CAENels
Gear For Science

Quick Start Guide

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Quick Start Guide – Models

This manual covers the following standard Power Supplies models:

- **FAST-Bi-1K5**

Table Of Contents

Document Revisions

Revision	Date	Comment
0.1	January 31st, 2024	Draft Release.
0.2	February 5th, 2024	Text revision and added internal memory description.
0.3	February 6th, 2024	Added Local control chapter. Added section "Controls toolbar".
1	August 8th 2024	Updated address and revision numbering
2	January 22nd 2025	Updated Local Display images -> compatible with fw 1.1.03.
2.1	January 24th, 2025	Reviewed text of sections: 3.2.2 and 3.2.4.

1. Introduction

The Power Supplies (PS) can be controlled in two different ways:

➢ **<u>REMOTELY</u>**:
  o By accessing a Graphical User Interface (GUI) from a web browser;
  o By using TCP/IP (SCPI-like) commands (see the *"Commands Reference Manual"*);

➢ **<u>LOCALLY</u>**: from the Local Display and Navigation Switch on the PS front panel.

Remote and Local control will be addressed respectively in chapter 2 and chapter 3.

2. Remote Control: GUI

In order to access the GUI, the PS network settings have to be configured accordingly to the User's network. The PS network settings can be configured from the Local Display as reported in **Figure 1**, or from the Device Manager (see the Device Manager *"Quick Start Guide"* for more information).
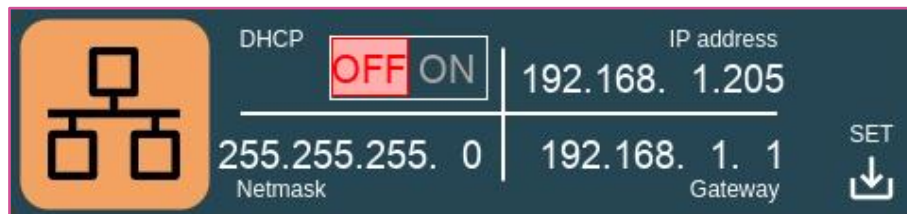

Figure 1: Local display, network menu.

In order to establish connection with the Power Supply (PS), double check that the network configuration of the User's PC is on the same subnet of the PS.

When the network is configured, open a web browser and type the PS IP address on the address bar. At the first connection you'll be asked to accept the EULA license agreement (**Figure 2**). Once you accept and click on "*continue*" you'll be redirect to the GUI *Home Page* (**Figure 3**).
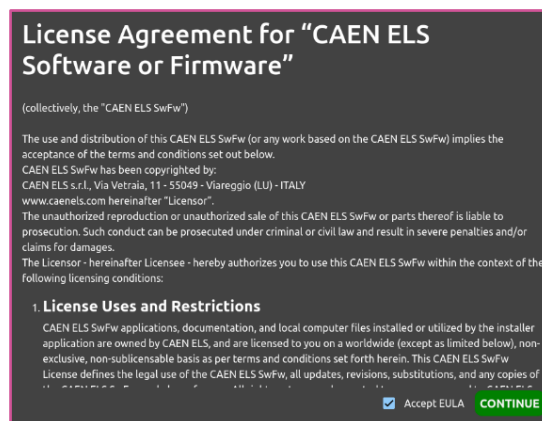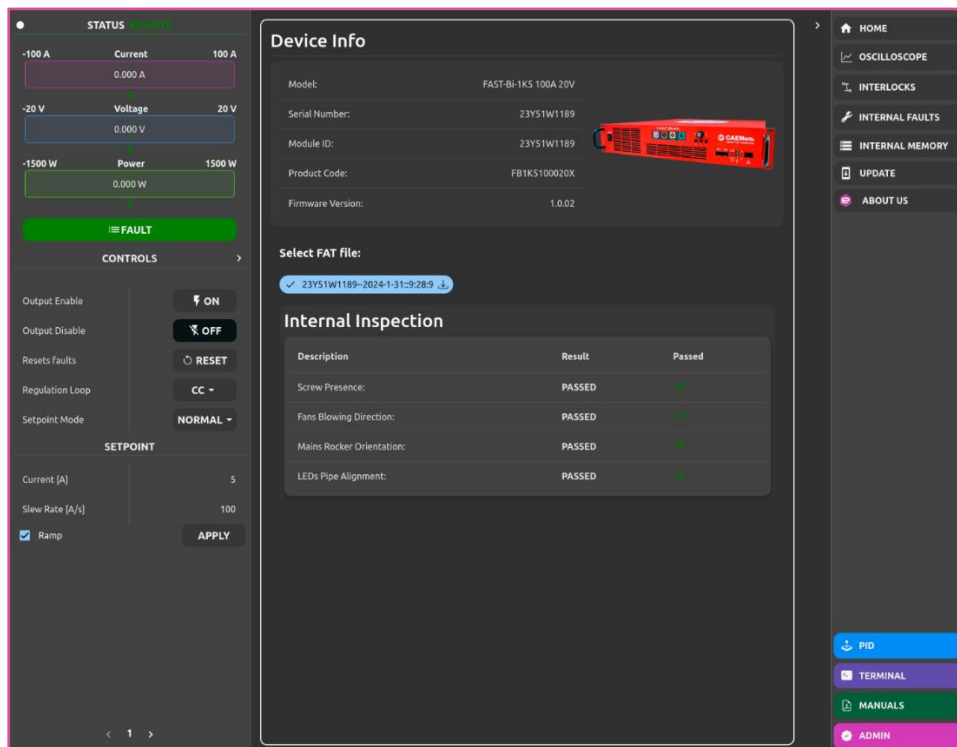

Figure 2: EULA agreement.

Figure 3: Home page.

The GUI (**Figure 3**) is structured in 3 parts:

1. *Controls toolbar*: this is the toolbar on the left side of the GUI from which are accessible the basic controls of the PS.
2. *Navigation toolbar*: this is the toolbar on the right side of the GUI from which are accessible the advanced configurations of the PS.
3. *Main window*: this is the central part of the GUI which changes its content depending on the page selected from the *Navigation toolbar*.

