

Easy - Driver

Compact Digital Bipolar Power Supply Series



Visual EASY-DRIVER Quick Start Guide



All Rights Reserved
© CAEN ELS s.r.l.
Rev. 1.1 – June 2016

MAGNET POWER SUPPLY SYSTEMS



 **CAEN ELS s.r.l.**
Via Vetraia, 11
55049 Viareggio (LU) – Italy
Mail: info@caenels.com
Web: www.caenels.com



Table Of Contents

1. “VISUAL EASY-DRIVER” SOFTWARE	5
1.1 OVERVIEW.....	5
1.2 CONNECTION.....	6
1.3 COMMUNICATION SETUP.....	8
1.4 HOW TO CONTROL THE EASY-DRIVER	10
1.5 EASY-DRIVER MEMORY MANAGEMENT	13
1.6 FIRMWARE UPDATE	15
1.7 TOOLS	16
1.8 DEVICE INFO.....	17
1.9 SAVE CONFIGURATION.....	17
ANNEX A	18



Document Revision	Date	Comment
1.0	December 22 nd 2015	First Release
1.1	June 11 nd 2016	Revisited all



1. “Visual EASY-DRIVER” Software

1.1 Overview

High efficiency, extreme reliability, easiness of configuration and maintenance are the key features of the EASY-DRIVER bipolar power supply series.

The *Visual EASY-DRIVER* software has been developed to setup and to control the system with a user friendly interface running on Windows Operating System. Different distributions of this software can run on Linux Operating Systems.

The cited software application allows users to:

- set and read the output current;
- read the output voltage and the status of the channel (interlocks, temperatures, DC-Link voltage, etc.);
- reset the power supply remotely;
- change module parameters - e.g. PID compensation loop constants, maximum settable current, maximum slew rate $[di/dt]$, etc.;
- update the DSP firmware.

1.2 Connection

Connect an Ethernet cable between the host computer running a Windows OS and the EASY-DRIVER power supply module in order to start communication with the channel.

Set the computer IP address on the same subnet used for the power supply. For instance, if the IP address of the EASY-DRIVER unit is 192.168.0.10 the computer's IP address must be 192.168.0.x, where **x** can be a decimal number between 1 to 244 but different from 10 (**Figure 1**).

