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DC Power Supplies
AL3000 series
User's manual

Release xx, November 2011

Firmware version: Vxx
DSP version: Vxx

This manual is integrant and essential to the product. Read carefully and completely the instructions and the warnings herein, they will provide important information regarding safety of operation and maintenance.

This equipment must be used only for the purpose for which has been designed. Any other utilization is improper and therefore potentially dangerous. The manufacturer is not responsible for possible damages caused by improper, incorrect and unreasonable utilization of this equipment.

Any intervention on the equipment, that would cause a change in the structure or in the cycle of operation, must be performed or authorized by the technical department of Zenone Elettronica.

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Attention

This manual provides all the necessary information regarding the mode of operation of AL3000 and AL3000R power supplies series. For the correct use of this specific equipment it is recommended to refer to the characteristics data sheet of the power supply, which is an integral part of this manual.

(Regenerative)[1] bidirectional Power Supply AL 3000R series

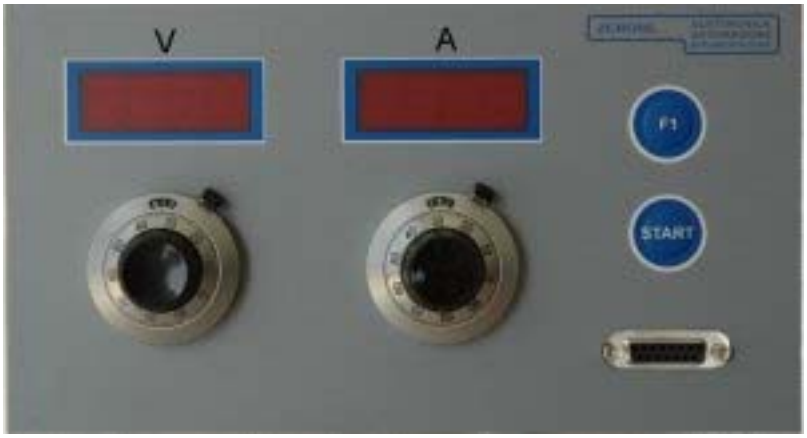
The power supplies AL3000 and AL3000R series are fast AC/DC static converters with double conversion and IGBT technology under microprocessor control. They supply the load with voltage or current at the value that has been set regardless of the inpedance[2] value and the mains fluctuations, they can also draw in energy from the load and put it on the mains net. They are particularly suited to users with high dynamic needs.
The information about voltage and current supplied is shown by means of 7 segments displays.
They can be controlled by external signals.
They are equipped with RS485 serial interface for diagnostics and parameters setting.

1) R model
2) in current control mode

Product presentation

According to the output power, the equipment can be assembled in:
table rack
recessed rack
metal cabinet

Control interface

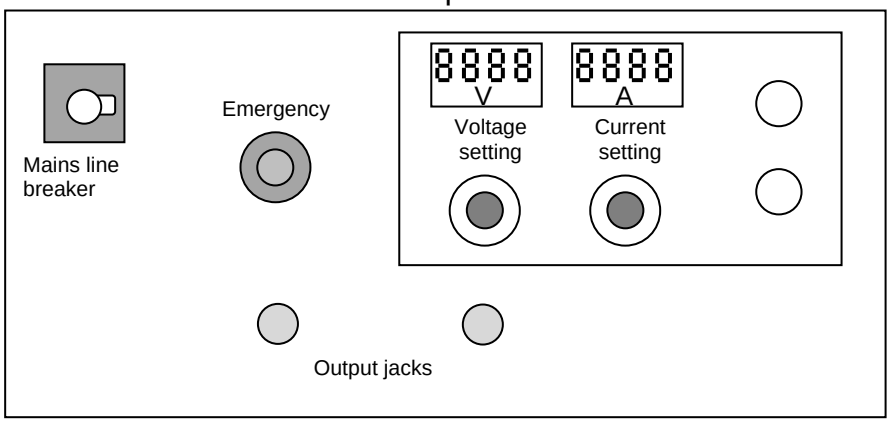


commands and connections

voltage setting command and visualization:	on front panel
current setting command and visualization:	on front panel
logical command for output-on:	on front panel
selection local/remote commands:	from serial interface
line breaker:	on front panel
RS485 serial interface:	on front panel
mains supply:	from cable on the back side (rack version) on terminal blocks inside the cabinet (heavy duty cabinet version)
outputs:	on front panel jacks or bars (rack version) on terminal blocks inside the cabinet (metal cabinet version)