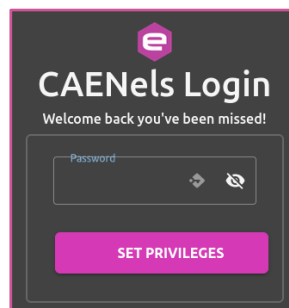As first step into the GUI, let's open the *Login* page from the bottom of the *Navigation toolbar*.

Figure 4: Login page.

When in the *Login* page (**Figure 4**) two level of privileges are available:

- "*user*": for user privileges, automatically logged-in, very limited controls and configurations;

- "*ps-admin*": for administrator privileges, access to all the advanced controls and configuration features;

From now on let's consider to be logged-in as administrator.

2.1 Controls Toolbar

The PS can be operated from the *Controls toolbar*. This toolbar is divided in vertical sections that are described here from top to bottom:

1. *Status*: in this section are reported the real-time values of *Current*, *Voltage* and *Power*. Additionally, a *Fault indicator* indicates the PS fault status. By clicking the *Fault indicator,* a window will show up with the faults list;

2. *Controls*: the control section (see **Figure 5**) is sub-divided in 2 regions. The top region is fixed (Output Enable, Output Disable and Reset faults) and the bottom region has three available menus which can be selected with the *Controls arrows* (left and right, highlighted in orange in **Figure 5(a)**). From the top region the PS output can be enabled or disabled and the faults can be reset. From the bottom region there are three available menus:

   a. *Regulation loop and setpoint mode*;
   b. *Persistent Switch*: from this menu it is possible to enable/disable the persistent switch;
   c. *Floating Mode*: from this menu it is possible to configure the PS to be floating or not, depending on the grounding connections;

3. *Setpoint*: in this section, depending on the setpoint mode selected, the PS setpoint and its configuration can be changed.
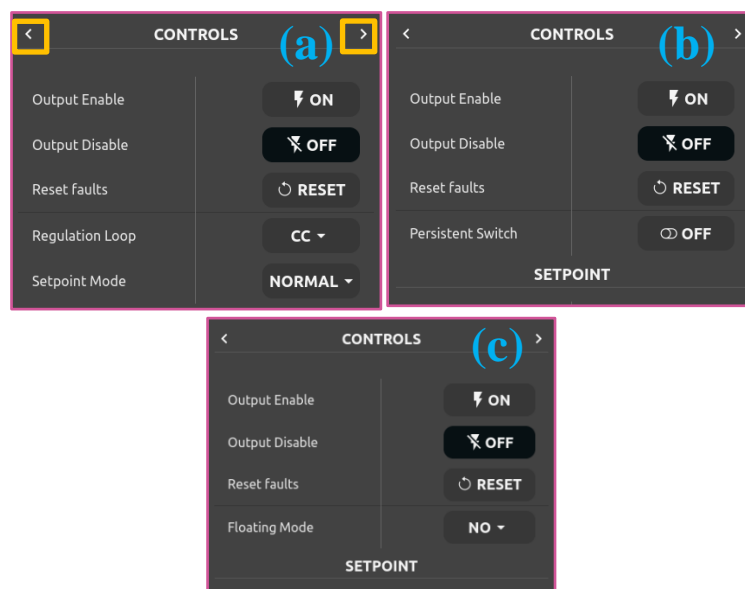

Figure 5: Controls pages.

The different *Regulation loop and setpoint modes* of the PS will be addressed in the following sections.

2.1.1   Setpoint Mode: NORMAL

The PS always powers-up in *OFF* condition (Output Disabled, **Figure 6**). The PS output can be enabled by clicking the *ON* button (Output Enabled, **Figure 6**). **When the PS output is enabled, the setpoint is always kept at 0 for safety reasons**. To apply a setpoint, click on the *Apply* button in the *Setpoint* section. If, during the operation, a fault arises, the *Fault indicator* will become red (see **Figure 6**), the PS will automatically go in *OFF* condition. By clicking on the *Fault indicator*, a window will show up with the faults list (**Figure 7**). The PS output cannot be enabled again if the faults are not resolved. When the faults are resolved, reset the faults status with the *Reset faults* button.
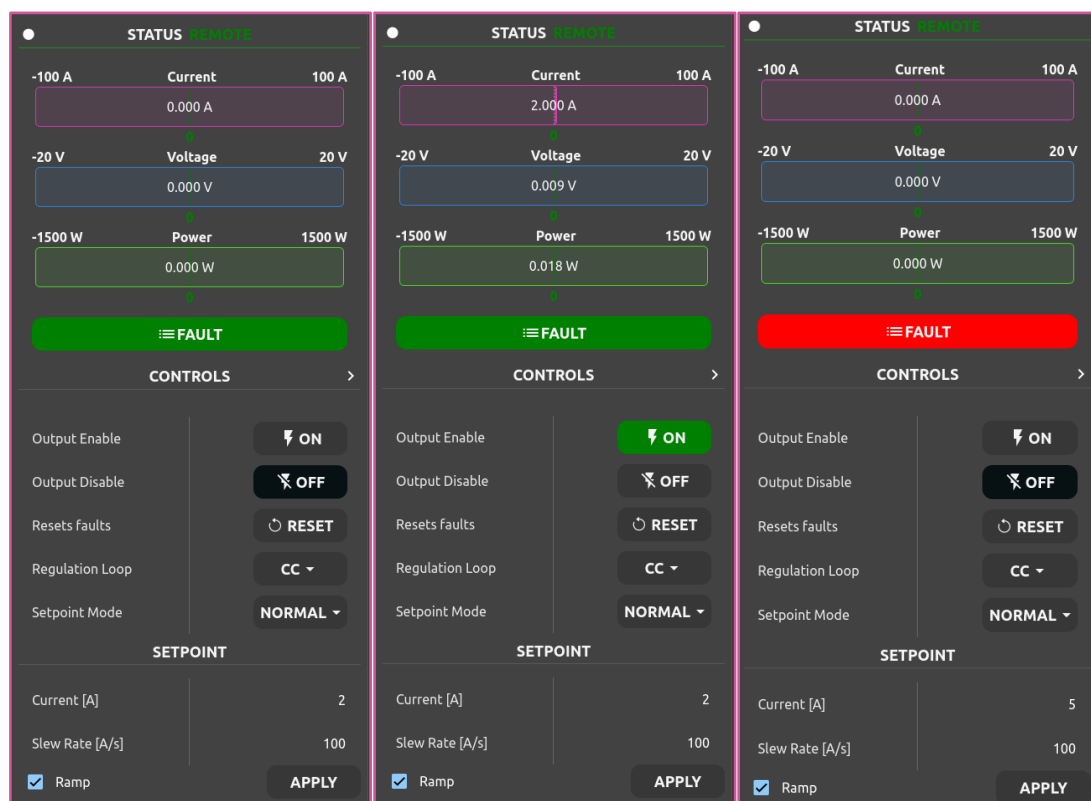
Figure 6: PS OFF (left), PS ON (center) and PS in fault condition (right).