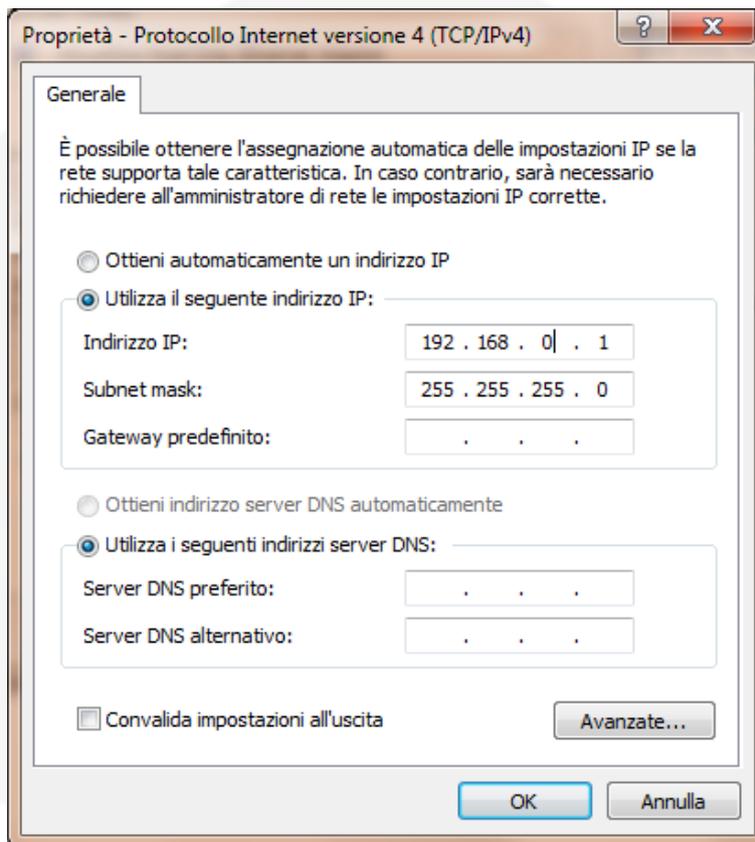


Figure 1: host computer IP address Setup

Install the Visual EASY-DRIVER software by launching the file *setup.exe*. The installer can be downloaded from the CAEN ELS website (www.caenels.com) in the corresponding product page. Follow the procedure that will lead you through the application installation on your PC. It is now possible to launch the Visual EASY-DRIVER software: the main window should now appear, as shown in **Figure 2**.

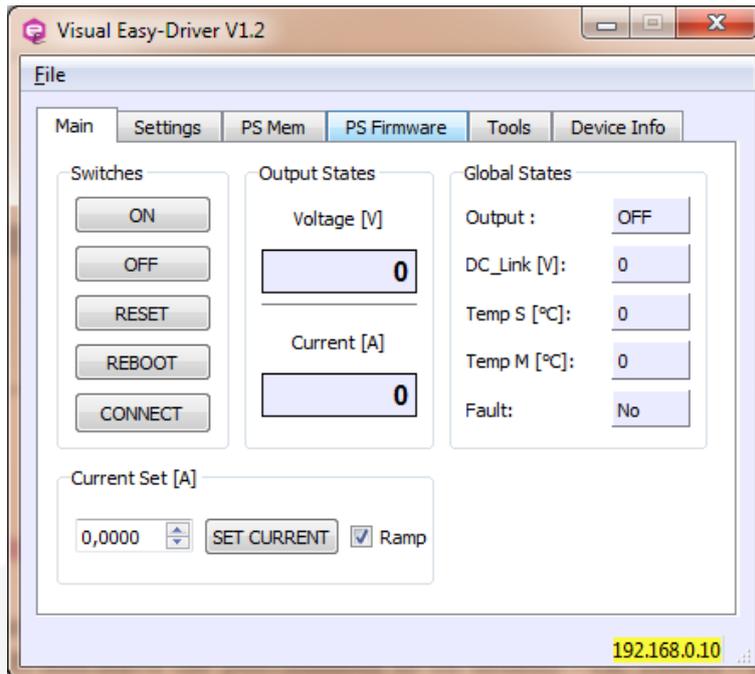


Figure 2: Visual Easy-Driver software *Main* TAB

1.3 Communication Setup

Enter the IP address of the power supply (PS) you want to control in the *Settings* TAB (**Figure 3**) and leave the port number to its default - i.e. 10001 - if this value has not been modified.

Please note that all modules are shipped with the following standard IP address:

- 192.168.0.10

It is very important, before running the IP address configuration procedure, to set the host machine – i.e. PC – address to “static” and its IP to 192.168.0.2

Standard communication port for the Ethernet device is 10001.

If the EASY-DRIVER IP address has been change, the current IP address can be retrieved by the local display after switch On the Power Supply.

In the *Setup* TAB it is possible to choose the communication rate between the computer and the power supply unit.

Default *refresh* rate (which also defines the refresh of the data displayed on the software interface) is set to 50ms, but can be reduced down to 20ms to have a more frequent read of the PS status.

The *time-out* is defined as the maximum time for the computer to wait in order to have a response from the PS: after this time interval, expressed in ms, the reading is discarded.

The *Max* and *Min Set Current* values - in [A] - are respectively the maximum and minimum current values that can be set from the Visual interface. These values can be set to 5 [A] and -5 [A] for the EASY-DRIVER 0520 power supply.

Clicking on the **Apply** button makes the inserted values active.

