allows the user to know the status and mode of operation of the power supply and to control voltage and current levels,
- an ON/OFF switch (S1).

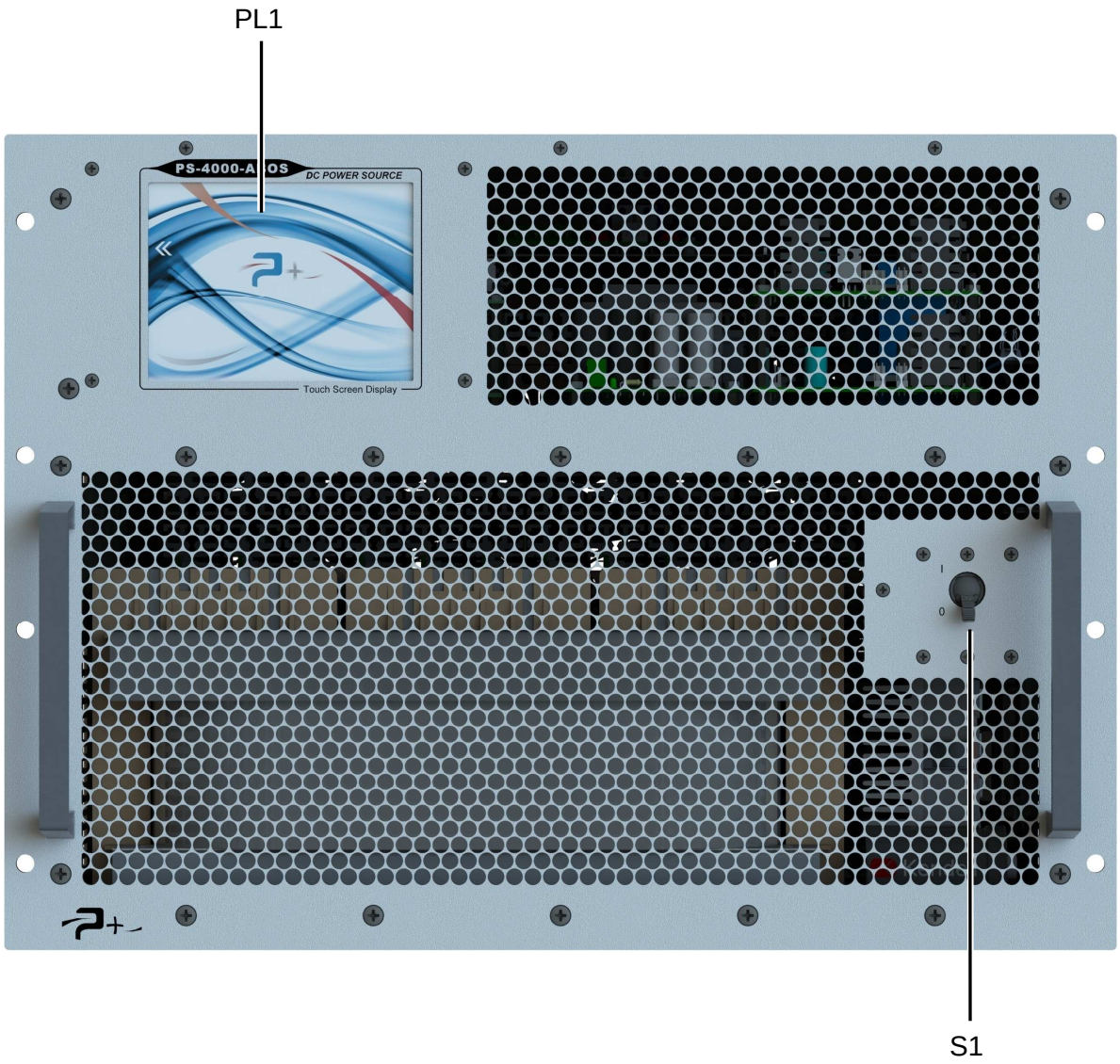


Figure 1 : Power supply front face

3.2.3 Rear face description

The rear face of the power supply comprises the various interfaces to perform its electrical connection. It also includes the air outlet grids behind which the hot air exhaust fans are located.

These interfaces are:

- J1: mains input connector,
- J2: power output connector,
- J4: Ethernet TCP/communication connector,
- J7: RS232 connector,
- E1: electrical shock danger/hazard label,
- E2: general terminal mechanical ground to perform, for example, a separate wiring of earth in a bay.

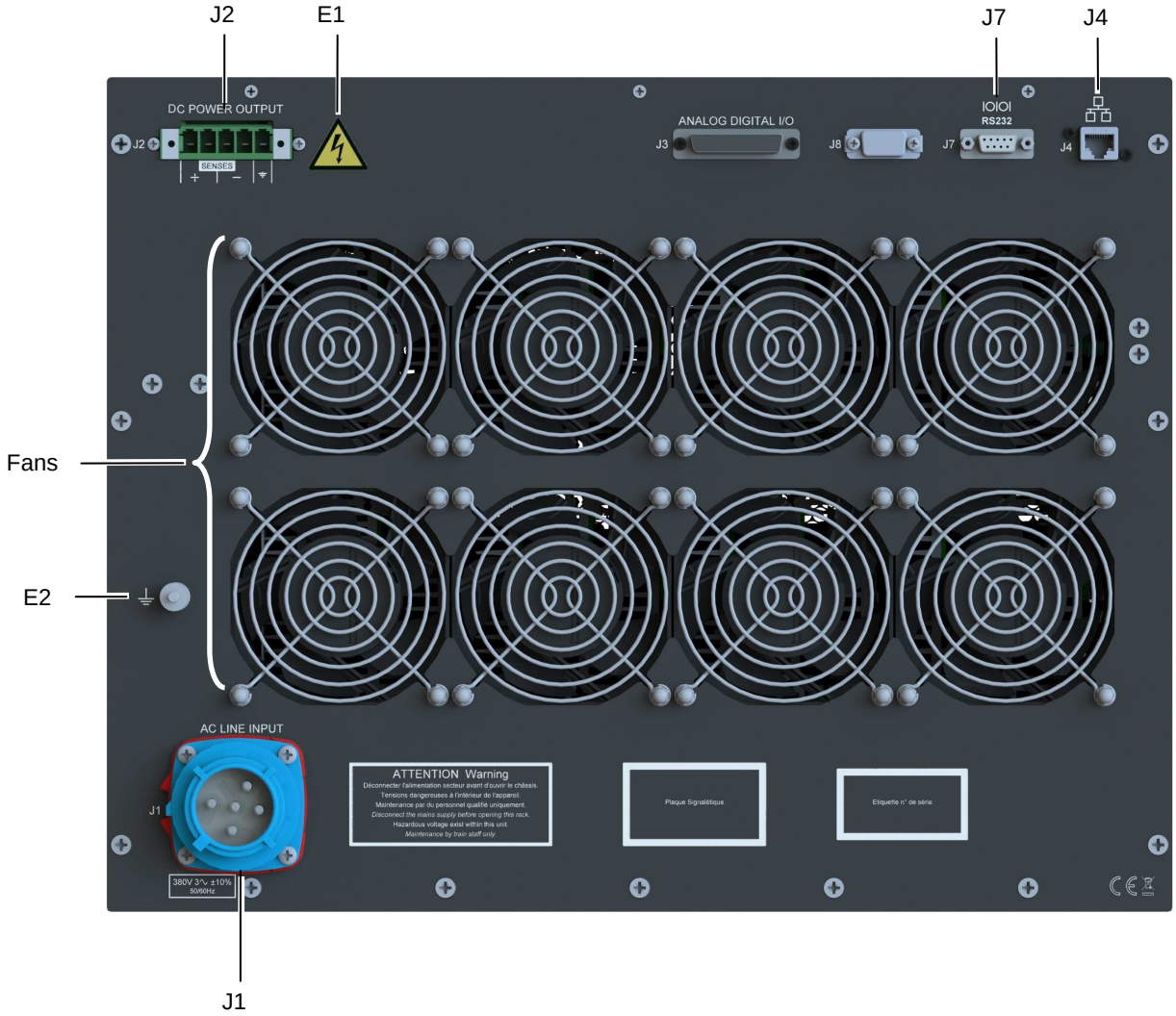


Figure 2 : Power supply rear face

3.2.3.1 Mains input (J1)

J1 connector:

- Receptacle: MARECHAL 01N8017
  Plug: MARECHAL 01N0401710 + handle 01NA313

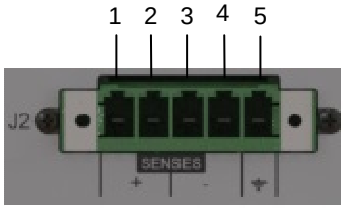
3.2.3.2 Power output (J2)

J2 connector:

- Receptacle: PHOENIX DFK-PC5/5-STF-7.62
  Plug: PHOENIX PC 5/5-STF1-7.62

J2 connector pin-out :

1	Power output +
2	Sense +
3	Sense -
4	Power output -
5	Earth



3.2.3.3 Ethernet connector (J4)

J4 connector:

- Receptacle: Amphenol MRJ-5780-01.
  RJ45 female 8 contacts, an Ethernet cable category 5 (at least) should be used for remote control using Ethernet TCP/IP.

3.2.3.4 RS232 connector (J7)

J7 connector:

- Receptacle: FCT F09S0G1A.

3.3 Functional description

The power supply is composed of all the elements common to a power supply with serial control:

- The breaker,
- The input transformer,
- The rectifiers,
- Filtering,
- The power block,
- The cards (regulation, µProcessor, driver).

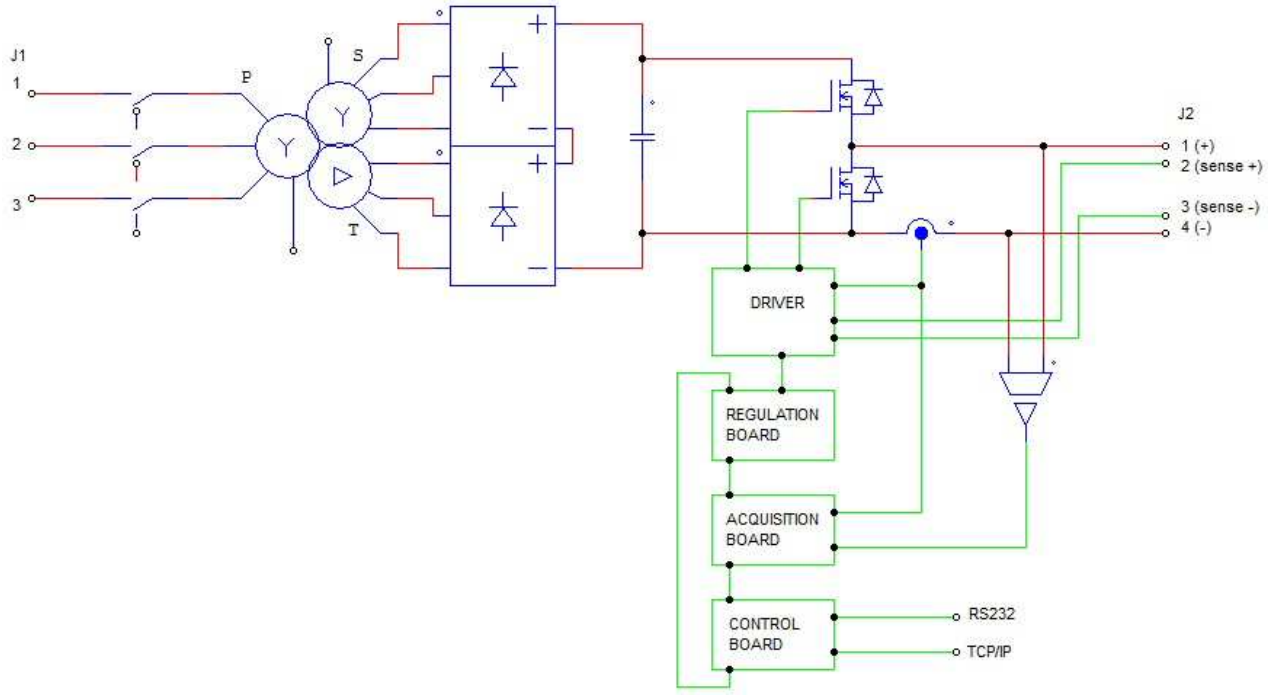


Figure 3 : Functional description

3.4 Electrical characteristics

3.4.1 Mains characteristics

- Input voltage: VE = 3 x 380 Vrms ±10% without neutral.
- Input frequency: from 47 to 63 Hz.
- Nominal current: 13 Arms.
- Dielectric strength: > 2 500 Vrms at 50 Hz during one minute mains input versus outputs connected to the mechanical ground.
- Insulation: Z > 100 MΩ under 500 V DC between output and mechanical ground.