Figure 7: Faults list.

2.1.2 Setpoint Mode: WAVE

The *Waveform* setpoint mode can be used to generate a custom waveform.

The correct procedure to work with a custom waveform should be the following:

1. Select *Wave* as setpoint mode from the *Controls toolbar*;
2. Configure the custom waveform from the *Main Window*, and click *Apply* to save the waveform settings;
3. Enable the PS output (*ON* button);
4. Click on *Start* from the waveform *Main Window* to actually output the custom waveform;
5. When completed, click on *Stop* button to stop the waveform. **When the waveform is stopped the PS will output the last waveform setpoint**;
6. Disable the PS output (*OFF* button).
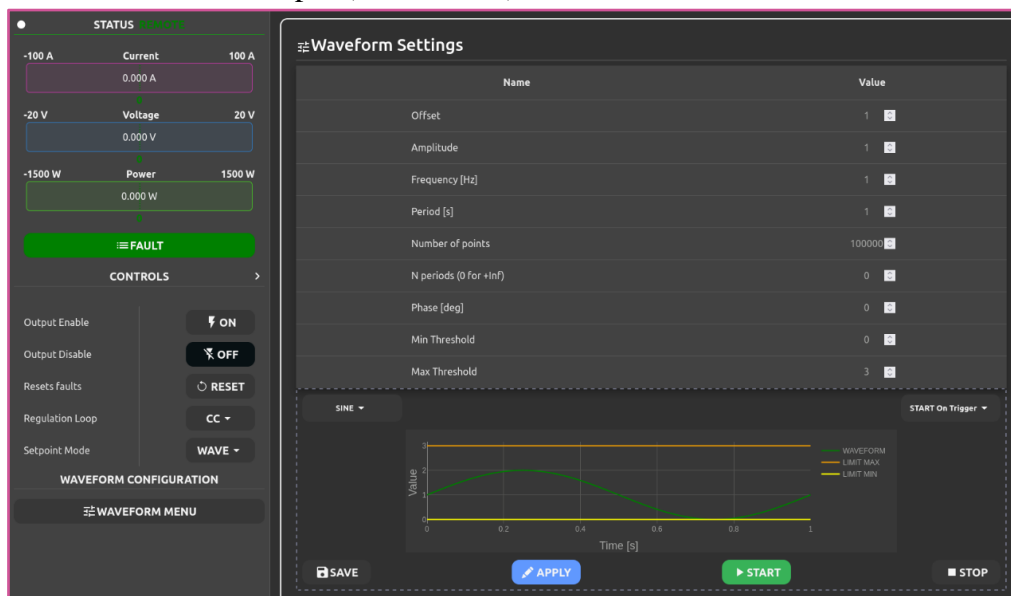
Figure 8: Waveform menu.

When selected a custom waveform (drop down menu "2" in **Figure 9**) it is possible to upload a custom waveform file (from the button "1" in **Figure 9**). **The custom waveform file has to be formatted as**:

{x: 0, y: 0}, {x: 0.25, y: 1.0}, {x: 0.5, y: 0.0}, {x: 0.75, y: 1.0}

where "x" is the horizontal variable (time in [s]) and "y" is the vertical variable (current in [A] if the PS is in regulation mode CC, or voltage in [V] if the PS is in regulation mode CV).
When the custom waveform is uploaded it is possible to select how to interpolate the custom wave points ("3" in **Figure 9**). Available options are: linear, step, polynomial or spline.
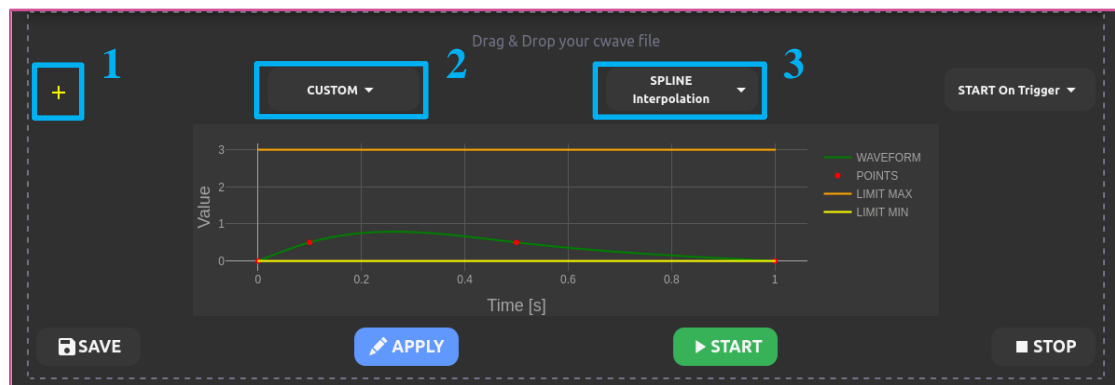
Figure 9: Waveform settings.