emergency input:	on front panel
auxiliary inputs/outputs	on front panel

Front panel



Introduction

Thank you for choosing our product. We invite you to read this manual thoroughly because here you can find the technical characteristics and all the necessary information for using this equipment correctly.
The information contained in this document is subject to change without notice and it is expected to be updated exclusively for the product for which is provided.
ZENONE ELETTRONICA is not liable for technical error, printing error or omissions that might be encountered in this manual; neither is responsible for accidental or consequential damages caused by the use of its product.
This guide provides specific information related only to the mentioned products.

The software herein described is provided with end user license, unless otherwise specified.
This technical document version voids and replaces all previous versions.
The products cited in this document could be trademarks and/or registered mark of respective manufactures.

Summary

1. Preface

1.1 How to use and understand the instructions provided in this manual

In this manual have been used conventional keys to simplify and standardize the utilization and the control of our generators.
In this manual you can find also functions that might not be present on the equipment you have purchased; nevertheless proper information will tell you about eventual limitations.
This solution has been chosen for clarity and to better evaluate the functional characteristics available on all our products.

1.2 Safety instructions

The following notes or graphic symbols list a series of instructions essential for the correct use of the equipments. Such information could be found, in graphic form, also on the equipment or used in the manual to focus the attention on the specific issue. It is highly recommended to read such instructions carefully before equipment installation.


Do not install the equipment in environments with temperatures different from those allowed

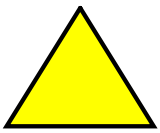

Do not expose the equipment to direct sun light

Do not pour any kind of liquids on the Equipment.
In case of fire, use foam, CO2 or dry chemicals fire-extinguishers

Attention

The lightning symbol within a triangle is a warning symbol that indicates the presence of “dangerous voltages” inside the equipment with risk of electric shock.

The exclamation mark within a triangle is a caution symbol that indicates the presence of important additional information for the correct use of the equipment.



The empty triangle it is a caution symbol that indicates a danger of equipment damage if improperly used.

The text that follows this symbol gives information, recommendations or other particular instructions for the correct operation of the equipment.

The text that follows this symbol gives information, recommendations or other particular instructions in order to avoid danger and/or injury to personnel.

A proper disposal of the shipment packing is recommended.

1.3 Compliance declaration

CE **MANUFACTURER DECLARATION OF CONFORMITY**

The Zenone Elettronica Power Supplies :

AL3000 and AL3000R

are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to:

- **Electromagnetic Compatibility, Directive 2004/108/EEC**

- EN 61000-6-1 - CEI EN 61000-6-1 (2° ed. 2007-10)Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments "

- EN 61000-6-3 - CEI EN 61000-6-3 (2° ed. 2007-11)
  Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments

  EN 61326-1 :2006
  Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

- **Low Voltage Equipment Directive (2006/95/EEC) and EN61010-1 ("Safety of Electrical Measuring Apparatus")**