3.4.2 Output characteristics

Output Power values	
Continuous power source	4000 W
Continuous power sink	500 W
Peak power sink	1680 W
Output Voltage values	
Voltage range	100 VDC
Max Voltage programmable value	110 VDC
Output Current values	
Continuous current source	40 ADC
Peak current source	160 A
Continuous current sink	16 ADC
Peak Current sink	40 A
Max Current programmable value	160 A
Programming values	
Voltage accuracy	0.05% of full scale + 0,05% of programmed value
Voltage resolution	12 bits
Current accuracy	0.1% of full scale + 0,1% of programmed value
Current resolution	12 bits
Regulation	
Voltage for a mains variation from +6% -10%	0.01% of full scale
Voltage for an output current variation from 0 to 100%	0.02% of full scale
Current for a mains variation from +6% to -10%	0.1% of full scale
Current for an output voltage variation from 0 to 100%	0.1% of full scale
Sense maximal compensation	2 V
Sense maximal wire length	30 m

Dynamic mode	
Bandwidth @ -3dB	DC – 10 kHz (50 kHz on demand)
Rise time from 10% to 90% (on square signal)	< 50 µs
Fall time from 10% to 90% (on square signal)	< 50 µs
Overshoot	< 5%
Recovery time	< 20 µs
Q1 to Q2 transition time	< 10 µs
Signal quality	
Max voltage ripple and noise (at full scale)	10 mV RMS
	40 mV peak to peak
Drift voltage	20 mV
Max current ripple and noise (at full scale)	16 mV RMS
	64 mV peak to peak
Drift voltage	32 mA
Variation regarding temperature	
Typical	50 ppm/°C
Max	100 ppm/°C
Stability after 15 minutes	
Max	< 0.05% of full scale
Insulation	
Output / mechanical ground	10 MΩ @ 500 VDC
Measurements on TFT screen	
Voltage range	110 VDC
Voltage accuracy	0.1% of full scale
Current range	160 ADC
Current accuracy	0.1% of full scale
Protections	
In case of overload	Voltage limitation (1)
In case of short-circuit on output	Output power switch off (2)
In case of overheat	Output power switch off (3)

(1) In case of temporary overload, voltage decreases to limit current.

(2) Output will be switched off and will have to be manually or remotely restart.

(3) A thermal switch is disposed on each power part. It switches off output in case of overheat.

3.4.3 Other characteristics

The power supply uses voltage regulation with current limitation.

According to the current value (positive or negative), the power supply operating is different:

- U>0 and I>0: the power supply is working as a “GENERATOR” or “SOURCE”, instantaneous power is positive,
- U>0 and I<0: the power supply is working as an “ABSORBER” or “SINK”, instantaneous power is negative.

3.4.4 Environment

- Operating Temperature: 0 °C to 40 °C.
- Storage Temperature: -10 °C to 85 °C.
- Humidity: 10% to 90% non-condensing.

The power supply is equipped with a forced ventilation system. Fresh air is drawn in from the front panel; the hot air is expelled through the rear fans grids.

4. INSTALLATION AND IMPLEMENTATION

4.1 General information

The power supply is equipped with two handles on the sides for easy transport.

It is recommended not to block the ventilation grids located on the front and on the rear of the power supply. Obstruction of these grids would result in an increase of the temperature inside the power supply and therefore a risk of malfunction.

4.2 Components and accessories supplied with the instrument

The power supply is delivered with the connector to realise the input and output power cables.

4.3 Inspection the unit

When you receive your power supply, inspect it for any obvious damage that may have occurred during shipment. Carry out a quick appearance check of connector's condition to find any possible defects (connector shell broken, contacts twisted, coaxial contacts damaged, foreign bodies in the connectors).

Until you have checked out the power supply, save the shipping carton and packing materials in case the unit has to be returned

4.4 Environment / ambient conditions of use

The power supply should only be used indoors, on a stable, horizontal and hard support, in a properly illuminated room. The temperature must be comprised between 0 and +40 °C.

4.5 Power supply installation

If the power supply is installed in a test bench, the slides must be properly sized to support their weight.

REMINDER: Take into account its high weight (approximately 104 kg). It must not be handled by a single person.

4.6 Implementation

4.6.1 General

To use the power supply, you must realise its power input and output cables.

To perform the wiring of the input cable, it is recommended to use a power cable with:

- 4 conductors (Brown + Black + Grey + Yellow/Green). The cable must be compatible with the IEC 60245 standard. Example: H07RNF 4G1.5 minimum.

To perform the wiring of the output cable, it is recommended to use a power cable with:

- 3 conductors (Blue + Brown + Yellow/Green). The cable must be compatible with the IEC 60245 standard. Example: H07RNF 3G4 minimum.

The power supply must be:

- Protected by circuit breakers against overcurrent,
- Protected by a safety device. It must prevent anyone from switching the power supply on while a maintenance intervention or any other task is performed.

CAUTION: Electrical Shock Hazard. Always turn off the power before making the electrical connection of the connectors on the rear panel.
Any connection must be performed by staff trained and empowered, 15 minutes after disconnecting from the mains supply.

- Connect the various cables to their destination and finally connect the power supply cable to its source.

4.6.2 On/Off procedure

Once all the operations necessary for the implementation done, you can turn on the power. To do this, set the power-on switch on front side up.

After starting the power supply, check the result of the selftest on the screen (see 5.9 Status of power supply).

To turn the power off, move the switch down.

WARNING: It is mandatory to wait until the end of a cycle of generation before turning off the power supply using the switch.

For operation with remote communication control Ethernet, the application manager communication must wait for complete starting of the power supply to start communicating.

4.7 Recommendations

In order to reduce or even to eliminate the influence of radio disturbances on the operation of the unit, which might result in degraded performances, several precautions must be taken with the external power supply wiring according to the severity of the environment:

4.7.1 Load output wiring

Connections between the power output and the load should be performed preferably with twisted pairs. If possible, the negative output should be connected to the ground (via the mechanical ground), either through a direct connection (connection between 4 and 5 of J2), or through a 1 µF capacitor.

4.7.2 Remote recopy wiring

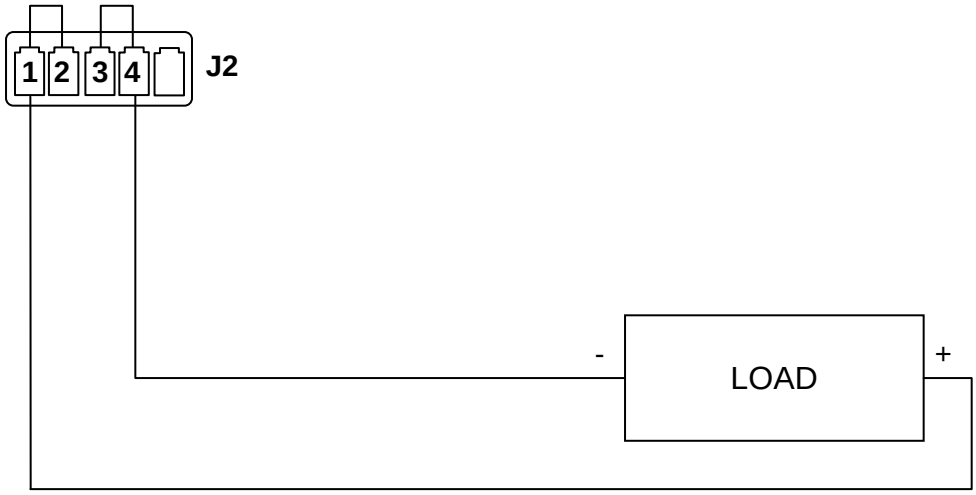
These connections shall be performed using twisted-shielded wires, with the shielding being connected to the ground (via the mechanical ground).

4.8 Load connection

4.8.1 Remote regulation in local mode

This simple load connection mode is designed for a resistive primary component load located near the power supply unit, or for a load requiring constant current operation.

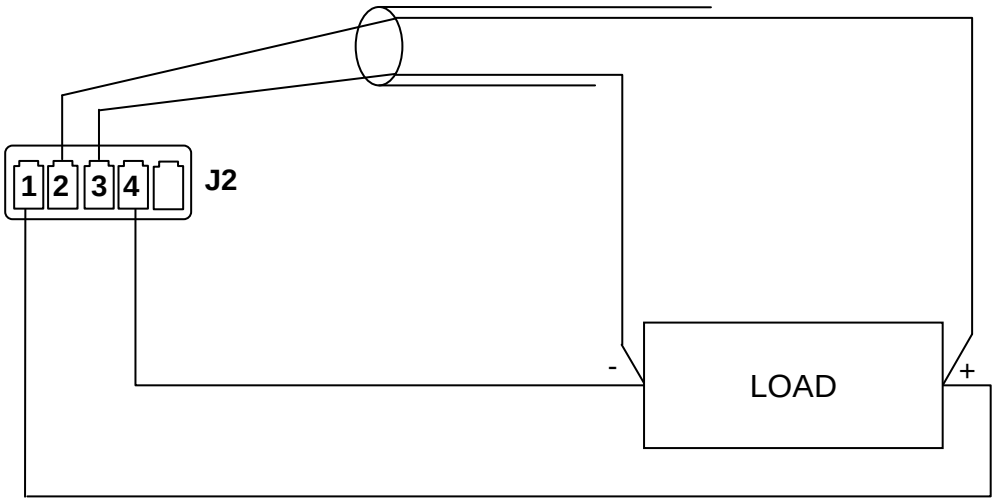
Implementation:



4.8.2 Remote regulation in remote mode

Remote regulation in remote mode is used to compensate significant voltage drops in the connections between the load and the power supply unit (long wires). Recopies must therefore be brought from the power supply unit to the load.

Implementation:



5. USING THE GENERATOR

5.1 General

The specific functions of this power supply are accessible via its touch screen and provide access to advanced features of the power supply. The corresponding parameters are described § 6.4.

The overcurrent function is designed to program an overcurrent comprised between 0 and 160A, for duration comprised between 0.2s and 1s.

This function is active if the overcurrent threshold is higher than the programmed current. If it is the case, the power supply unit allows an output current equal to the threshold during up to 1s consecutively. Once this time has elapsed, the output current is automatically returned to the programmed current.

In order to allow full overcurrent duration again, the power supply unit must switch to voltage mode (output I < programmed I) during 4x overcurrent duration.

5.2 Using the touch screen

The power supply uses a control card fitted with a touch screen. This screen may be operated with a finger or a stylus by a “click” on the selected object.

Numbers are entered using a keyboard which is as follows:

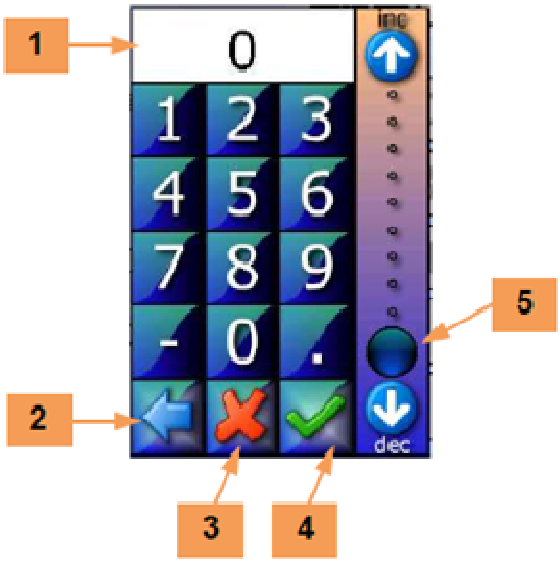


Figure 4 : Keyboard MMI

Zone **1** receives the value entered. **2** button deletes the previous character.