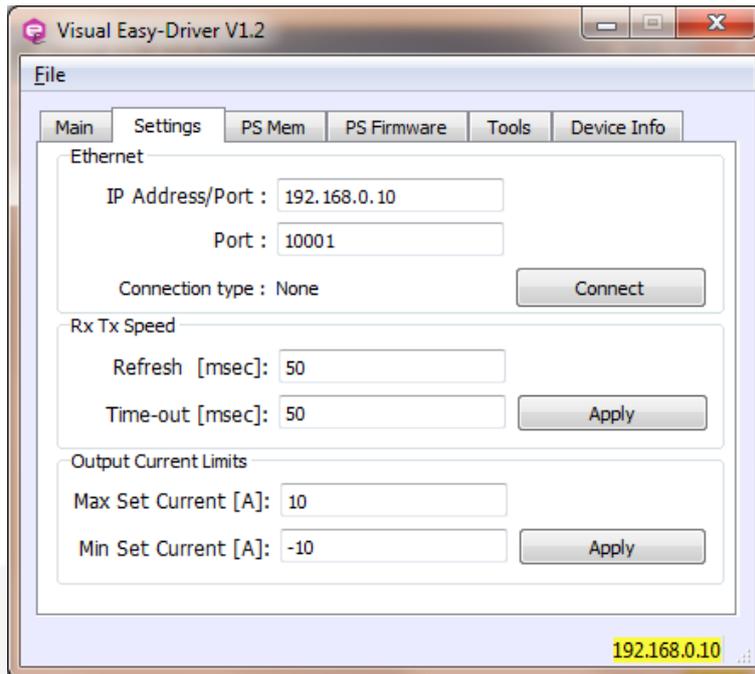


Figure 3: Visual Easy-Driver software *Settings* TAB

The **Connect** button initializes communication between the EASY-DRIVER and the PC running the software. If the host is not reachable (check the power supply IP address, computer IP subnet and the cabling) a window will report the message “Connection host refused”.

If everything is put into correct operation, the power supply identification name (contained in EEPROM cell #28) will be displayed on the Status Bar (**Figure 4**) as a confirmation that communication was established successfully.

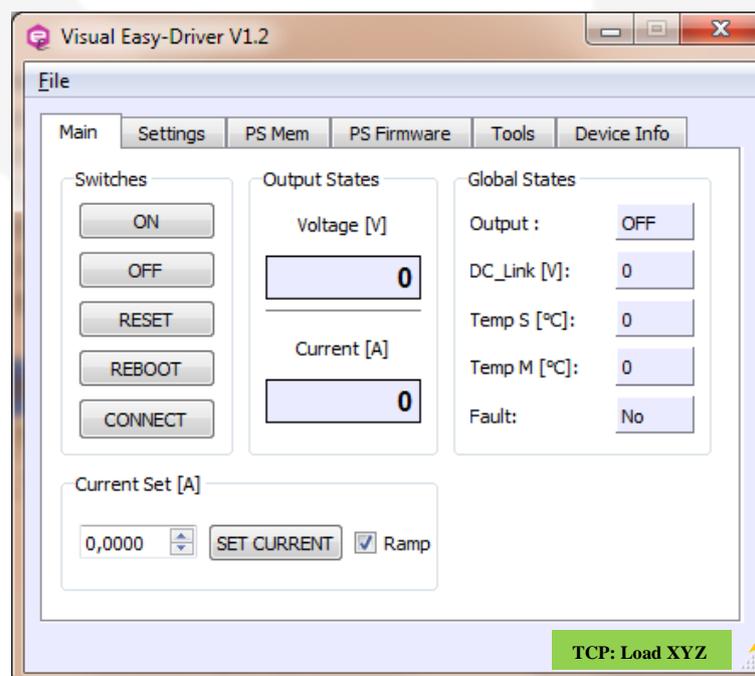


Figure 4: Visual EASY-DRIVER software - connection established

1.4 How to Control the EASY-DRIVER

When the communication with the EASY-DRIVER module has been established, it is possible to control and read its internal values and its status; this can be done from the Main TAB (**Figure 5**). In the *Switches* section:

- **ON**: enables the PWM pulses on the H-Bridge and starts current regulation (initial default to 0A);
- **OFF**: disables the PWM pulses on the H-Bridge. No current is fed to the load in this case;
- **RESET**: resets the power supply internal status register - i.e. to “No Faults” condition. The output stage is still disabled (OFF). If the fault cause has not been removed before resetting the status, the same fault condition will show up again;
- **REBOOT**: it resets the on-board digital signal processors by reloading the firmware stored in the Flash memory.
- **Disconnect**: stops the communication between the power supply and the computer running the Visual EASY-DRIVER software.