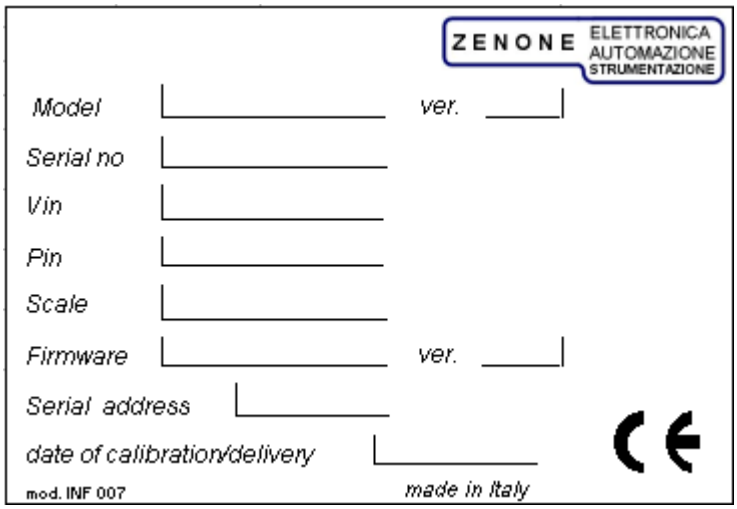
Mirabella 01-03-2011

Zenone Eletrronica S.r.l.

Luigi Zenone

1.4 Identification label

Each equipment is identified by the following label.
We invite you to consider the data shown in it as essential for product traceability, and to communicate them for eventual request for assistance.



2. Preliminary operations

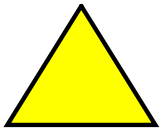
2.1 Working environment

The Power Supply is designed for indoor use.

 + 5 °C °  + 40 °C

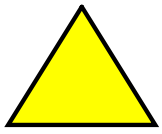
Place the device on a suitable support or on a plane surface for good stability. Be sure that proper ventilation is allowed and no objects obstruct the ventilation openings.

2.2 Precautions



Operate the equipment at its rated mains voltage, on earthed outlet only. Fasten suitable cables or bars of adequate section on the output bolts, calculated on the bases of equipment functional characteristics.

WARNING: Power connections can generate high temperature spots, that could cause burnings.



WARNING: All standard power supplies are delivered with output **FLOATING**, not connected to any potential (unless otherwise specified); at the moment of installation **MUST BE CONNECTED TO GND OR TO ANY OTHER POTENTIAL**. Maximum allowed voltage on the output bolts, when not connected to earth, is 300VAC. If necessary connect eventual protection devices (differential relay, isolation control relay, etc.)

WARNING : This equipment puts energy into the mains net, if power to the equipment is supplied from an external source (batteries, independent generator, etc.), make sure to have adequate protection elements complying with local actual regulations, and eventual authorizations from the energy supplier agency.

2.3 Emergency circuit

The AL3000 series is equipped with an emergency circuit that provides to opening the main breaker

The opening condition are:

- Pressing the emergency button
- Opening of doors
- Main power failure
- Opening external circuit

The emergency circuit is always powered, even when the main breaker is off

2.4 Switching the equipment on

Connect the power supply to the power mains, *it is recommended to follow the instructions given on the equipment (or in the attached sheet) regarding voltage, frequency and earth connection,* then turn on the power switch, that could be located on the back panel or by the cabinet side depending on the type of equipment.
In some models the power-on command can be part of an external power supply frame.
In some cases the integrated console, keyboard/display, can be connected to the cabinet by means of an external cable.
At system power-on an self-diagnostic routine tests the most important equipment functionalities and detects eventual faults **(the information are visible with the proper software)**.
In case of failure or malfunctions, we must be informed in advance before sending the equipment to our laboratories.

2.5 Regeneration(only AL3000R models)

The AL3000R power supply series are bidirectional devices, as a matter of fact they can either supply energy to the load or absorb energy from it; the energy is taken from or is put on the power mains. This function is accomplished through an extra converter called REGENERATOR.
In fact it will adjust the DC voltage on an intermediate bus taking it or putting it back into the network, providing also to put in phase the absorption and the regeneration so to guaranty a PF >0.95 at Pn.
According to the model, the regenerator block can be either internal to the equipment or external in a separate unit. The regenerator block, in normal mains network condition, does not need any setting or adjusting because it works autonomously controlling the BUS voltage, in some special cases it might be necessary to touch up some control parameters using the software PWMutil. The power that the equipment is capable to draw from the load is the same that is capable to supply. The regenerator has its own electronics with microprocessor that provides the energy management and the monitoring of all alarms and system parameters.