The **3** button closes the window without validating. The **4** button validates data entry.

Scale **5** allows a summary entry of the value between 0 and 100% of the limits of the programmable parameter.

In case of failure or warning, the software displays a message on the touch screen in a message popup (for example):

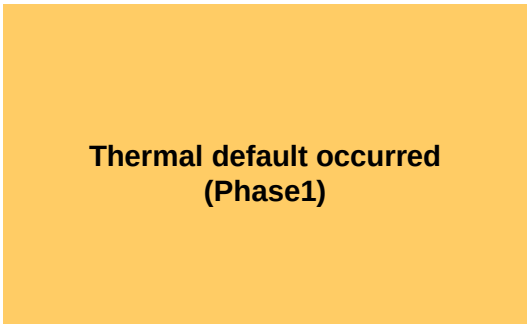


Figure 5 : Example of error message

The display remains in this status until the popup has not been acknowledged.

Acknowledge is done by a simple “click” on the popup.

If the fault disappears before acknowledge, the message changes to inform of the disappearance of the fault but the popup remains displayed: it must still be acknowledged. This principle allows knowing that a fault has been detected, although it has disappeared.

On the various screens appears the following button:

Figure 6 : Access to the general information MMI

Pressing this button displays:

- Coordinates of Puissance on **6** area,
- The name of the product in area **7**,
- The serial number of the product in area **8**,
- The revision of software installed in area **9**.

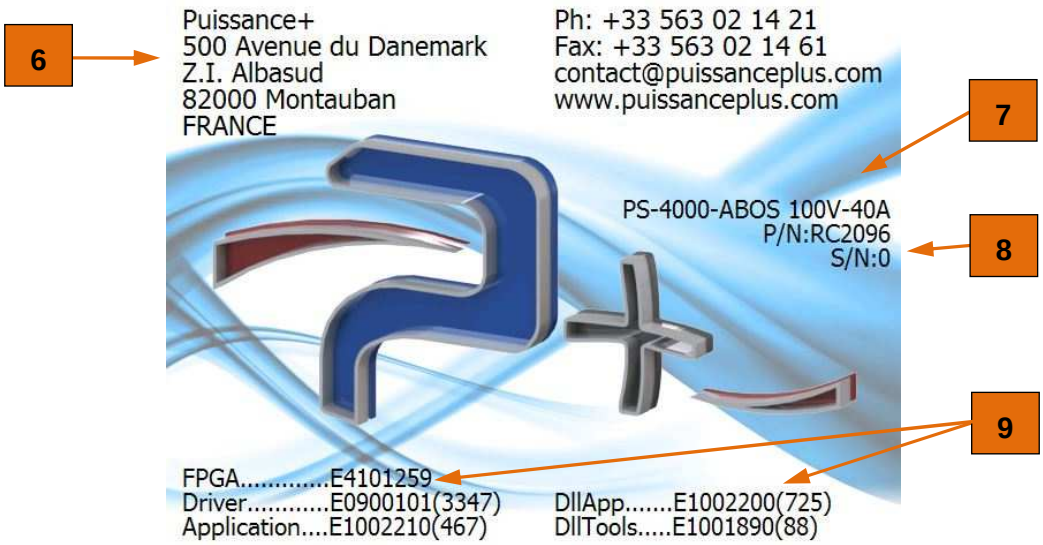


Figure 7 : General information MMI

A “click” on this screen clears it and returns to the previous screen.

5.3 Start screen

When the power supply starts, the following screen (power supply settings screen) is displayed:

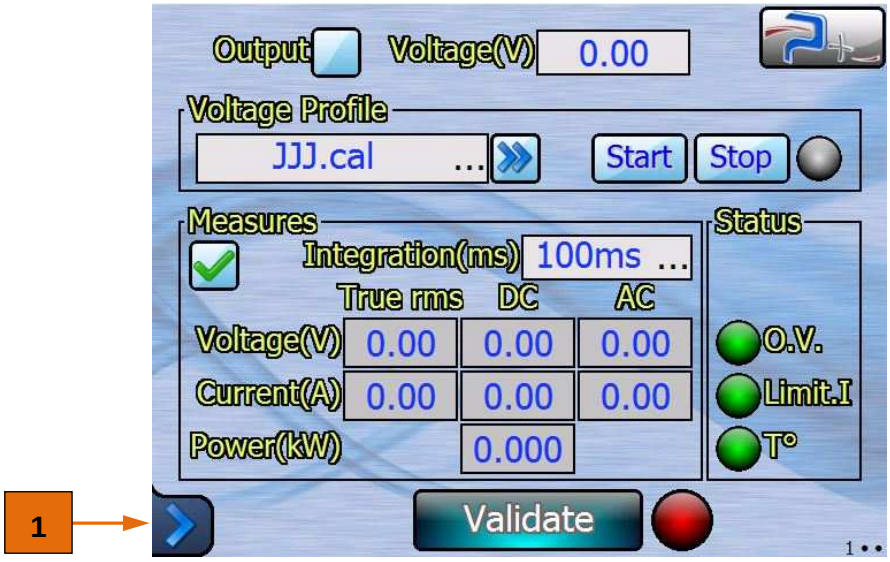


Figure 8 : Start screen

The blue arrow **1** in the lower left corner of the screen gives access to the general menu (see § 5.4 General menu).

5.4 General menu

This menu is opened clicking the blue arrow **1** in the lower left corner (see 5.3 Start screen).

The general software menu is divided in three main tabs:

- Tab "**PS-4000-ABOS…**" **1** displaying the buttons giving access to the power supply settings and measurements (see 5.4.1 " PS-4000-ABOS…" tab).
- Tab "**System…**" **2** displaying the functions which can be configured to control the power supply (see 5.4.2 "System…" tab),
- Tab "**Maintenance…**" **3** providing access to the "factory setup" of the system. This access is password-protected and reserved for Puissance +.

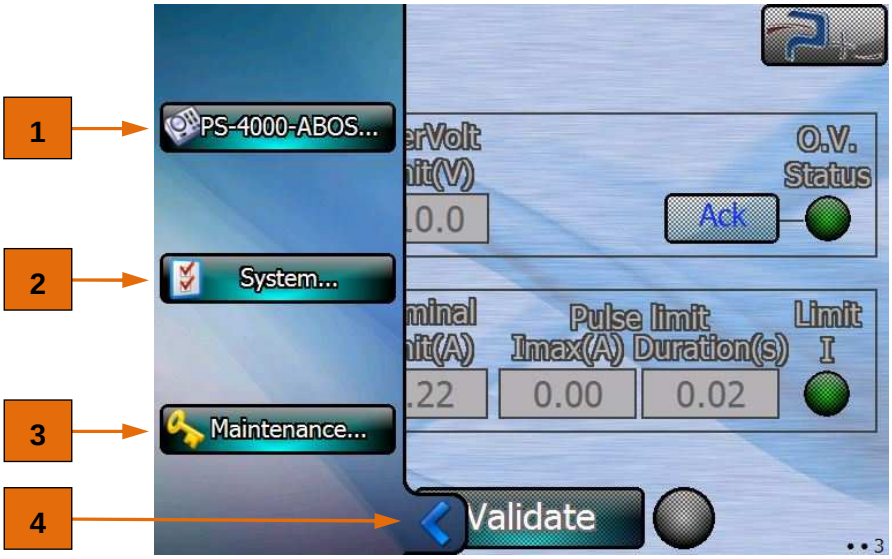


Figure 9 : General menu

The blue arrow **4** in the lower left corner of the screen returns to the power supply settings screen (see 5.3 Start screen).

5.4.1 “ PS-4000-ABOS…” tab

The “**PS-4000-ABOS…**” tab comprises:

- The **ProgMeas** **1** button to access the screen (see § 5.5.1 Programming the power supply) used to set the power supply,
- The **Profile** **2** button to access the screen (see § 5.5.2 Using the Profile screen) used to manage the voltage curves,
- The **Limits** **3** button to access the screen (see § 5.5.3 Programming the voltage and current limits) used to set the voltage and current limits (Over Voltage and Over Current).

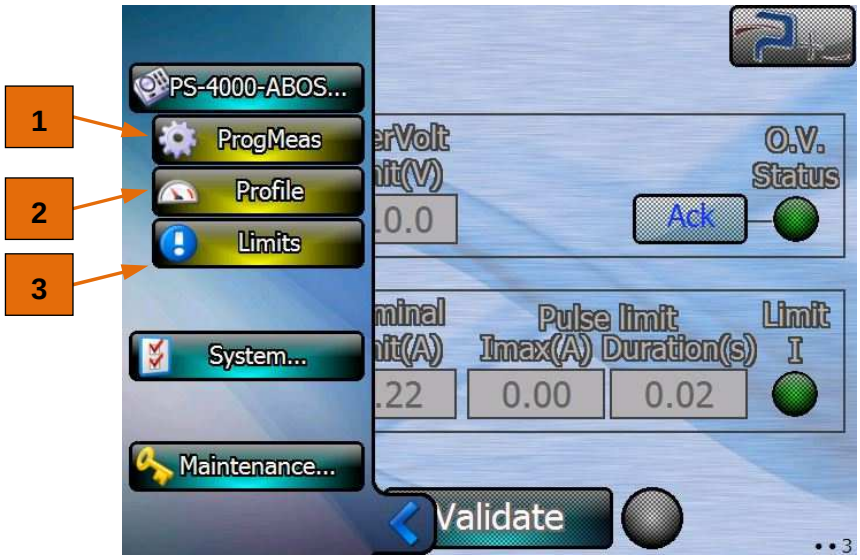


Figure 10 : PS-4000-ABOS… menu

5.4.2 “System…” tab

The “**System…**” tab comprises the buttons giving access to the configuration screens of the different controls of the power supply. The five configuration screens are:

- "**Ethernet**" screen, accessible using **1** button, allows the configuration of the Ethernet link (see § 5.6 Setting of Ethernet link),
- "**RS232**" screen accessible using **2** button, allows the configuration of the RS232 serial link (see § 5.7 Setting of serial RS232 link),
- "**Fan Setting**" screen accessible using **3** button, allows the configuration of air forced cooling (see § 5.8 Fan settings),
- "**Selftest**" screen accessible using **4** button, displays the result of the self-test of the source (see § 5.9 Status of power supply),
- "**Screen Calib.**" screen, accessible using the **5** button, allows the adjustment of the touch screen (see § 5.10 The configuration of the touch screen).

When one of these screens is displayed, the corresponding screen number appears at the bottom right (1 • • • • for the Ethernet screen and so on).

Note: Once the first configuration screen is displayed, switching to the following configuration screen may also be made by a horizontal sweep on the screen with a finger or a stylus.

Figure 11 : System… menu

5.5 Using the power supply

The power supply can be programmed either in constant voltage mode or with a curve ("Profile" mode). The “profile” mode allows the voltages generation according a voltage curve.

5.5.1 Programming the power supply

This menu is opened clicking the **ProgMeas** button **1** described § 5.4.1 “ PS-4000-ABOS…” tab.

This screen is divided in three areas:

- The upper to control the power supply,
- The central to select a voltage curve to generate,
- The lower displaying the power supply state and the power-meter measurement values.

Control area:

- **Output** **1** check box allows the activation of the power supply,
- **Voltage (V)** **3** allows programming the voltage to generate from 0 to 110V,

Note: See § 5.5.3 Programming the voltage and current limitsProgramming the voltage and current limits to program the over voltage and over current limits and its duration.

Voltage profile (curve) area:

- The field **17** allows the selection of an existing voltage profile to generate,

Note: A maximum a 20 files can be displayed.

- The **Start** **4** ,button launches the generation of the voltage profile selected. At the end of the generation, the power supply returns to the voltage/current programming mode,
- The **Stop** **5** button stops the generation of the voltage profile in progress,
- The light **6** indicates the voltages profile generation status,
- The button **2** gives access to the **Profile** screen to create or modify a voltage profile.

Measurement area:

- **Integration(ms)** **7** field to be fill to defines the time to integrate the measures,
- **Voltage (V)** **15** and **Current(A)** **14** fields indicate the measurement values in **True rms**, in **DC** and in **AC**. These fields are no more available when the PC software is used to acquire a waveform,
- **Power(kW)** **13** indicates the measured power value. This field is no more available when the PC software is used to acquire a waveform,
- **Status** area indicates if the following event occurs:
  - Over voltage ; light **O.V.** **8** ,
  - Over current ; light **Limit.I** **9** ,
  - Over heat ; light **T°** **10** ,
- The check box **16** allows the activation of the measurements.