2.1.3 Setpoint Mode: AIN

The *Ain* setpoint mode can be used to output a waveform supplied externally from the "AIN" input on the rear panel (see the PS "*User's Manual*" for more details regarding the analog input hardware connections).
The correct procedure to work with the analog input should be the following:
1. Select *Ain* as setpoint mode from the *Controls toolbar*;
2. Supply an external signal on the "AIN" input on the rear panel;
3. Check the setpoint on the *Oscilloscope* page before enabling the output;
4. If the setpoint is as desired, enable the PS output (*ON* button);
5. The PS output should follow the input signal (setpoint), as reported in **Figure 10**;
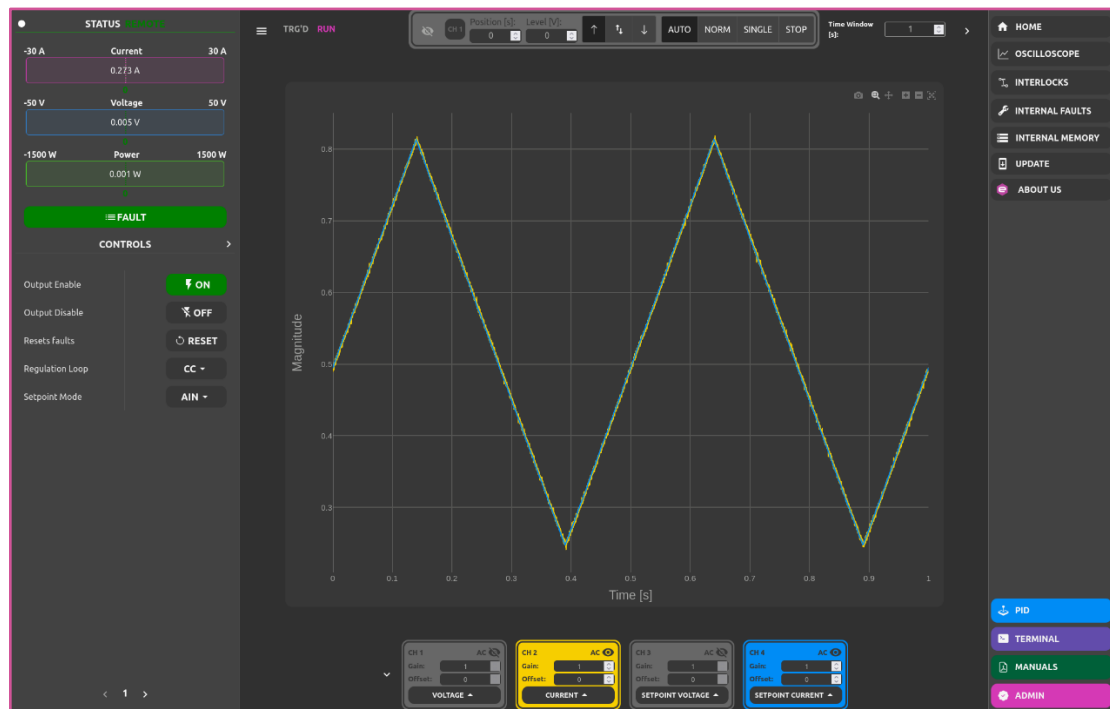6. When the operation is completed, disable the PS output (*OFF* button).

Figure 10: Analog input setpoint mode.

2.1.4 Setpoint Mode: SFP

Not yet implemented.

2.2 Navigation Toolbar

A quick introduction before addressing the navigation toolbar pages is necessary to understand how the memory of the PS works. The memory is organized as a table with the following columns:

ID	Name	Value	Privileges

- o *ID*: memory address (not editable);
- o *Name*: name of the variable (not editable);
- o *Value*: variable value (editable);
- o *Privileges*: variable privileges (not editable).

A *Value* can be edited by clicking on the value cell [(1) in Figure 11] and saved temporarily by pressing *Enter*. Temporarily means that it won't be saved permanently in the memory and it will be discarded if the PS is power-cycled.

To save the edited values permanently, use the *Save* button [(2) in Figure 11].

It is possible to download/upload the memory configuration by using the *Download/Upload* buttons [(3) in Figure 11].

Keep the same text format and file extension of the downloaded file when uploading a new memory configuration file.

Figure 11: Editing memory variables.

2.2.1 Home

From the Home page the User can access the main device information. Additionally the User can also inspect and download the Factory Acceptant Test (FAT) file.
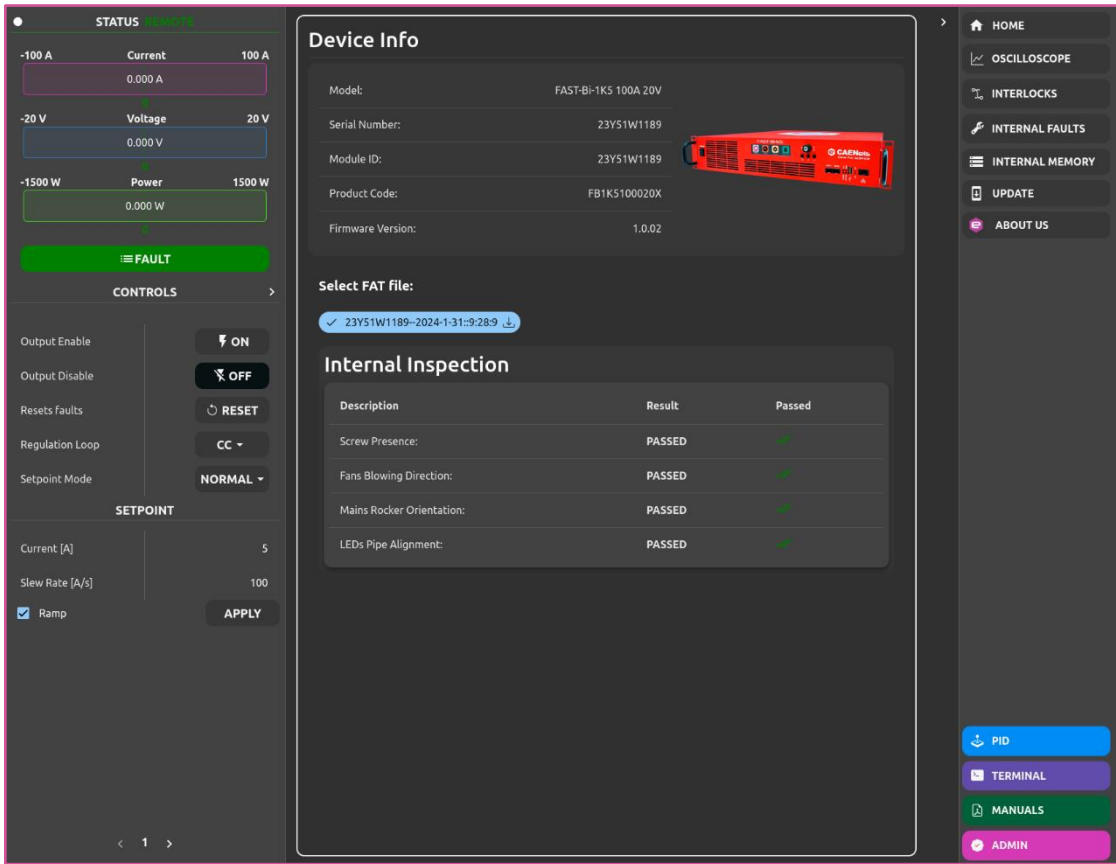