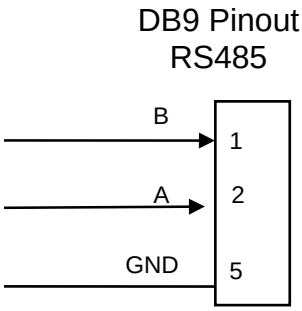
2.6 Regenerator error conditions

Under error conditions, the regenerator stops the operation and signals the failure by display on the cards . The cause of the fault can be visualized by error code or means of the PWMutil program connecting it to the appropriate serial port on the regenerator.

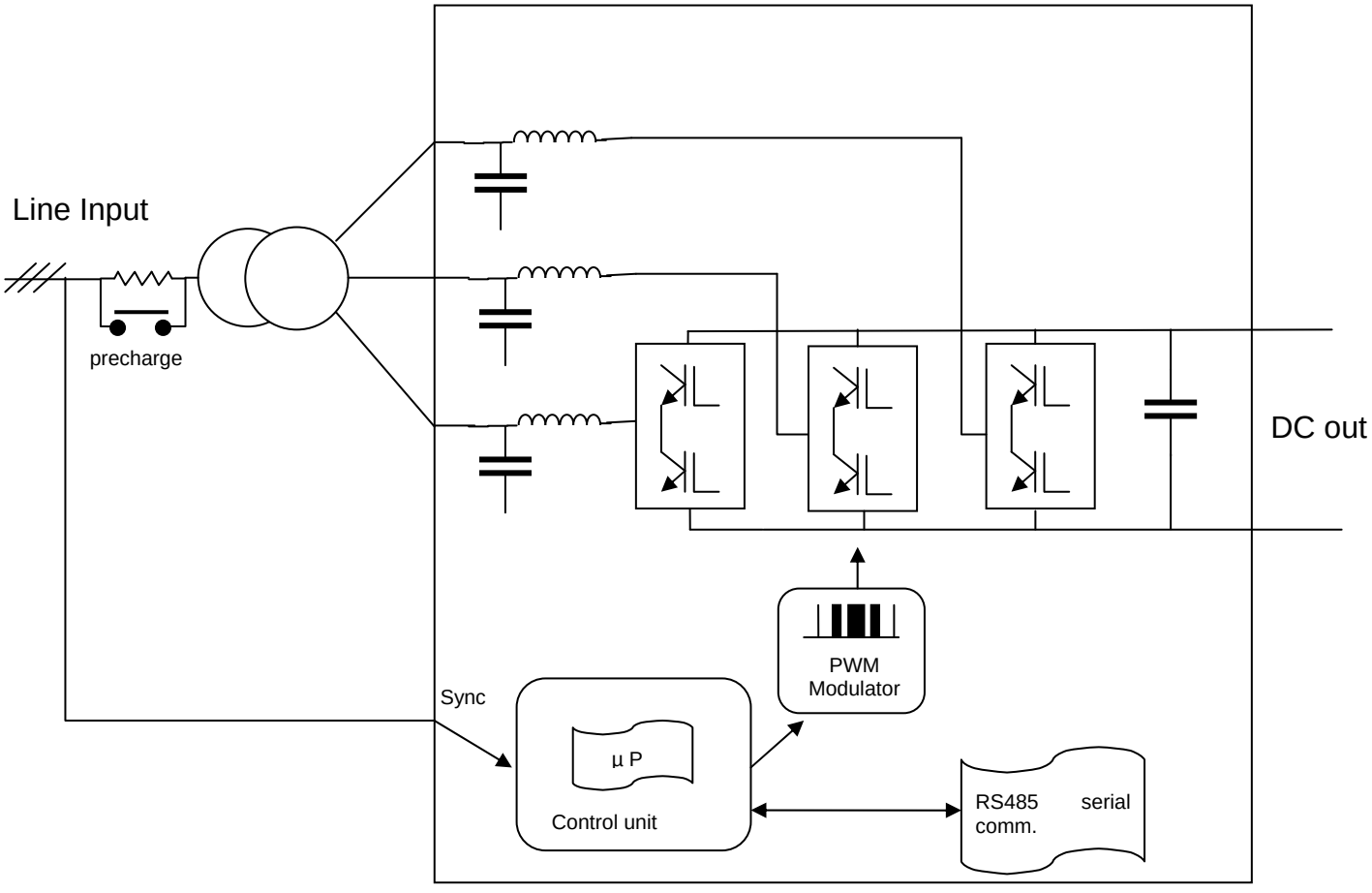
signal	Type error	Remedy
1	DC overvoltage	
2	DC undervoltage	
3	Over temperature	
4	IGBT Error (FAULT)	
5	Precharge error	
6	Current limitat	
7	NTC error	
8	CKS error	
9	AC overvoltage	
A	AC undervoltage	
B	HI frequency	
C	LOW frequency	
D	ZC missing	
E	Feedback error	
0	Slave T.OUT	