Once the parameters are entered, click the button **Validate** **12** to program the power supply. The light **11** indicates the validation status:

- Grey indicates that the parameters are not already programmed,
- Green indicates that the parameters are well programmed,
- Blue indicates that changes are in progress,
- Red indicates that errors occurred during programming. The parameters are not correctly programmed and have to be programmed again.

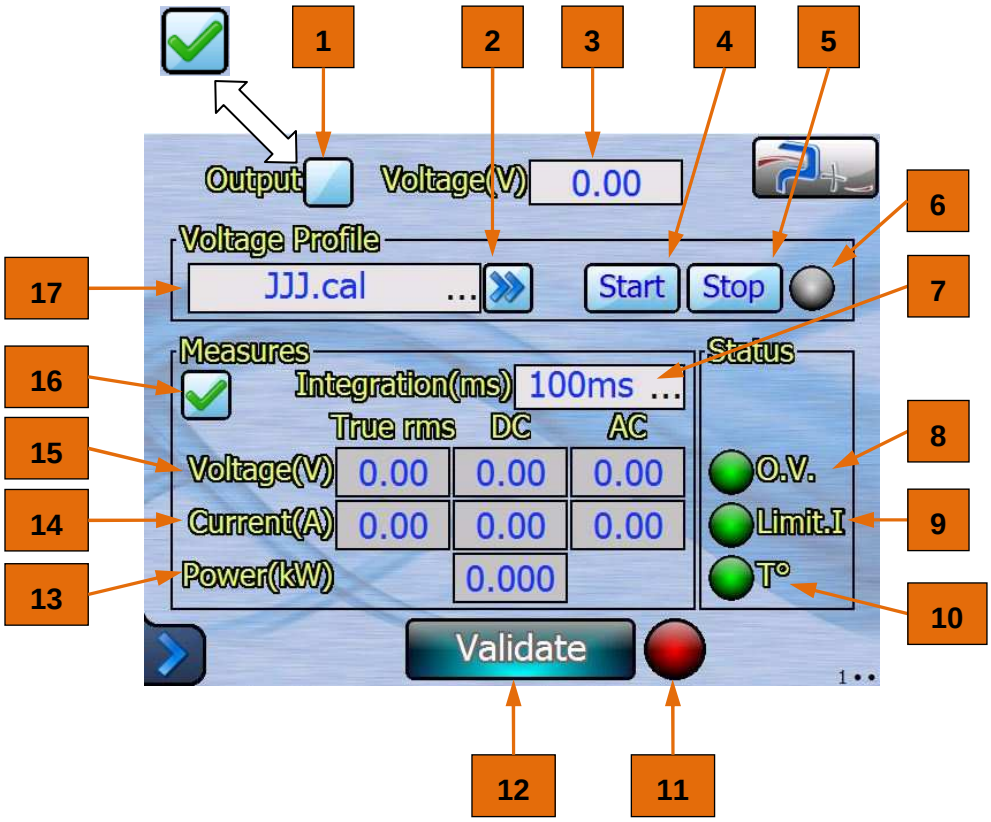


Figure 12 : Setting screen

5.5.2 Using the Profile screen

The profile screen allows creating or modifying or deleting voltage curves.

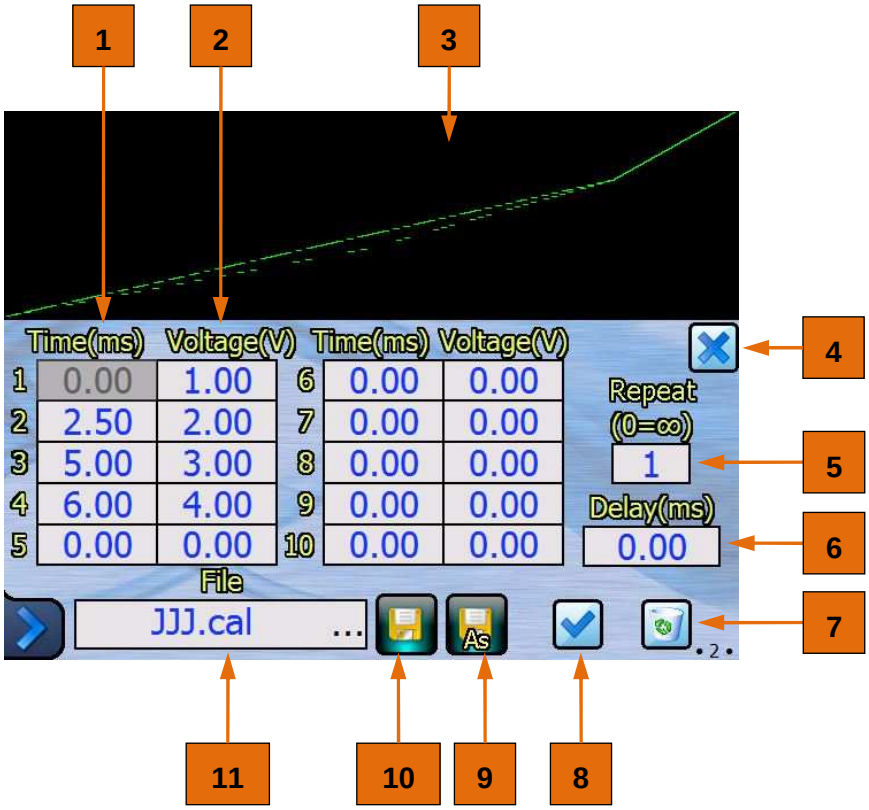


Figure 13 : Voltage profile (curve) screen

To create a new curve complete the fields **Time(ms)** 1 and **Voltage(V)** 2, the corresponding curve appears on the screen 3. The time values must be increasing.

Note: .The number of files must be limited to 20.

.When Repeat is different to 1, if the user wants to resume generation in voltage/current mode after generating each repeat of curve, it is necessary that the last value of the curve is equal to the programmed **Voltage (V)**.

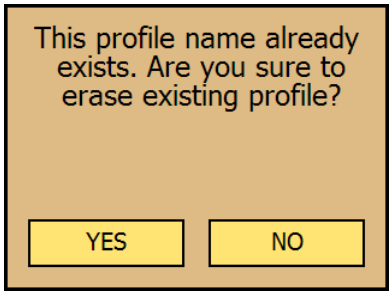
The management of the curve is made using the following buttons and fields:

- The button 4 allows resetting the fields **Time(ms)** 1 and **Voltage(V)** 2,
- The field **Repeat** 5 is used to set the number of repeat of a voltage curve,

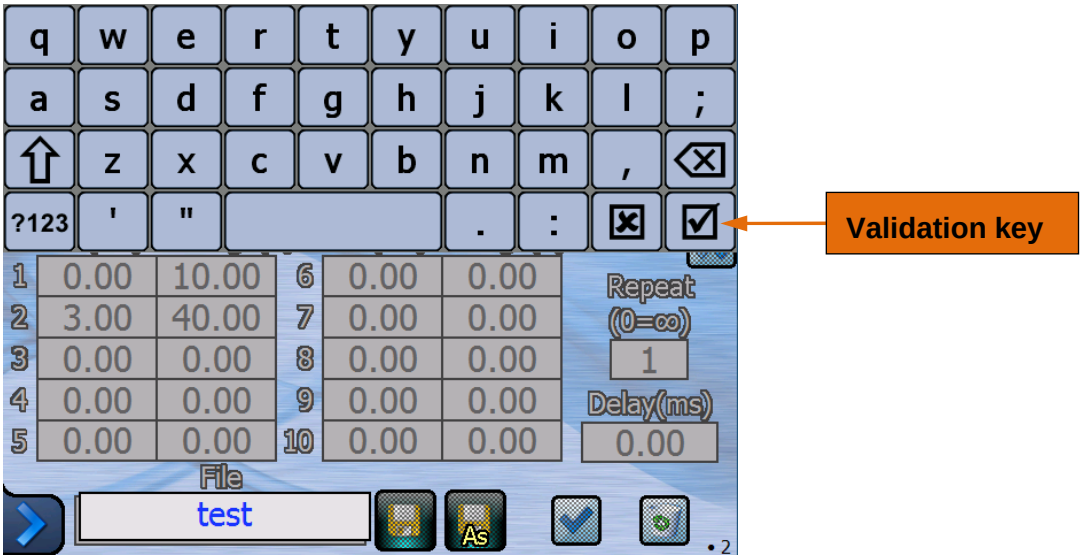
Note: Use 0 to repeat indefinitely.

- The field **Delay(ms)** 6 is used to set the delay between each voltage curve repeat,
- The field 11 gives access to a registered voltage profile,
- The button 9 and 10 allows to "Save as" or "Save" the voltage curve,

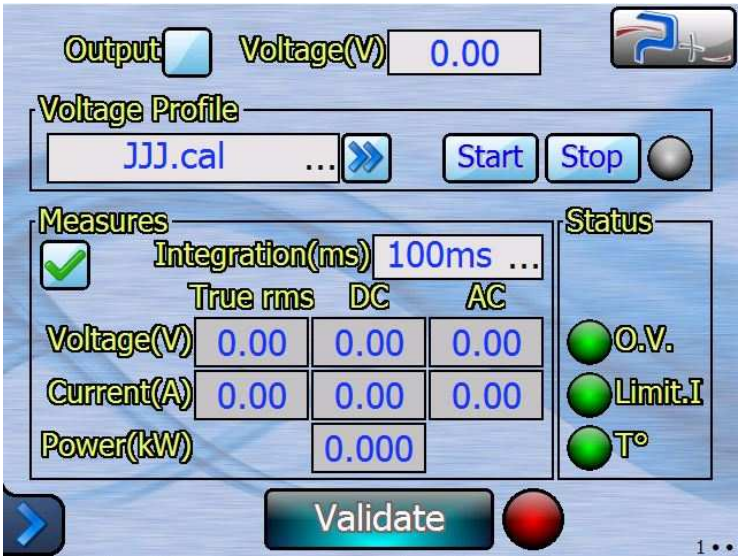
- If a curve with the same name exists the following message comes into view:



Then enter the name of the new curve and validate the typing,



- The button **8** returns to the power supply setting screen to start the voltage curve:



- The button **7** is used to delete the selected curve.

5.5.3 Programming the voltage and current limits

This menu is opened clicking the **ProgMeas** button **3** described § 5.4.1 " PS-4000-ABOS…" tab.

This screen allows the voltage and current limits programming and is divided in two areas:

- The upper for the voltage,
  The lower for the current.

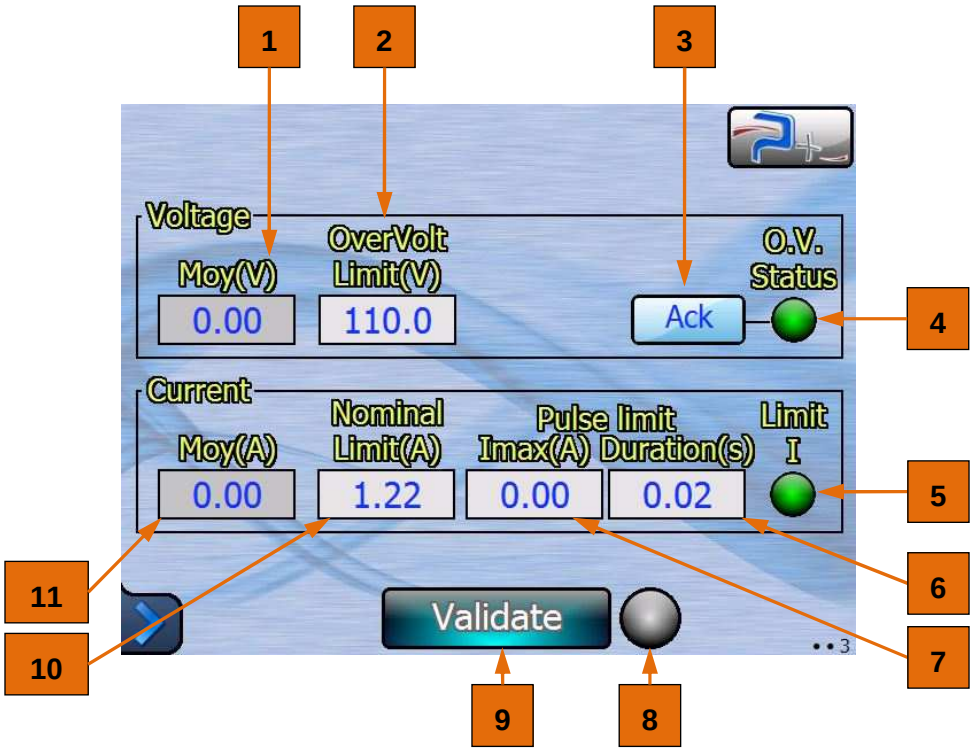


Figure 14 : Limit value setting screen

Voltage:

- The **Moy(V)** **1** field indicate the voltage measurement.
  The content of this field is available when the PC software is used to acquire a waveform, but the value is not generated from power-meter,
- The **OverVolt Limit(V)** **2** filed allows programming the voltage limitation from 0 to 115V,
- The **Ack** **3** button is used to acknowledge an over voltage,
- The light **O.V. Status** **4** indicates if an over voltage has occurred. If so, the output is set to OFF.