Figure 12: Home page.

2.2.2 Oscilloscope

The real-time oscilloscope is an essential tool of the PS. The main oscilloscope configurations are highlighted in **Figure 13** and are the following:

1. *Trigger toolbar*: trigger indicator (on the left) and trigger configuration (on the right);
2. *Time window* configuration;
3. *Graph toolbar*: take a snapshot, zoom with cursor, moving pan, zoom in, zoom out and autoscale (buttons from left to right respectively);
4. *Channel toolbar*: from this toolbar is possible to enable/disable a channel, enable/disable the DC component and set a gain/offset.
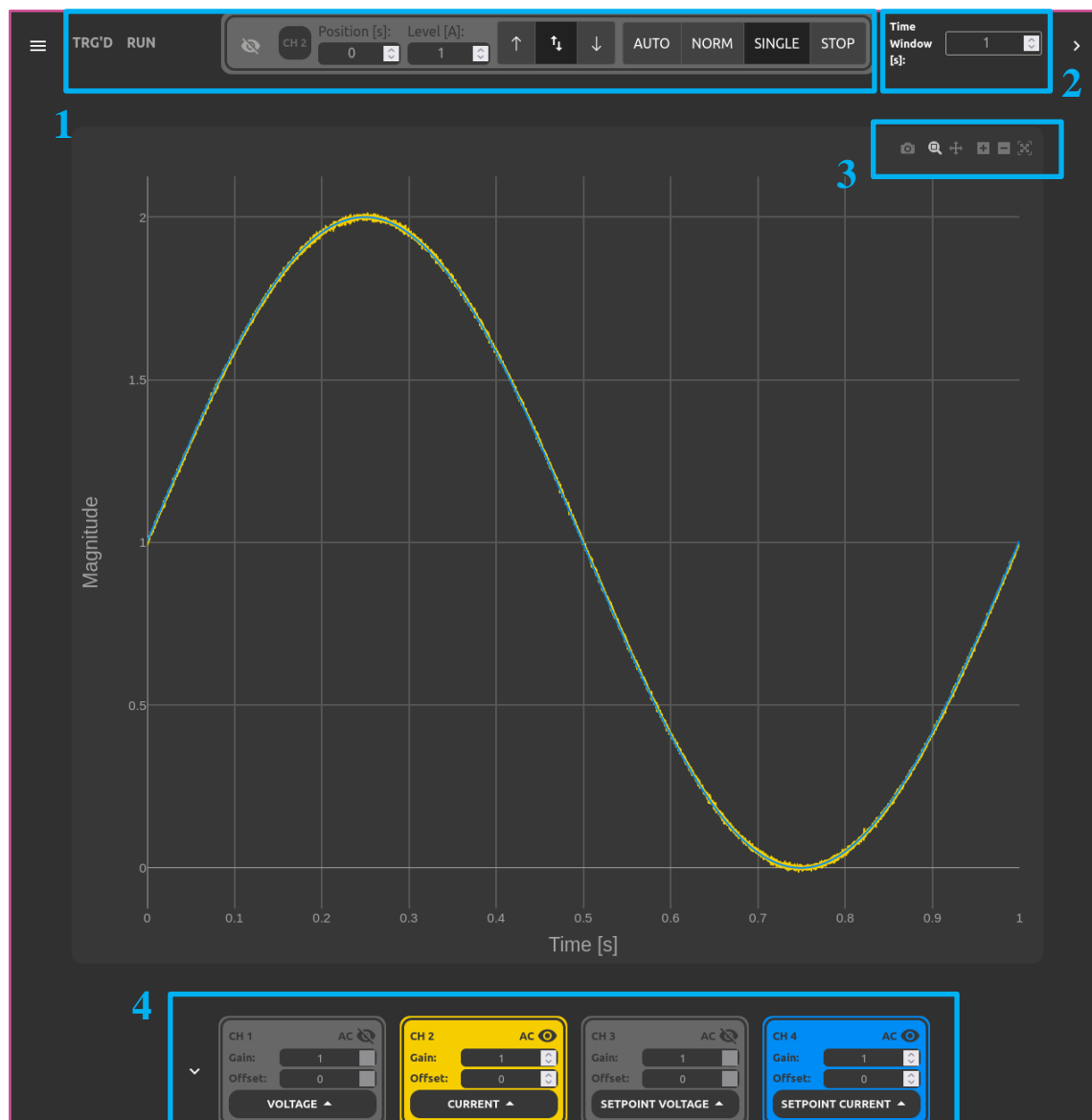
Figure 13: Oscilloscope page.

2.2.3 Interlocks

The *Interlocks page* gives access to the interlock configuration. Possible configuration are:

1. Enable/Disable;
2. Interlock name (or label);
3. Intervention time in [ms];
4. Polarity: unchecked (fault if open) or checked (fault if closed).

The External Interlock configuration are applied and saved permanently only when the *Apply&Save* button is pressed.