2.7 Regenerator serial port

The regenerator is equipped with standard RS485 serial port communication with rate fixed at 9600

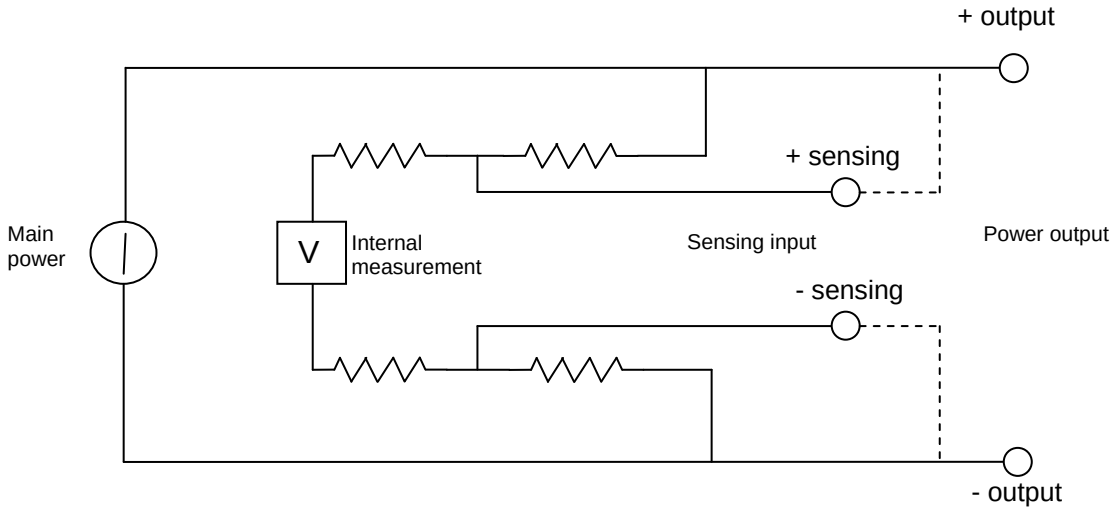


2.8 Regenerator functional diagram (only AL3000R models)



3. Inputs / Auxiliary outputs

3.1 sensing



Sensing circuit diagram

The sensing circuit has internally resistors that link the senses to the main output in order to prevent the AL3000 to go to its maximal voltage when the sense line is broken or accidentally removed.

The resistors are sized that If the sense is broken or removed, the output voltage result:

(Set output voltage X 1.1) circa

If the sensing is reversed the AL3000 will not started and can break the sense circuit.