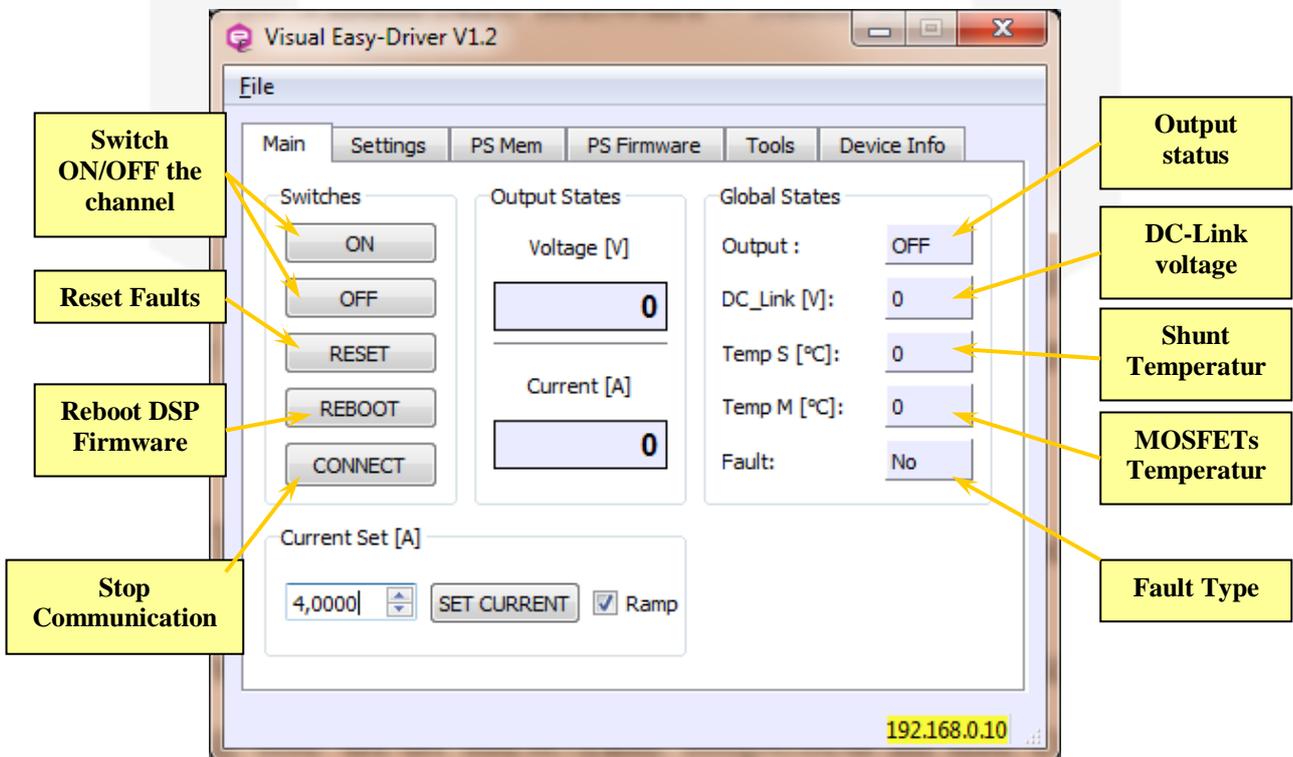


Figure 5: Visual EASY-DRIVER software - Main TAB description

In the *Current Set [A]* section:

- **Current Set [A]**: it is possible to set the desired output current value either by clicking on the arrows knob or by directly typing the number in the dedicated field;
- **SET CURRENT**: send the current value to the PS;
- **Ramp**: when active, makes the PS ramp to the current set value following the di/dt slew-rate imposed in the corresponding parameter (stored in the EEPROM). When the ramp is disabled the PS reaches the current set value as fast as possible (with its closed-loop response).