Current:

- The **Moy(A)** **11** field indicates the current measurement.
  The content of this field is available when the PC software is used to acquire a waveform, but the value is not generated from power-meter,
- The **Nominal Limit(A)** **10** field allows selecting the current limitation from 0 to 40A,
- The **Pulse limit Imax(A)** **7** field allows programming the maximum value (from 0 to 160A) which can be generated during the time defined in the field
  Pulse limit Duration(s) **6** (from 0.02s to 1s),

- The light **Limit I** **5** indicates if a current limitation is running. If so, the voltage is reduced in order to respect the current limitation,
- Once the parameters are entered, click the button **Validate** **9** to program the power supply. The light **8** indicates the validation status.

5.6 Setting of Ethernet link

This menu is opened clicking the "**Ethernet**" button **1** described § 5.4.2 "System…" tab.

These parameters must be modified only in accordance with your network administrator

The button "**Touch Screen**" **1** of the panel below displays the operating mode, Local (Touch screen field = **ON**) or Remote (Touch screen field = **OFF)**. The power supply switches to remote mode as soon as it receives a valid command frame.

In remote mode, the screens remain accessible but no command can be entered (a red indicator recalls it). Pressing this button allows to return to mode LOCAL (touch screen enabled).

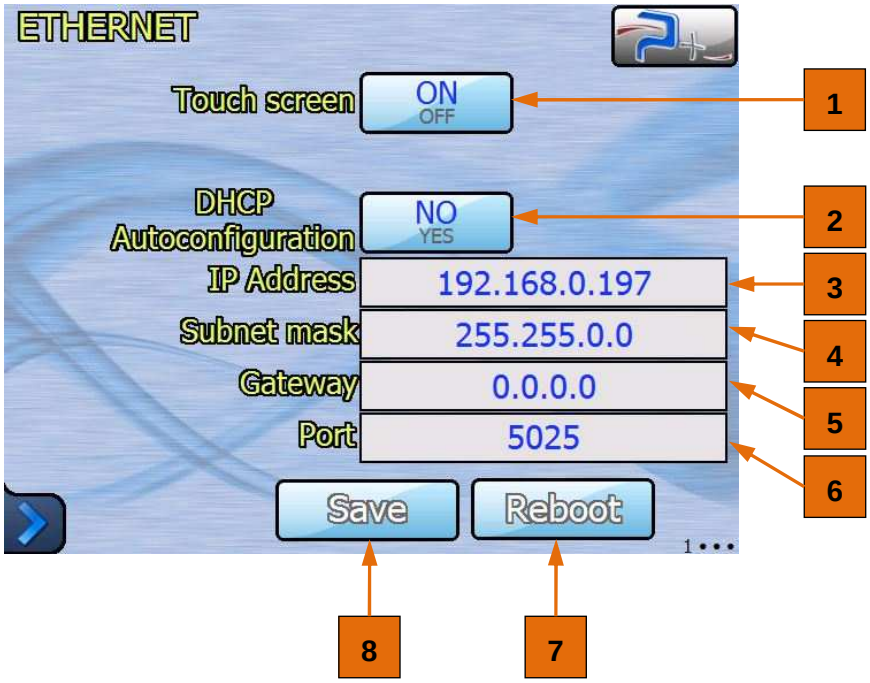


Figure 15 : Ethernet settings menu

The Button "**DHCP Autoconfiguration**" **2** selects the choice of assigning an IP address:

- Obtained automatically if **YES** (DHCP mode),
- Manual specification if **NO**.

If the "**DHCP Autoconfiguration**" field **2** specification is manual, the input boxes "**IP Address**" **3**, "**Subnet mask**" **4** and "**Gateway**" **5** must be filled.

Field "**Port**" **6** should be informed in all cases.

After changing one of these parameters, click the **Save** **8** button to record your new configuration.

After recording, this new configuration will be taken into account only during a restart of the control card. It can be forced, without turning off the power supply, clicking the **Reboot** **7** button.

5.7 Setting of serial RS232 link

This menu is opened clicking the "**RS232**" button **3** described § 5.4.2 "System…" tab.

The button "**Touch screen**" **1** of the panel below displays the operating mode, Local (**Touch screen** field = **ON** → screen is **Enable**) or Remote (**Touch screen** field = **OFF** → screen is **Disable**). The power supply switches to remote mode as soon as it receives a valid command frame.

In remote mode, the screens remain accessible but no command can be entered (a red indicator recalls it). Pressing this button allows to return to mode LOCAL (touch screen enabled).

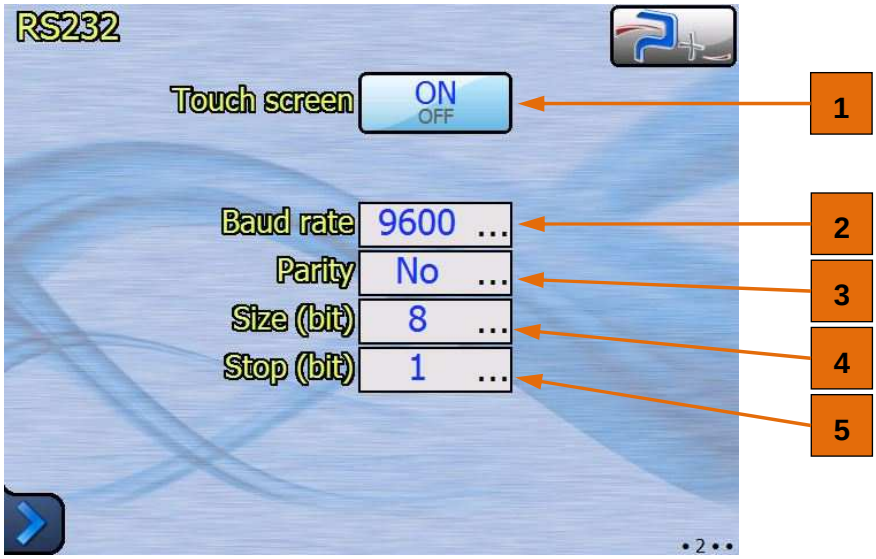


Figure 16 : RS232 settings menu

The "**Baud rate**" menu **2** selects the communications speed. The allowed values are 4800, 9600 (default), 19200, 38400, 57600 and 115200 baud.

The "**Parity**" **3** menu allows to set the parity among three possibilities:

- "**No**" parity (default value),
- "**Odd**" odd parity,
- "**Even'** parity.

The menu "**Size (bit)**" **4** lets choose the number of data bits among two possibilities:

- "**7**",
- "**8**" (default value).

The "**Stop (bit)**" menu **5** allows to choose the number of stop bits among three possibilities:

- "**1**" (default value),
- "**1.5**"
- "**2**".

Taking account of the modifications is immediate and does not require a restart of the power supply. The changes are stored in non-volatile memory: they are kept upon the power-off of the power supply.

5.8 Fan settings

This menu is opened clicking the "**Fan Setting**" button **4** described § 5.4.2 "System…" tab.

This power supply manages the speed of the fans, from 0% to 100%, according to the temperature of the elements of power.

The box "**Thermal(°C)**" **9** allows the input of the expected temperature. As soon as the indicator exceeds this value, fans start.

The boxes "**Regul T° Kp**" **8** and "**Regul T° Ki**" **7** are for fans speed.

The boxes "**Fan min speed(%)**" **6** and "**Fan max speed(%)**" **5** are maximal and minimal values of fans speed.

The indicator "**Fan speed(%)**" **4** displays actual fans speed.

The button "**Autospeed**" **3** allows to enable or disable automatic fans regulation. It may be interesting to force fans speed for more efficient cooling after a thermal alarm for example.

The indicator **(Ipos)** **1** displays the temperature measured on the power block generating the positive current.

The indicator **(Ineg)** **2** displays the temperature measured on the power block generating the negative current.

It is more efficient to use power supply with "Autospeed" ON.
A regulated ventilation too slightly will involve a more important risk of thermal alarm.

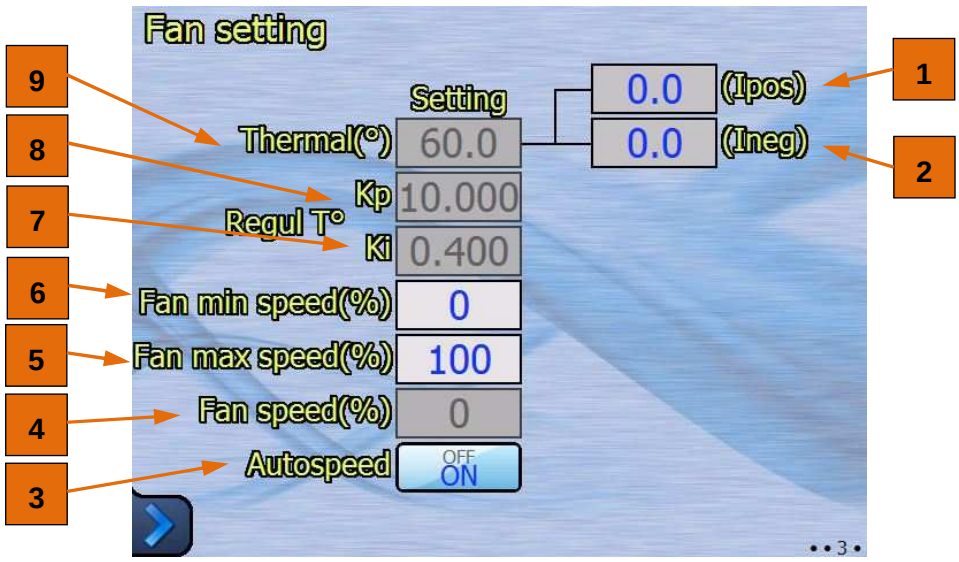


Figure 17 : Fan settings menu

5.9 Status of power supply

This menu is opened clicking the "**SelfTest**" button **5** described § 5.4.2 "System…" tab.

Light is green on normal operation, red in case of failure.

Light **1** is for amplifier card.

Light **2** is for synthesizer card,

Light **3** is for wattmeter card.

This self-test is made dynamically: if an error occurred on an internal communication, the corresponding light is affected.

The color code is:

- Red if a communication error is still present
- Green if no communication error has occurred since the system was started
- Orange if at least one communication error occurred since the system was started but the last one was OK.