3.2 Inputs

The AL 3000 power supplies are equipped with some inputs for the remote control.

function	Description
Emergency	NC contact with no voltage, its opening causes the immediate disengagement of the line breaker disconnecting the equipment from the mains
on – off	NO contact with no voltage, allows to start the power supply from a remote command
Voltage command	Analog input 0 ÷ 10V, remote command for the output voltage 0 ÷ 100%
Current command	Analog input 0 ÷ 10V, remote command for the output current 0 ÷ 100%

3.3 Outputs

The AL 3000 power supplies are equipped with some outputs for remote signaling.

function	description
Run/stop	PNP digital output, signaling for output on/off Max 30V 0,5A
Alarm	PNP digital output, fault signaling Max 30V 0,5A

3.4 Communication port

The power supply is equipped with a RS484 communication port which allows to connect a PC for some parameters setting and for the alarm register reading.
The Baud Rate is the transfer speed and is set at 9600.

4. Power output

4.1 Command type selection

The selection of the command type:

- Front panel
- analog or digital inputs
- serial port

can be done via serial link by means of "AL Manager" software.

4.2 Starting the output of power

After the preliminary operations, connecting the equipment to the mains and to an eventual load, have been done it's possible to turn on the power supply acting on the main switch.

Note: the main switch will not activate if the emergency circuit is open or the emergency push-button is pressed.

Once the equipment is turned on it's possible to start the output of power in following ways:

- With local command; acting on the on-off push-button.
- With remote command; activating the proper input.
- With command from serial port; entering the appropriate string.

Under these conditions the power supply will take immediately the voltage and current values set.

4.3 Setting the voltage and current values

The setting of voltage and current output can be done:

- With local command; by means of the potentiometers on the front panel
- With remote command; by means of analog signal 0 ÷ 10V
- With command from serial port; by means of appropriate strings

Note: some particular settings are possible only by means of command from serial port

4.4 Setting the simulated resistance

The power supply can simulate a resistance in the output such that given a set voltage V:
The output voltage is dynamically reduced by the value R (*set*) x I (*circulating*) in case of power output, is dynamically increased by the value R (*set*) x I (*circulating*) in case of absorption.

The resistance setting is expressed in OHM with respect to the maximum value and has a 1mOHM resolution. It can be done through the analog input (if selected) or through a serial string.
If resistance is selected on analog input, is possible to set the maximum value corresponding at 10V by software "GESMD"

Note: with simulated resistance and some types of reactive loads instabilities might be triggered.

4.5 Maximum power limitation

The power supply can work with constant power operation. To use this function first adjust voltage and current limits within which you want to work, then set the value of maximum power output.
In these conditions when the load will require more power than that set, the voltage will be automatically decreased so that the $P\ (out) \leq P\ (set)$. In the case of regeneration the voltage is increased.

The setting of power is expressed in W with respect to the value of the specification sheet and has a resolution of 1W. It can be done through analog input (if selected) or through serial string.

4.5.1 Ramps up and down

Ramps up and down allow a "sweet" start of the output voltage avoiding overshoot.
Ramps can be set at "0" or from 100mS up to 10S.
Ramps have effect only during the transition OFF-ON.
The setting of ramps can be done through serial interface.

4.5.2 Separate control of the current limits (supply / absorption)

You can independently set the maximum limits of positive and negative current. In this way the power supply will follow the current limitation set by the potentiometer or other input up to the maximum limit set for this polarity, for any other value over the limit the current will be cut to the limit.
This function is used to set profiles of current asymmetrical between supply and absorption.
The two parameters are settable by serial link.

4.6 Visualization of values entered

In stand-by it's possible to visualize on the displays the voltage and current values simply pressing the "F1" push-button

"F1" pressed = visualization of voltage and current entered
"F1" released = off

4.7 Visualization of measurements

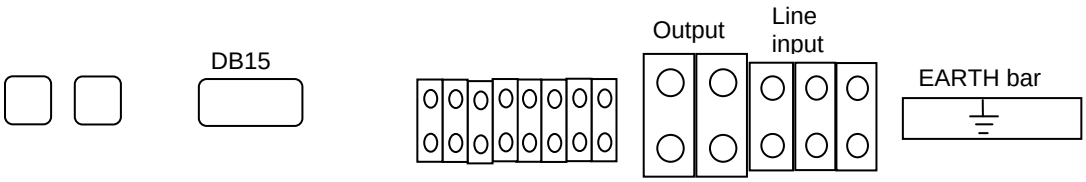
While the output is on the power supply shows on the displays the voltage and current outputs.
Pressing "F1" it's possible to visualize voltage and current setting.