In the *Output States* section:

- **Voltage [V]**: displays the actual output voltage value in [V];
- **Current [A]**: displays the actual output current value in [A].

In the *Global States* section:

- **Output**: shows the output state of the PS channel. It is ON when the H-Bridge drives the load with the set current and OFF when there is no current at the output;
- **DC_Link [V]**: displays the DC-Link voltage value;
- **Temp S [°C]**: displays the current sensing shunt heatsink temperature in [°C];
- **Temp M [°C]**: displays the output MOSFET heatsink temperature [°C];
- **Fault**: indicates the type of fault occurred, if any. The same message is reported in the status bar and an example is shown in **Figure 6**.

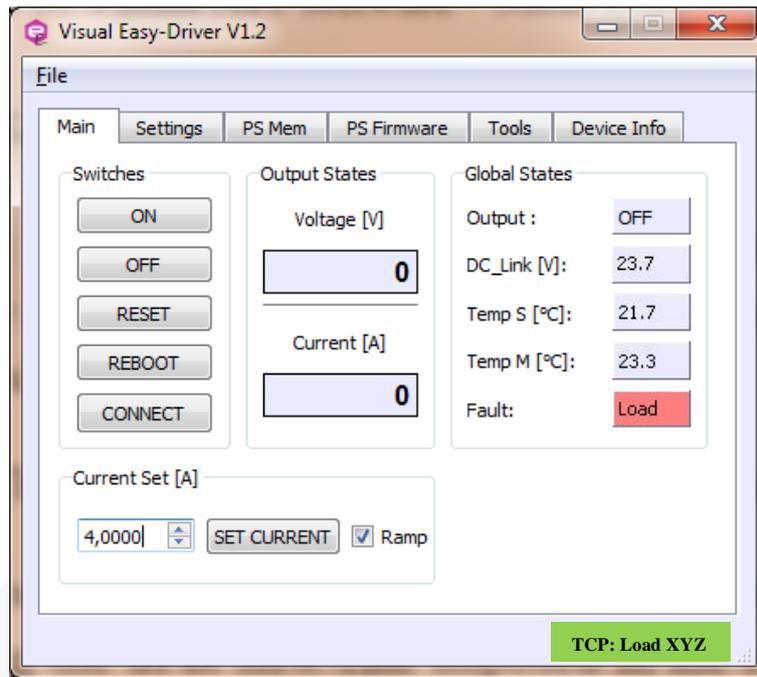


Figure 6: Visual EASY-DRIVER - external fault from the magnet/load

Possible fault conditions are shown in **Table 1**.

<i>Fault</i>	<i>Possible causes</i>
Magnet Fault	External Interlock Activation Level set to 0 and there is no jumper between interlock connector (pin 2 & 1) Or External Interlock Activation Level set to 1 and there is jumper between interlock connector (pin 2 & 1)
DC Link voltage out of range	The Bulk power supply is Fault
Shunt Over-temperature	The shunt heatsink exceeded the maximum allowable temperature (value defined in the EEPROM)
Mosfet/Shunt Over-temperature	The MOSFET heatsink or the MOSFET heatsink exceeds the maximum allowable temperature (value defined in the EEPROM)

Table 1: EASY-DRIVER possible fault conditions

1.5 EASY-DRIVER Memory Management

When the communication with the power supply has been established, it is possible to read and write the parameters stored in the internal EEPROM memory; this can be done from the *PS Mem* TAB (**Figure 7**).

These parameters define, in different ways, the behaviour of the power supply.

Some memory cells are write-protected to avoid accidental or unwanted modifications of the data that could compromise either the module hardware or the correct load current regulation.

A password is required to change the write-protected cells.