Figure 14: Interlocks page.

2.2.4 Internal Faults

From the *Internal faults page* the User can access the configuration of configurable internal faults, as reported in **Figure 15**.

Figure 15: Internal faults page.

2.2.5 Internal Memory

Additional advanced configurations are accessible to the User from the *Internal memory page*.

Figure 16: Internal memory page.

2.2.6 Update

Load the firmware file and click on *Install* button, as shown in **Figure 17**.
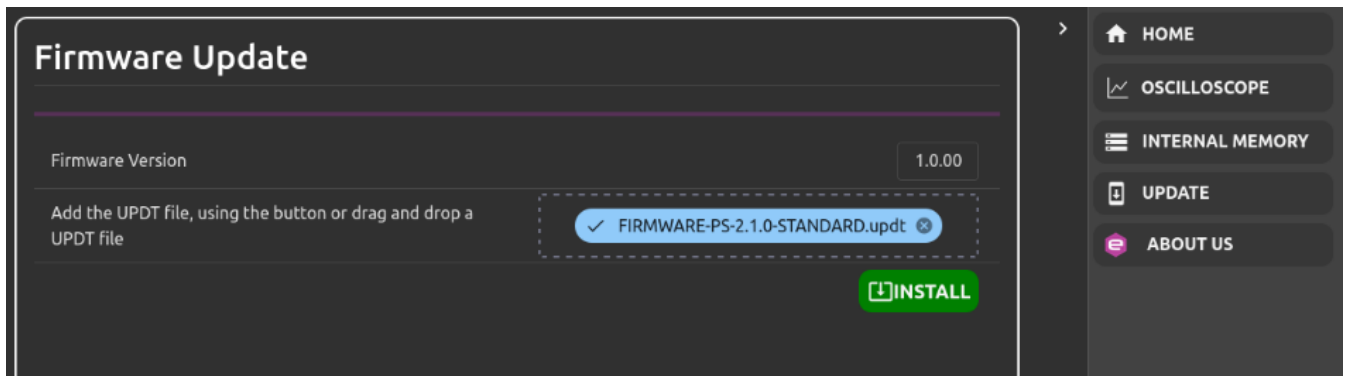

Figure 17: Upload firmware file.

<u>The firmware update procedure can take up to 5 minutes to complete</u>.

At the end of the update procedure the PS is automatically rebooted and once the reboot is completed the webpage should refresh automatically. If not, refresh the webpage manually.
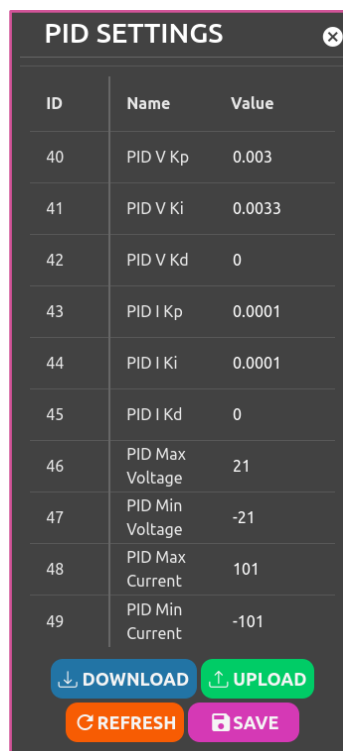
More information about the firmware update on the PS "*User's Manual*".

2.2.7 PID

By accessing the *PID page* a window will pop-up with the configurable PID settings. This window can be kept floating while operating the PS and tuning the PID.

WARNING

> ➢ **Only experienced Users should change the PID settings.**
> ➢ **Always keep the Oscilloscope in background when changing the PID parameters in order to see the actual effect of the changed PID parameter.**
> ➢ **When tuning the PID always use small (~ 1% of Full Scale) square wave signals.**

ID	Name	Value
40	PID V Kp	0.003
41	PID V Ki	0.0033
42	PID V Kd	0
43	PID I Kp	0.0001
44	PID I Ki	0.0001
45	PID I Kd	0
46	PID Max Voltage	21
47	PID Min Voltage	-21
48	PID Max Current	101
49	PID Min Current	-101

Figure 18: PID page.

2.2.8 Terminal

By clicking on the *Terminal page* a *Console* will open. From the *Console* the User can send direct TCP/IP commands (SCPI-like commands) to the PS. For the complete list of commands see the *"Commands Reference Manual"*.
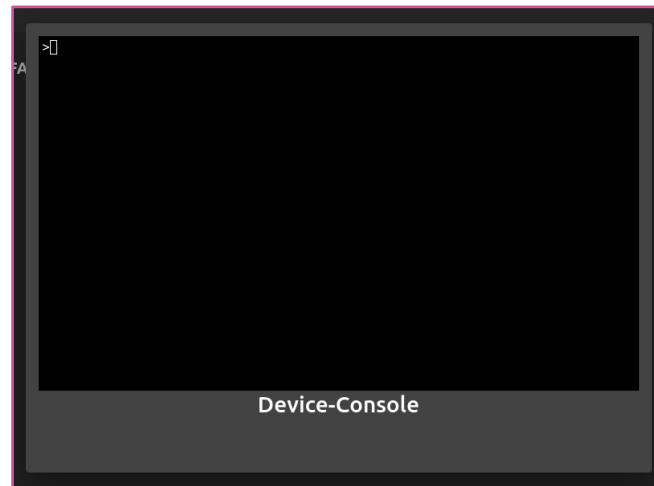

Figure 19: Terminal page.

2.2.9 Manuals

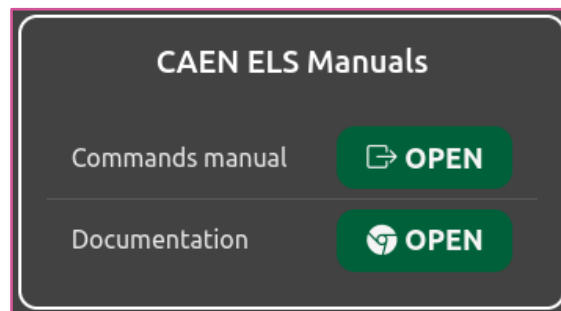From the *Manuals page* the User can access the PS manuals.