-

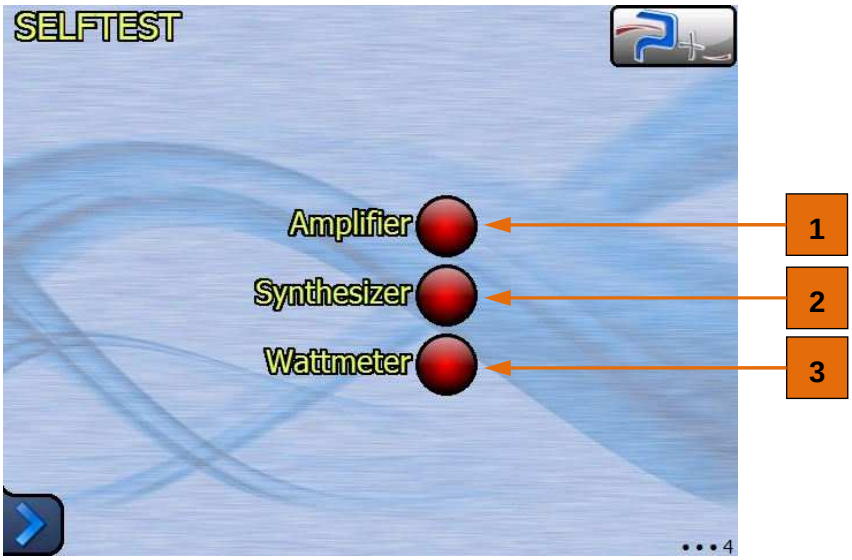


Figure 18 : Selftest menu

5.10 The configuration of the touch screen

This menu is opened clicking the "**Screen Calib.**" button **6** described § 5.4.2 "System…" tab.

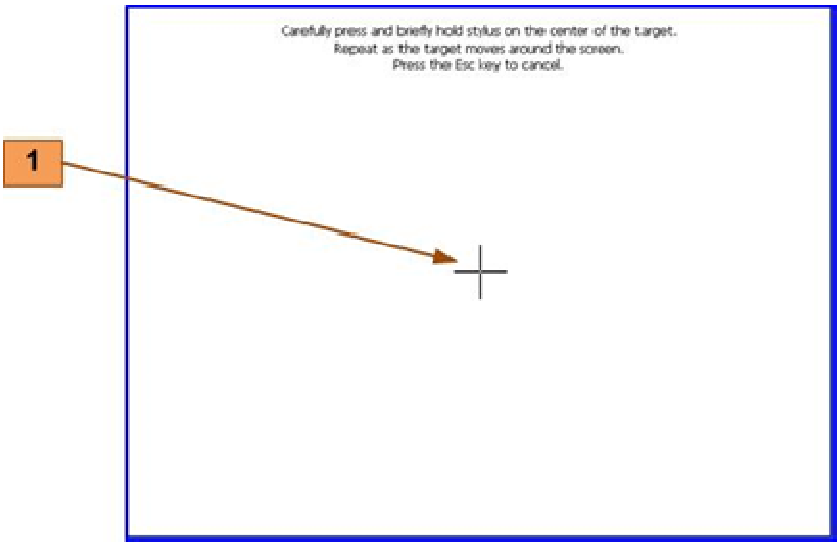


Figure 19 : Touch screen settings menu

The operator has just click the cross **1** which will appear in different places on the screen then to match the image to display with the size of the screen.

6. PROGRAMMATION

The remote control is performed using a TCP/IP communication on Ethernet bus or a serial communication on RS232.

6.1 Ethernet link

It is configured by the “Ethernet” page described in § 5.6 Setting of Ethernet link.

Ethernet is the physical standard used to transmit commands that can fly the generator via a LAN.

The instrument uses standard architecture client/server **TCP/IP WinSock** on the chosen port. The instrument behaves as a **Server**, to which equipment seeking to control the generator will come to connect as a **Client** by opening a **socket** communication.

The commands are ASCII strings transported on the TCP protocol.

6.2 RS232 link

Communication is configurable (speed, parity, data bits, stop bits) by the "Serial Port" page described in § 5.7 Setting of serial RS232 link.

The commands are ASCII character strings terminated with CR characters (ASCII code 0x13) and LF (ASCII code 0x10).

6.3 Programmables parameters for the Ethernet and RS232 links

They begin with the characters "P" and are positioned following the syntax:

➔ 'keyword = value' (followed by LF)

They are followed by a reply from the current generator:

🡐 'OK' (followed by LF) if the order is correct

or

🡐 "ERRxxx" (followed by LF) if the order is not correct. The error codes are described in § 6.5 List of error codes.

Coherence is in the format of the command: command is fully in (literal) standard.
Example for an analog value standard:

➔ P_123CurrLimit = 2.9 (followed by LF)

🡐 OK (followed by LF)

6.4 List of commands:

NOTE: Non-volatile configuration communication parameters: the set value is saved in non-volatile memory. The software takes this value each start or reboot. The "Default value" column shows values taken at each start or reboot.

Parameter Adr	Name	Panel	Possible Programming Values	Conversion Standard/hexa	Default value	Volatile
00h	P_SysDisplay	None	ProgMeas Profile Limits Ethernet RS232 Fan Selftest	ProgMeas/00h Profile/01h Limits/02h Ethernet/40h RS232/41h Fan/44h Selftest/46h	ProgMeas	YES
01h	*RST	None	/	/	/	YES
02h	*IDN	None	PUISSANCE-PLUS, RC2096,0,E1002200 + E0900101 + E4101259 + E1002210 + E1001890	/	/	/
03h	OPC	None	No Yes	No/0000h Yes/0001h	Yes	YES
04h	P_Output	ProgMeas	OFF ON	OFF/0000h ON/0001h	OFF	YES
05h	M_VoltValue	Limits	Min : 000.00V Max : 115.00V	ReAn= Hexa*Max/FFFh		
06h	P_OverVLimit	Limits	Min : 000.0V Max : 115.0V	Hexa= PrAn*FFFh/Max	110.0V	NO
07h	P_OverVAck	Limits	OFF ON *Automatic reset to OFF*	OFF/0000h ON/0001h	OFF	YES
08h	M_OverVStatus	Limits ProgMeas	(Red) KO (Green) OK	KO/0001h OK/0000h		
09h	M_CurrValue	Limits	Min : -166.5A Max : +166.5A	ReAn= Hexa*max/FFFh		
0Ah	P_CurrLimit	Limits	Min : 00.00A Max : 40.00A	ReAn= Hexa*166.5/FFFh	01.20A	NO
0Bh	P_OverILimit	Limits	Min : 000.00A Max : 160.00A	ReAn= Hexa*166.5/FFFh	00.00A	NO
0Ch	P_OverIDur	Limits	Min : 0.02s Max : 1.00s	/	0.02s	NO
0Dh	M_LimitIStatus	Limits ProgMeas	(Green) OFF (Red) ON	OFF/0000h ON/0001h		
0Eh	P_DCVoltValue	ProgMeas	Min : 000.00V Max : 110.00V	Hexa= PrAn*FFFh/115V	000.00V	NO
0Fh	P_ProfilName	ProgMeas	*FileName*	*FileName/0000h*	*Empty*	NO
10h	P_ProfilStart	ProgMeas	OFF ON *Automatic reset to OFF*	OFF/0000h ON/0001h	OFF	YES

Parameter Adr	Name	Panel	Possible Programming Values	Conversion Standard/hexa	Default value	Volatile
11h	P_ProfilStop	ProgMeas	OFF ON *Automatic reset to OFF*	OFF/0000h ON/0001h	OFF	YES
12h	M_ProfilStatus	ProgMeas	OFF ON	OFF/0000h ON/0001h		
1Ch	P_Wattmeter	ProgMeas	OFF ON	OFF/0000h ON/0001h	ON	YES
13h	P_MeasIntegDur *Not available if M_VoltTRMS=OFF*	ProgMeas	100ms 200ms 500ms 1s 2s	100ms/0064h 200ms/0032h 500ms/0014h 1s/000Ah 2s/0005h	100ms	YES
14h	M_VoltTRMS *Not available if M_Wattmeter=OFF*	ProgMeas	Min : 000.00V Max : 115.00V	ReAn=Hexa*max/7FFFh		
15h	M_VoltDC *Not available if M_Wattmeter=OFF*	ProgMeas	Min : 000.00V Max : 115.00V	ReAn=Hexa*max/7FFFh		
16h	M_VoltAC *Not available if M_Wattmeter=OFF*	ProgMeas	Min : 000.00V Max : 115.00V	ReAn=Hexa*max/7FFFh		
17h	M_CurrTRMS *Not available if M_Wattmeter=OFF*	ProgMeas	Min : 000.00A Max : 166.50A	ReAn=Hexa*max/7FFFh		
18h	M_CurrDC *Not available if M_Wattmeter=OFF*	ProgMeas	Min : -166.50A Max : +166.50A	ReAn=Hexa*max/7FFFh		
19h	M_CurrAC *Not available if M_Wattmeter=OFF*	ProgMeas	Min : 000.00A Max : 166.50A	ReAn=Hexa*max/7FFFh		
1Ah	M_Power *Not available if M_Wattmeter=OFF*	ProgMeas	Min : -19.147kW Max : +19.147kW	ReAn=Hexa*max/7FFFh		
1Bh	M_Thermal	ProgMeas	(Red) KO (Green) OK	KO/0001h OK/0000h		
20h to 2Ah	P_ProfilTime***xx*** xx = 01 to 10	Profile	Min : 000000.00ms Max : 999999.99ms	/	0	NO
30h To 3Ah	P_ProfilVolt***xx*** xx = 01 to 10	Profile	Min : 000.00V Max : 110.00V	/	0	NO
40h	P_ProfilRepeatN	Profile	Min : 000 Max : 999	/	0	NO
41h	P_ProfilRepeatD	Profile	Min : 000000.00ms Max : 999999.99ms	/	0	NO
42h	P_ProfilNewName	ProgMeas	*Entre new name*	Entre new name/0000h	*Empty*	YES
43h	P_ProfilSave	ProgMeas	OFF ON *Automatic reset to OFF*	OFF/0000h ON/0001h	OFF	YES
44h	P_ProfilSaveAs	ProgMeas	OFF ON *Automatic reset to OFF*	OFF/0000h ON/0001h	OFF	YES
45h	P_ProfilReset	ProgMeas	OFF ON *Automatic reset to OFF*	OFF/0000h ON/0001h	OFF	YES

Parameter Adr	Name	Panel	Possible Programming Values	Conversion Standard/hexa	Default value	Volatile
46h	P_ProfilDelete	ProgMeas	OFF ON *Automatic reset to OFF*	OFF/0000h ON/0001h	OFF	YES
47h	P_ProfilSelect	ProgMeas	OFF ON *Automatic reset to OFF*	OFF/0000h ON/0001h	OFF	YES
8CCh	MD5	None	*MD5Value*	*MD5Value*/0000h	*Empty*	YES
8CDh	P_Validate	Prog	OFF ON *Automatic reset to OFF*	OFF/0000h ON/0001h	OFF	YES
8CEh	M_Status	Prog	*(Red)* KO (Green) OK *(Gray)* Modified (Bleu) Running	KO/0000h OK/0001h Modified/0002h Running/0003h		
8CFh	P_AbortAction *Not availlable*	None	OFF ON *Automatic reset to OFF*	OFF/0000h ON/0001h	OFF	YES
8D0h	A_Amplifier	SelfTest	(Red) KO (Green) OK (Orange) Warning	KO/0000h OK/0001h Warning/0002h		
8D1h	A_Synthesizer	SelfTest	(Red) KO (Green) OK (Orange) Warning	KO/0000h OK/0001h Warning/0002h		
8D2h	A_Wattmeter	SelfTest	(Red) KO (Green) OK (Orange) Warning	KO/0000h OK/0001h Warning/0002h		
900h	P_FanAutoSpeed	Fan	OFF ON	OFF/0001h ON/0000h	ON	NO
902h	P_FanMinSpeed	Fan	Min : 000% Max : 050%	Hexa= PrAn*64h/Max	0%	NO
903h	P_FanSpeed *Not available when P_FanAutoSpeed=ON*	Fan	Min : 000% Max : 100%	Hexa= PrAn*64h/Max	0%	NO
904h	P_FanMaxSpeed	Fan	Min : 050% Max : 100%	Hexa= PrAn*64h/Max	100%	NO
905h	P_ThermInput *System parameter*	None	Min : 0 Max : 15	Hexa= PrAn*15/Max	2	YES
906h	M_ThermalValue	Fan	Min : 000.0°C Max : 100.0°C	ReAn= Hexa*Max/03FFh		
90Ah	P_ThermalSet	Fan	Min : 000.0°C Max : 100.0°C	Hexa= PrAn*0FFFh/Max	60°C	NO
90Bh	C_FanRegkp	Fan	Min : 000.000 Max : 100.000	/	10	NO
90Ch	C_FanRegki	Fan	Min : 000.000 Max : 100.000	/	0.5	NO
910h	P_RS232_Speed	RS232	4800 9600 19200 38400 57600 115200	4800/0000h 9600/0001h 19200/0002h 38400/0003h 57600/0004h 115200/0005h	9600	NO

Parameter Adr	Parameter Name	Panel	Possible Programming Values	Conversion Standard/hexa	Default value	Volatile
911h	P_RS232_Parity	RS232	No Odd Even	No/0000h Odd/0001h Even/0002h	No	NO
912h	P_RS232_Data	RS232	7 8	7/0007h 8/0008h	8	NO
913h	P_RS232_Stop	RS232	1 1.5 2	1/0000h 1.5/0001h 2/0002h	1	NO

Table 1: list of parameters or commands

6.5 List of error codes

Error codes

In the event of faulty operation, the generator returns an error in the form ERRxxx instead of OK.