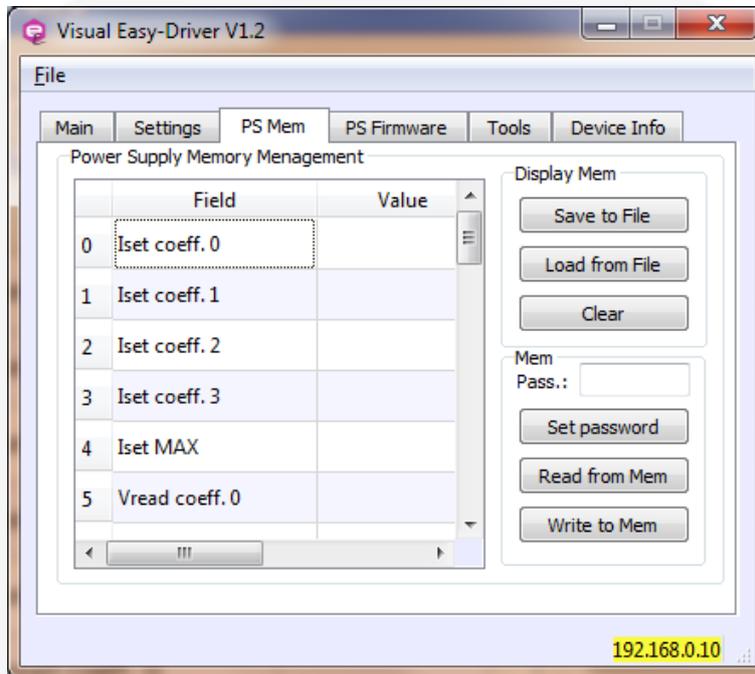


Figure 7: Visual EASY-DRIVER software - memory management

In the *Power Supply Memory Management* table:

- **Field:** indicates the description of the specific EEPROM cell;
- **Value:** numeric data or string stored in the EEPROM memory cell;

In the *Display Mem* section:

- **Save to File:** saves the Values listed in the table into a proprietary text-based file (.EP5) located on the local hard disk;
- **Load from File:** loads in the table the Values of a previous saved .EP5 file;

- **Clear:** clears the values of the table.

In the *Mem* section:

- **Pass.:** text field to type the password to "write-enable" the protected cells. Customer password is:

ps –admin

- **Set password:** "write-enables" the EEPROM cells if the Pass. content is correct;
- **Read from Mem:** reads all memory cells from the connected EASY-DRIVER module and displays Values in the table;
- **Write to Mem:** if password has been inserted and the module is then write-enabled, all the Values displayed in the table will be stored in the corresponding EEPROM cells; if no (or wrong) password was set, only the un-protected cells will be updated. No EEPROM cells are updated if there is no character written the table.

The structure of the non-volatile memory (EEPROM) is presented in Annex A.

1.6 Firmware Update

The EASY-DRIVER has two different digital signal processors (DSP): one is dedicated to communication and diagnostics while the other one to perform the digital current control loop.

By using the Visual EASY-DRIVER software it is possible to upgrade the DSP firmwares with a new release. Visual EASY-DRIVER also allows users to upgrade the Ethernet XPort device (Ethernet) mounted on the EASY-DRIVER.