Figure 20: Manuals page.

3. Local Control

This chapter describes the local control functionalities provided by the PS Local Display and Navigation Switch and some useful information on how to use them.

The PS can work either in LOCAL mode or in REMOTE mode. The control mode (LOCAL or REMOTE) can be set on the *Configuration Page* of the local display.

3.1 Navigation Switch

The front panel Navigation Switch (reported in **Figure 21)** of the PS, in combination with the Local Display, allows the user to locally control the PS.
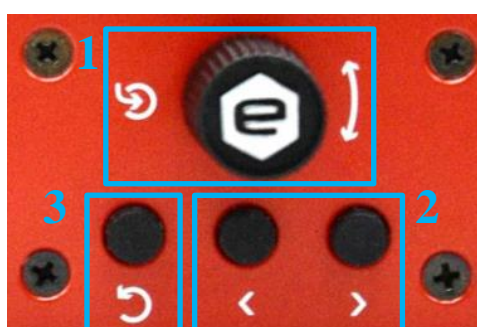

Figure 21: Navigation switch.

The Navigation Switch allows the user to perform three main actions (refer to **Figure 21**):
1. Rotary encoder with central push button (it will be referred as "Enter");
2. Left and Right arrow push buttons;
3. Back push button.

3.2 Local Display

The Local Display on the PS front panel is used in combination with the push buttons and the Navigation Switch to control and configure the PS locally. The screens and pages of the Local Display can be navigated using the push buttons, while values can be adjusted with the rotary encoder.

By default, the Local Display will be automatically turned off after 30 minutes from the last local command or from the PS power on time.

3.2.1 Power-up

The PS, upon power-up or power-cycle, will display an empty screen until the unit embedded OS is initialized.

Please note that this procedure will take approximately 25-seconds before the *Home Screen* is displayed.

3.2.2 Home Screen

The PS *Home Screen* (**Figure 22**) is the main page and contains the following information:

- PS module ID;
- output voltage readback value [V] with the yellow status square;
- output current readback value [A] with the light blue status square;
- IP address on the bottom (this is selectable);
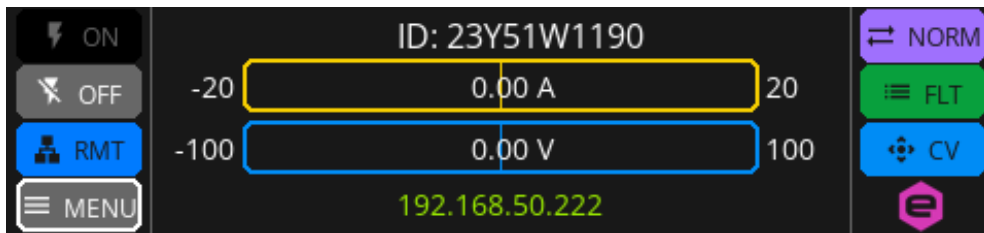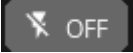- four (4) selectable icons on the left side and three (3) on the right side.

Figure 22: Home Screen

The icons on the *Home screen* can be selected using the arrows on the navigation switch and linked by pressing the "Enter" button:

- **ON**: enabled PS output;
- **OFF**: disabled PS output;
- **RMT – LCL**: displays the active control mode and provides access to Config page. *RMT (Remote)* icon is highlighted in blue and *LCL (Local)* in green);
- **MENU**: provides access to the Menu page;
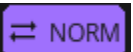- **NOR – WAV – *AIN – SFP**: displays the active setpoint mode and provides access to the Config page;
- **FLT**: displays the fault status and provide access to Fault page (*FLT* icon is highlighted in green if the fault condition is clear, or red if a fault occurs);
- **C.C. – C.V.**: displays the active regulation mode and provides access to Control page (*CV* icon is highlighted in blue and *CC* in yellow);
- **IP address**; provides access to the Network page.

*Only with FB1K5OPT001 option

3.2.3 Menu Page

The *Menu page* is reachable from the *Home Screen.*

The *Menu Page* gives access to all the local features of the PS. There are five options that can be selected as shown in **Figure 23**:

Figure 23: Menu Page

The accessible sub-pages from this page are hereafter listed (note that the selected sub-page is lightened in a lighter shade):

- **CONTROL** – *sub-page*;
- **CONFIG** – *sub-page*;
- **NETWORK**– *sub-page*;
- **FAULT** – *sub-page*;
- **INFO** – *sub-page*;

Accessing each sub-page requires highlighting the selected rectangle using the arrows on the navigation switch and pressing the "Enter" button.

3.2.4 Control Page

The *Control Page* can be accessed by selecting the corresponding rectangle from the Menu Page or by using the *C.C. – C.V.* icon on the *Home Screen*.

The *Control Page* gives access to the main settings of the PS. An example of a *Control Page* visualization is shown in **Figure 24**:
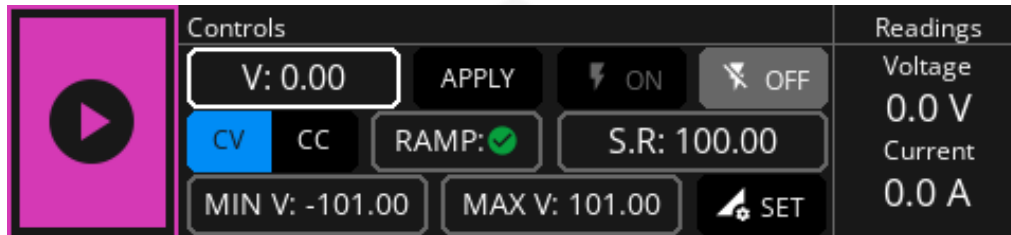

Figure 24: Control Page.

From this page it is possible to:

- turn the PS output *ON/OFF* (the selected icon is highlighted in a light gray);
- set the output Current or Voltage;
- set the regulation mode, *C.C.* or *C.V.* (*CV* icon is highlighted in blue and *CC* in yellow);
- Apply or disable the RAMP and slew rate (S.R.) (the selected icon shows a green check mark when activated);
- set minimum and maximum current or voltage limits.