Possible values are:

```
#define ERRVAL_BAD_PARAMETER                0x001
#define ERRVAL_BAD_FORMAT_OR_COMMAND        0x002
#define ERRVAL_BAD_VALUE                    0x004
#define ERRVAL_SYSTEM_ERROR                 0x008
#define ERRVAL_SENDREAD_TIMEOUT             0x010
#define ERRVAL_DISABLED_PARAM_OR_CONNECT    0x020
#define CKSUM_ERROR                         0x040
#define ID_ERROR                            0x080
#define ERRVAL_ANOTHER_ACTION_RUNNING       0x100
#define ERRVAL_INACCESSIBLEINOUT            0x200
```

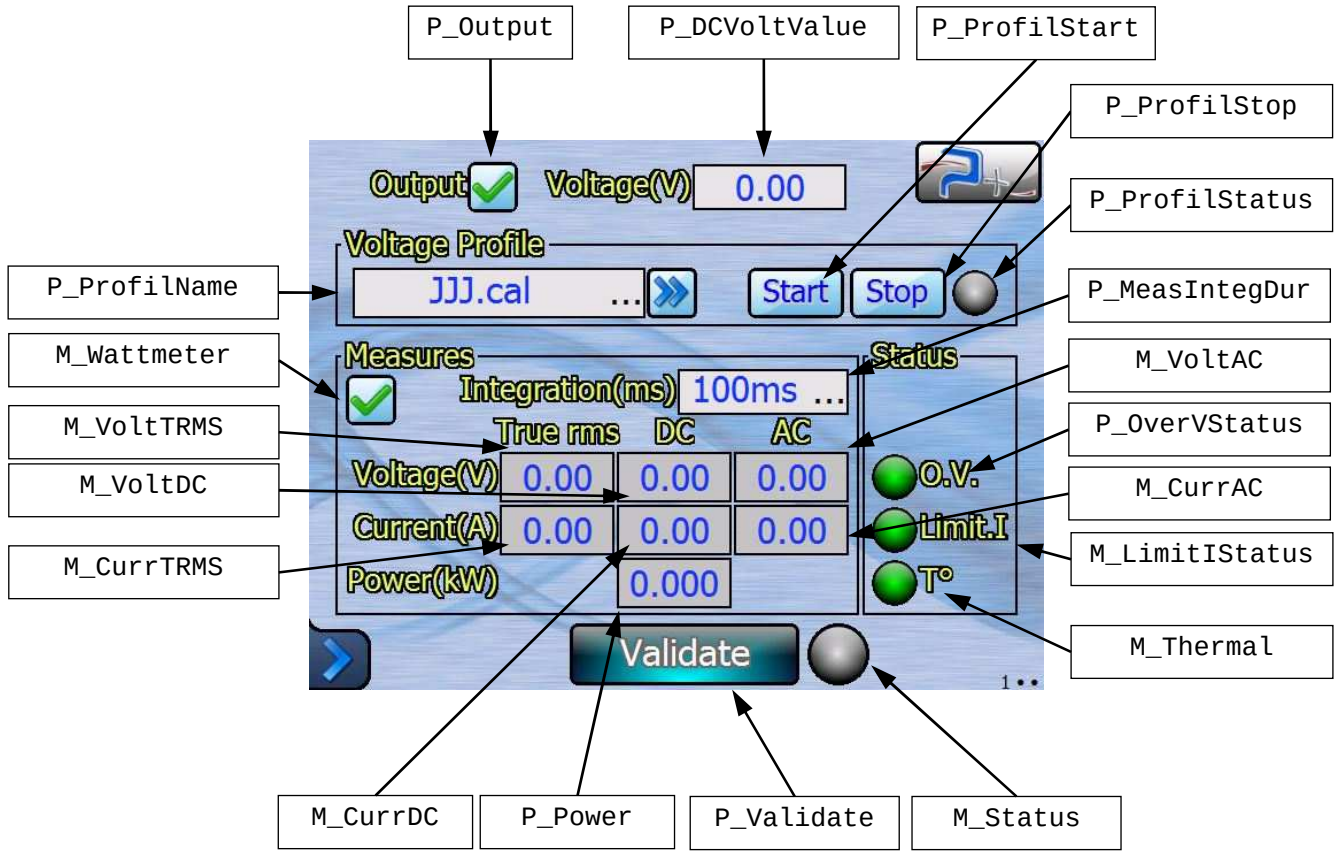
List of internal communication errors

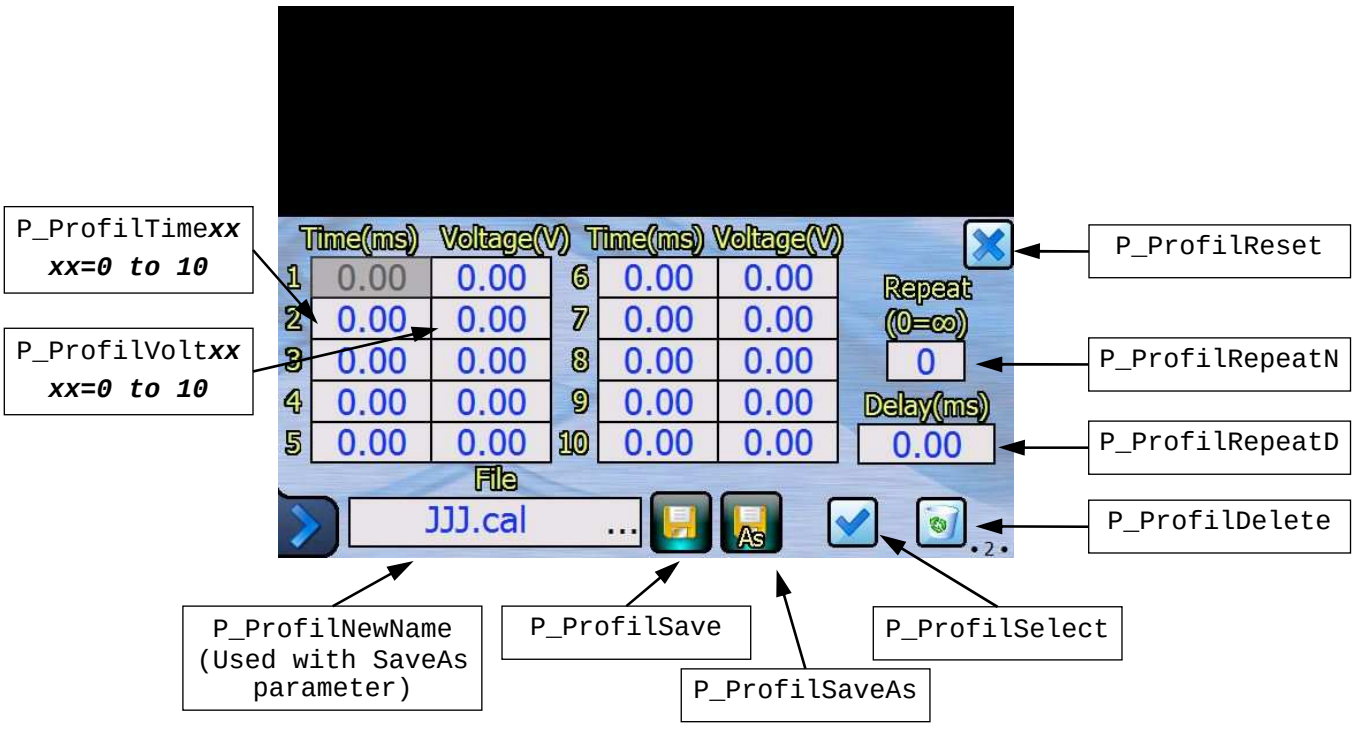
```
#define LOWLEVEL_ERR_SHIFT 16
#define FPGA_FO_DEVICEIO_ERROR_CODE     0x01 /*<< LOWLEVEL_ERR_SHIFT*/
#define FPGA_FO_BUSY_ERROR_CODE         0x02 /*<< LOWLEVEL_ERR_SHIFT*/
#define FPGA_FO_NODATA_ERROR_CODE       0x04 /*<< LOWLEVEL_ERR_SHIFT*/
#define FPGA_FO_TIMEOUT_ERROR_CODE      0x08 /*<< LOWLEVEL_ERR_SHIFT*/
```