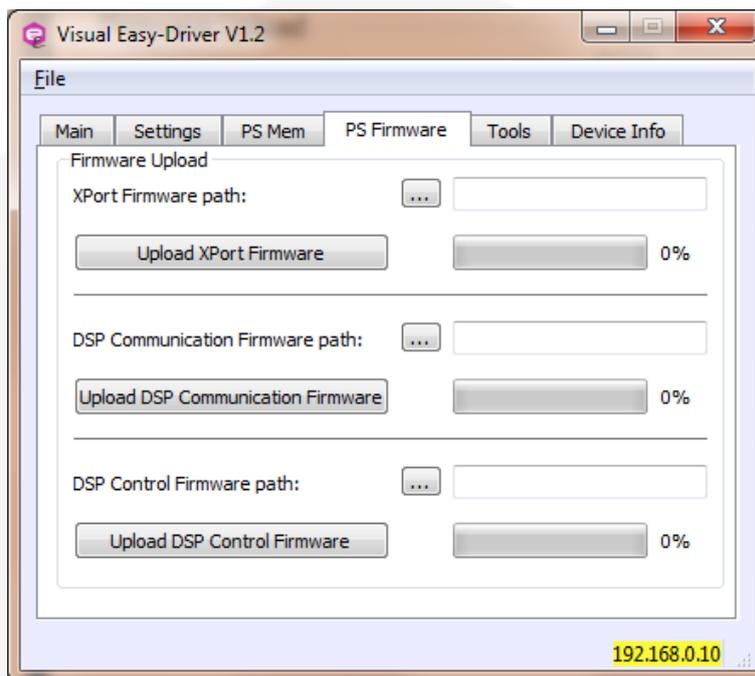


Figure 8: Visual EASY-DRIVER - firmware update

A description of the fields/tabs present on the *PS Firmware* TAB is herein listed:

- **Upload XPort Firmware:** starts to upload the firmware on the Ethernet device. A message dialog will report that the procedure has successfully completed if the process ends without errors;
- **DSP Communication Firmware path:** choose the new firmware file (with **.hex** extension) for the Communication DSP;
- **Upload DSP Communication Firmware:** starts to upload the firmware on the Communication DSP. A message dialog will report that the procedure has successfully completed if the process ends without errors;
- **DSP Control Firmware path:** choose the new firmware file (with **.hex** extension) for the Control DSP;

- **Upload DSP Control Firmware:** starts to upload the firmware on the Control DSP. A message dialog will report that the procedure has successfully completed if the process ends without errors.

1.7 Tools

When there is the need to setup a new power supply, the *Tools* TAB provides basic functionalities to setup the IP address and communication protocol. The main fields, shown in **Figure 9**, are herein listed:

- **Set the communication protocol:** sets the communication protocol with the remote client - e.g. Visual EASY-DRIVER. Click on the Apply button to change the Ethernet device configuration with the selected communication protocol;
- **Old IP Address:** type the IP address number of the power supply that has to be changed;
- **New IP Address:** type the new IP address for the power supply. Click on the Apply button to change the IP number of the Ethernet device. The Subnet Mask and the Gateway will not change.

NOTE: the subnet of the computer must be the same of the Old IP Address and New IP Address.

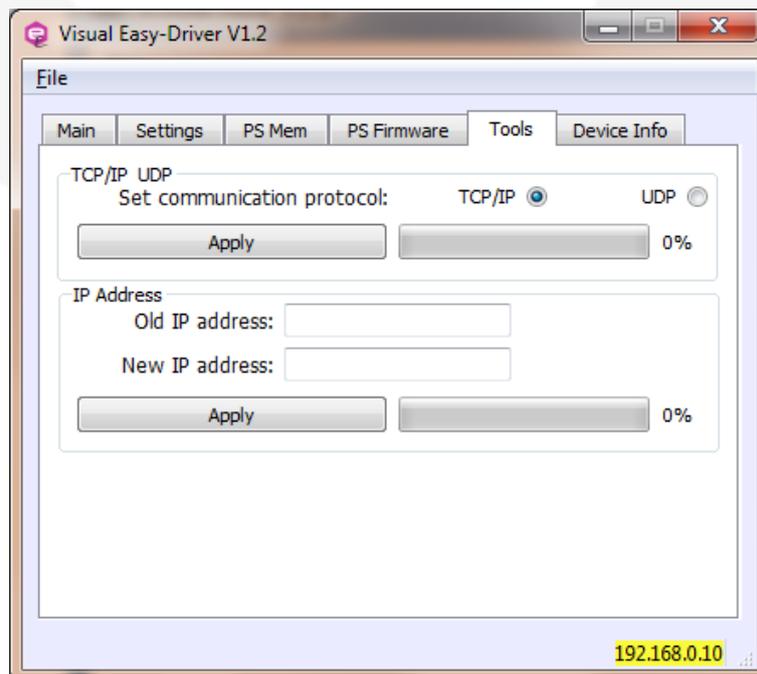


Figure 9: Visual EASY-DRIVER - Tools

1.8 Device Info

Information on the EASY-DRIVER power supply can be found under the *Device Info* TAB, shown in Figure 10. The power module MAC address and the communication DSP firmware are herein presented.