To actually apply the current or voltage setpoint, press "*APPLY*" using the "Enter" push button.

Once all the settings and values are configured, press "*SET*" using the "Enter" push button.

Real-time values of output current and output voltage (readbacks) are reported on the right side.

3.2.5 Config Page

The *Config Page* can be accessed by selecting the corresponding rectangle from the Menu Page, by using the *LCL – RMT* or *NORM – WAVE – AIN – SFP* icon on the *Home Screen*.
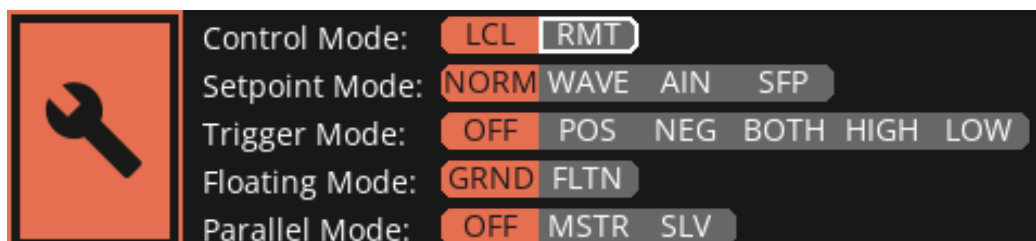An example of a *Config Page* visualization is shown in **Figure 25**:

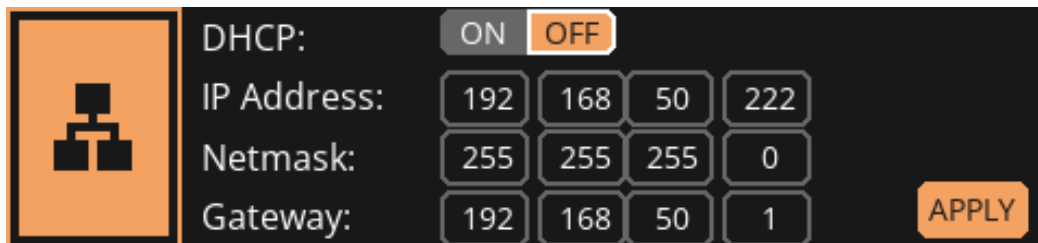**Figure 25: Config Page.**

From this page is it possible to:

- set the Control Mode: Local (*LCL*) or Remote (*RMT*);

- choose the Setpoint Mode: *Normal*, *Wave, *AIN* and *SFP*;

- set Trigger Mode*: *ON/OFF and POS – NEG – BOTH – HIGH – LOW*;

- set the Floating mode: Grounded (*GRND*) or Floating (*FLTN*);

- set the Parallel Mode: *ON/OFF* and Master (*MSTR*) or Slave (*SLV*).

*Only with FB1K5OPT001 option

3.2.6　Network Page

The *Config Page* can be accessed by selecting the corresponding rectangle from the Menu Page, or by selecting the *IP Adress* on the *Home Screen* and pressing *Enter*.
An example of a *Network Page* visualization is shown in **Figure 26**:
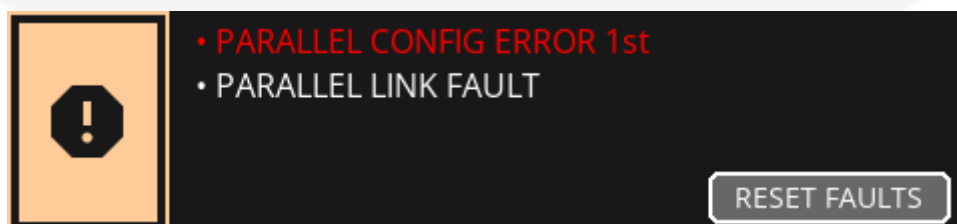

Figure 26: Network Page

This page allows to locally set the power PS IP address, the Network Mask and the Gateway. Alternatively, the user may select "DHCP ON" and the Network configuration will be automatically assigned by DHCP server (if present).

To change the Network configuration, use the Navigation Switch and complete the operation by placing the cursor on the "*Apply*" icon and by pressing "Enter". **Wait some seconds for the configuration to be applied.**

3.2.7　Fault Page

The *Fault Page* can be accessed by selecting the corresponding rectangle from the Menu Page, or by selecting the *FLT* icon on the *Home Screen*.
An example of a *Network Page* visualization is shown in **Figure 27.**

Figure 27: Fault Page.

If the PS has experienced one or more faults – e.g. interlock intervention, over-temperature, DC-Link, etc. – the *FLT* icon is highlighted in red on the *Home Screen,* and a list of faults is displayed on the *Fault Page.*

Press the "*RESET FAULT"* rectangle to resets the status register of the power supply.

3.2.8 Info Page

The *Info Page* can be accessed by selecting the corresponding rectangle from the Menu Page. An example of a *Network Page* visualization is shown in **Figure 28**:
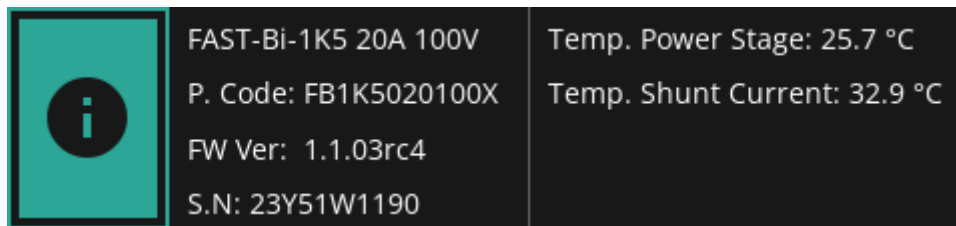

Figure 28: Info Page

This page displays the device information:

- Acronym of the PS model;
- Product Code;
- Firmware version;
- Serial Number;

Additionally, internal temperature readings are also displayed:

- Power Stage temperature;
- Shunt Current temperature.