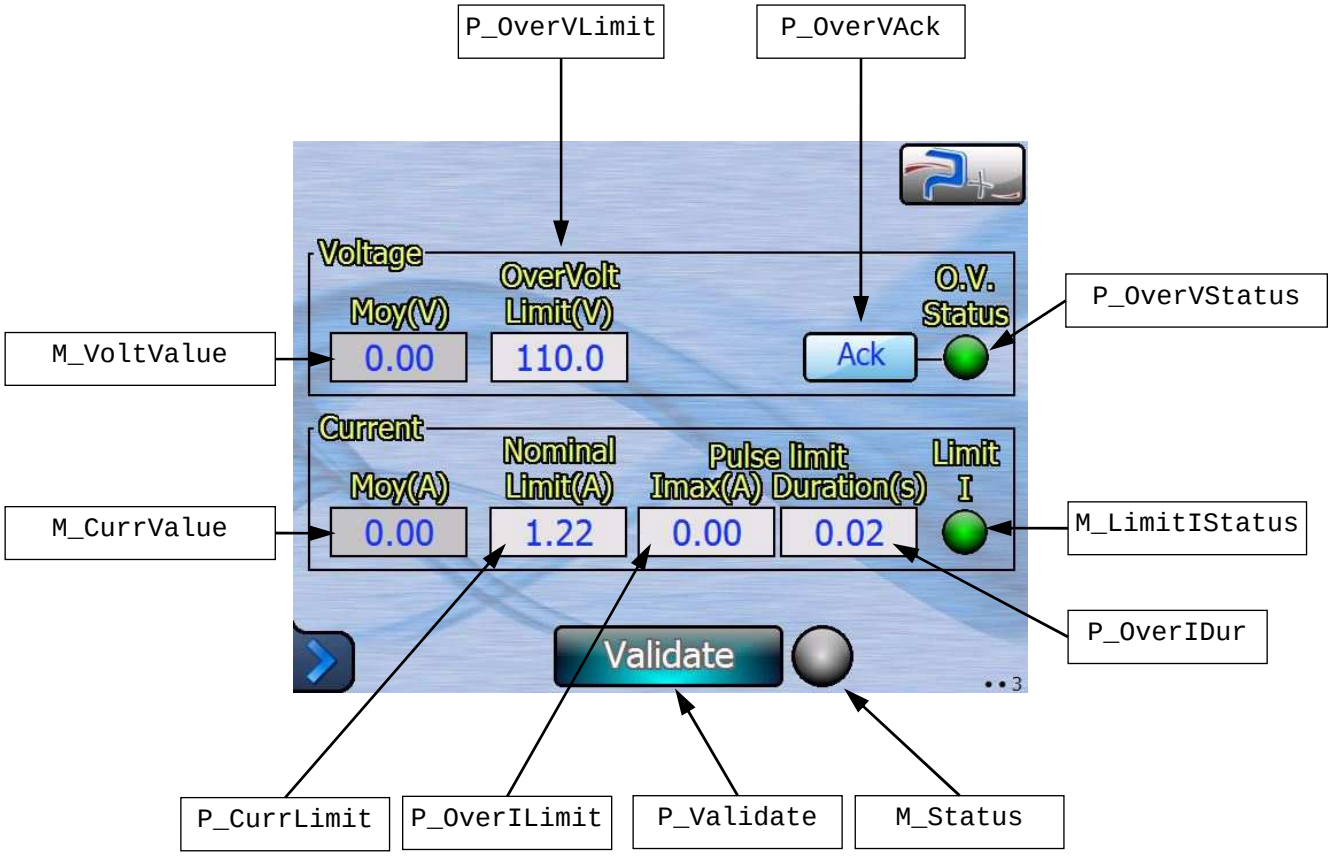
6.6 Viewing parameters

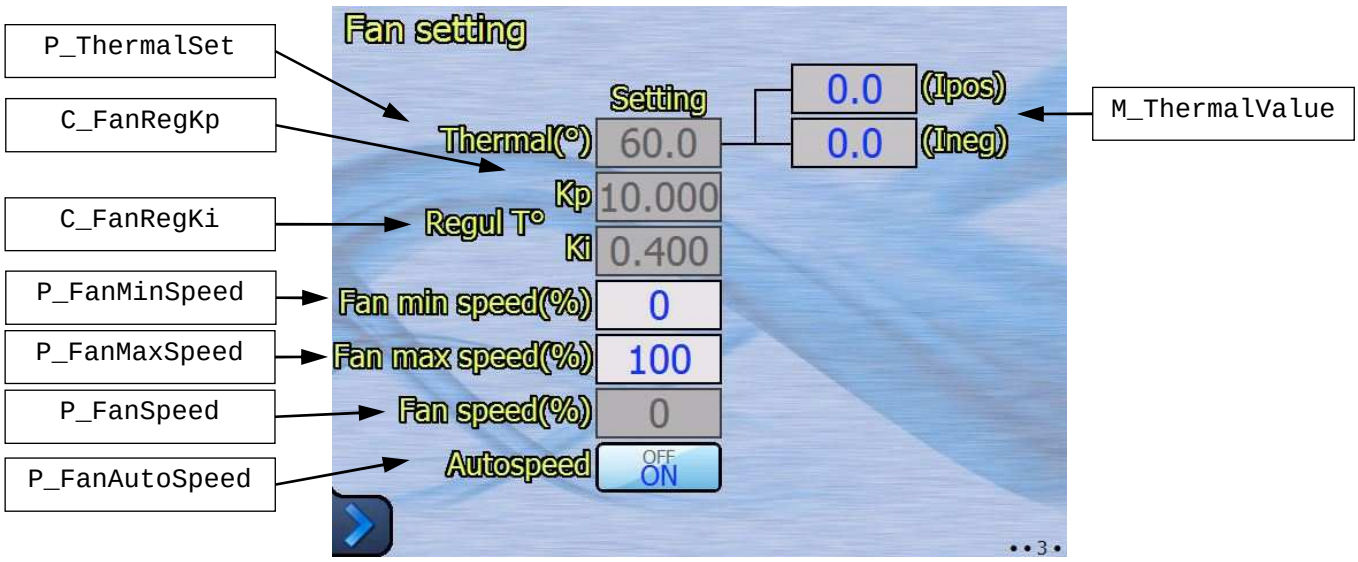
The parameter "P_SysDisplay" defines the different pages of the interface.

The correspondence between the screens and the programming parameters is given in the following figures.






P_OverVLimit
P_OverVAck
Voltage
Moy(V)
OverVolt Limit(V)
O.V. Status
M_VoltValue
0.00
110.0
Ack
P_OverVStatus
Current
Moy(A)
Nominal Limit(A)
Pulse limit Imax(A)
Duration(s)
Limit I
M_CurrValue
0.00
1.22
0.00
0.02
M_LimitIStatus
P_OverIDur
Validate
P_CurrLimit
P_OverILimit
P_Validate
M_Status


P_ThermalSet
C_FanRegKp
C_FanRegKi
P_FanMinSpeed
P_FanMaxSpeed
P_FanSpeed
P_FanAutoSpeed
Fan setting
Setting
Thermal(°)
60.0
Regul T°
Kp
10.000
Ki
0.400
Fan min speed(%)
0
Fan max speed(%)
100
Fan speed(%)
0
Autospeed
OFF
ON
0.0
(Ipos)
0.0
(Ineg)
M_ThermalValue

7. MAINTENANCE

In principle, PUISSANCE + power supply requires no maintenance or metrological verification.

However according to the conditions and time of operation of the power supply, check the cleanliness of ventilation and air extraction grids regularly.

7.1 Cleaning

RISK OF ELECTRIC SHOCK: To prevent electrical shock, disconnect the power supply from the mains before cleaning it.

Using the vacuum cleaner, crevice attachment, and the soft bristle brush, clean away any dust and residue from the front panel air intakes of the power supply.

Using surface mark remover, cleaning swabs, and a lint free cloth, clean any residue from the power supply air intakes.

WARNING: Do not spray surface cleaner directly into the Power Supplies. Spray the cleaner onto the cloth or swab, then use the moistened item to clean the power supply.

7.2 Fans

Visually check the fans for correct operation (their grids are located at the rear of the power supply). Make sure that there are no abnormal noises.

7.3 Fuse

WARNING : The power supply contains an internal fuse that is not accessible to customers. In case of problems, please contact customer support.

8. STORAGE CONDITIONS

During storage, power supply should be stored in their original packaging with all guards in place. Accessories / cables or connectors must also be stored in the same package.

They must be stored on shelves, away from humidity and at a temperature between 0 ° C and + 50 ° C.

9. APPENDIX 1 : MECHANICAL DIMENSIONING

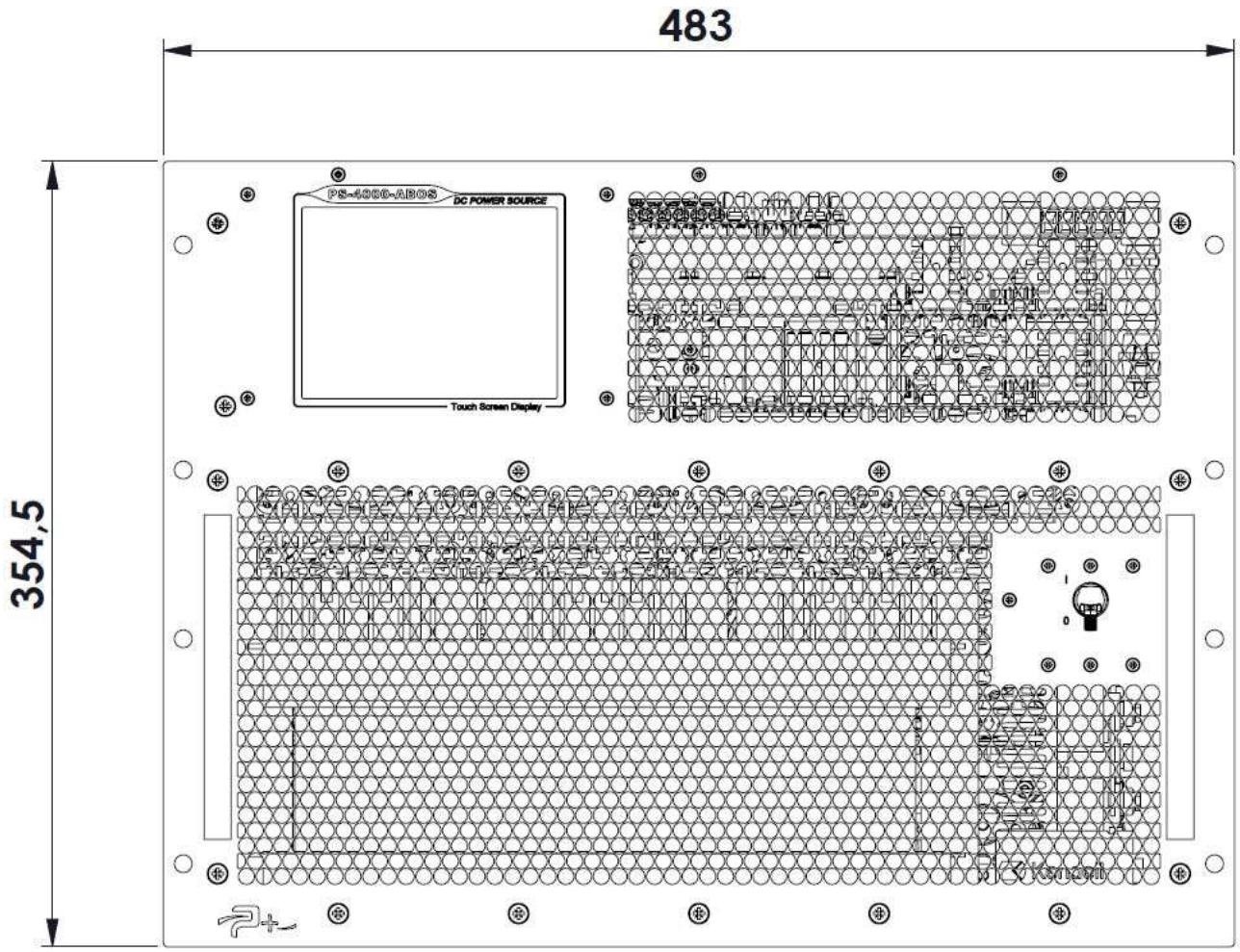


Figure 20 : Mechanical dimensioning – Front face

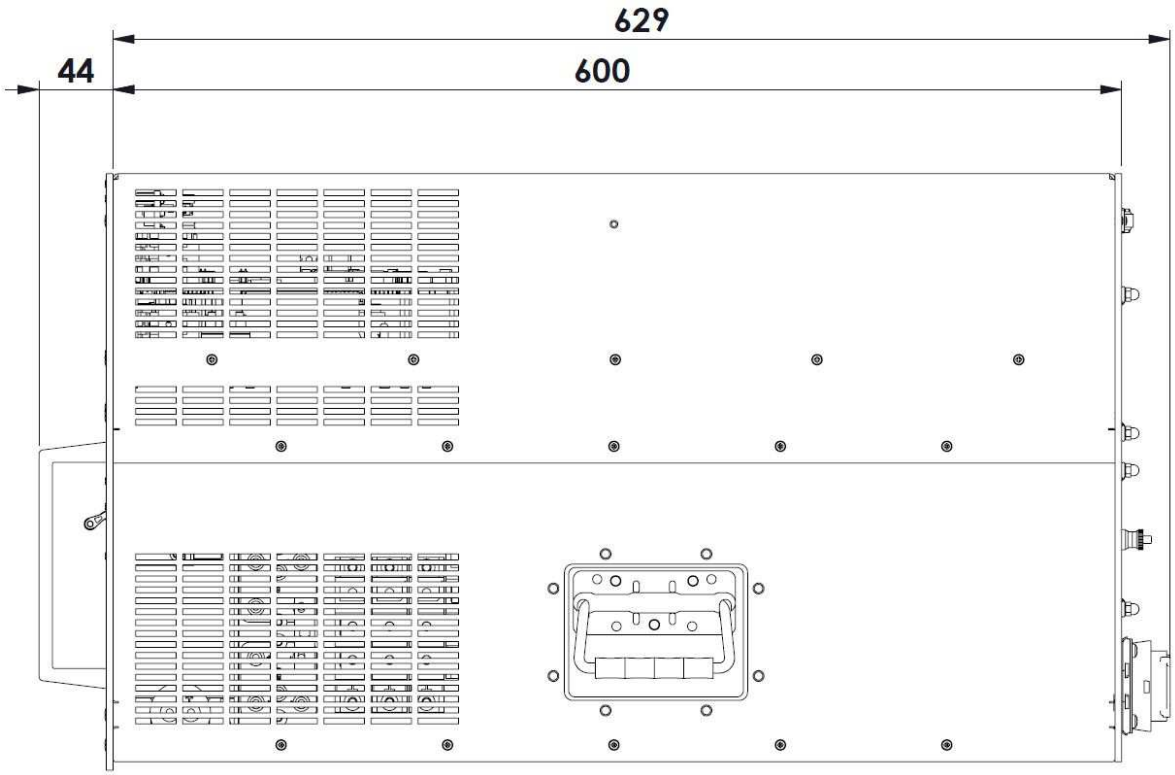


Figure 21 : Mechanical dimensioning – Upper view