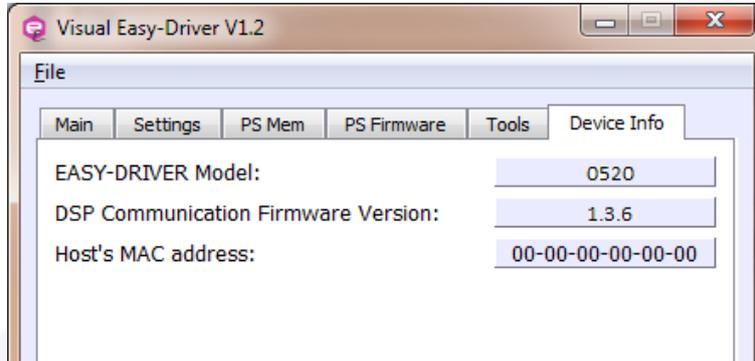


Figure 10: Visual EASY-DRIVER - Device Info

1.9 Save Configuration

In the *File* menu, the *Save* command will save the configuration of the Visual EASY-DRIVER software, i.e. the Settings parameters and the firmware file paths.

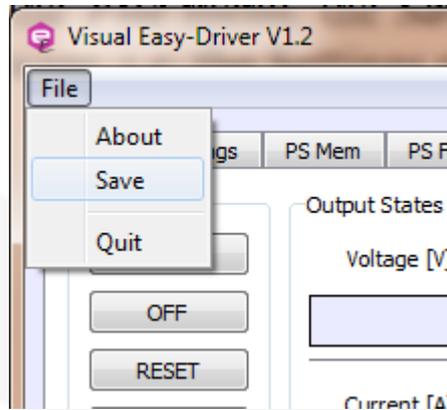


Figure 11: Visual EASY-DRIVER - File menu

After having saved the Visual EASY-DRIVER configuration, the software will start-up the following time with the saved parameters.

Annex A

Please note that:

- cells marked in **blue** are password-protected;
- cells marked in **green** are not accessible by the user (factory-reserved).

Cell #	Cell Caption	Description
0	c_0I_{set}	Zero-order current calibration coefficient
1	c_1I_{set}	1 st -order current calibration coefficient
2	c_2I_{set}	2 nd -order current calibration coefficient
3	c_3I_{set}	3 rd -order current calibration coefficient
4	I_{max}	Maximum settable current set-point
5	c_0V_{read}	Zero-order voltage calibration coefficient
6	c_1V_{read}	1 st -order voltage calibration coefficient
7	c_2V_{read}	2 nd -order voltage calibration coefficient
8	c_3V_{read}	3 rd -order voltage calibration coefficient
9	c_0DC_{Link}	Zero-order DC-link calibration coefficient
10	c_1DC_{Link}	1 st -order DC-link calibration coefficient
11	c_2DC_{Link}	2 nd -order DC-link calibration coefficient
12	c_3DC_{Link}	3 rd -order DC-link calibration coefficient
13	K_P - proportional constant	PID regulator proportional gain
14	K_I - integral constant	PID regulator integrative gain
15	K_D - derivative constant	PID regulator derivative gain
18	Newton-Raphson Iterations	Number of iterations for inverse calibration
19		<i>reserved</i>
20	Max MOSFET Temperature	Maximum MOSFET heatsink temperature
21	Max SHUNT Temperature	Maximum shunt resistor temperature
22	Serial Number	Module serial number
23	Undervoltage Protection	Under-voltage protection threshold
24 ... 25		<i>reserved</i>
26	Calibration Date	Date of last calibration
27	Identification	Module identification name
28		<i>reserved</i>
29	External Interlock Activation Level	"1": Fault when INTK shorted "0": Fault when INTK shorted
30	Slew Rate [A/s]	Module slew rate value

Table 2: EEPROM "Value" section