5. Maintenance instructions

- Check periodically the air vents, clean them or change the filter;
- Check the fans efficiency.
- Check periodically the bolts of the connections between the power outputs and the external circuit under test.

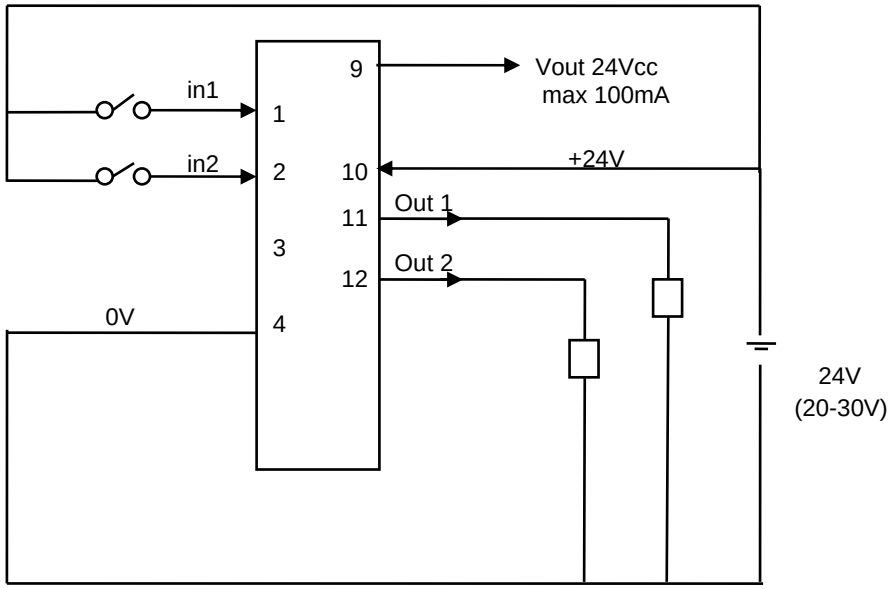
6. External connections

6.1 MAIN connections



6.2 DB15 I/O connections

DB15 Pin Out
I/O section



Max current sink from each input: 4mA@24Vdc	Max current for each output: 500mA

I/O section

The I/O section of the interface connector is made of:

- 2 Inputs “PNP” type at 24V (Pin 1 and 2)
- 2 outputs “PNP” type at 24V (Pin 11 and 12)
- 1 24V supply output limited at 100 mA max
- 2 Pins assigned for a 24V supply (4=GND e 10=VCC).

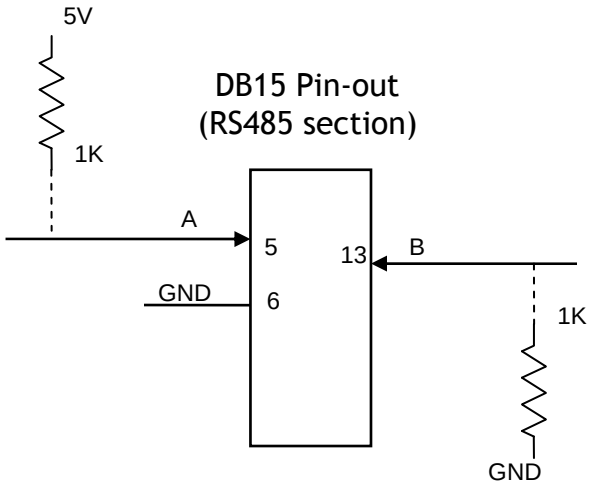
The inputs have the following function:

- Input 1: Allows to START the output supply
- Input 2: Not used
- Input “Emergency”: normally closed to the common of 24V. When opened causes the disengagement of the line breaker.

The outputs have the following function:

- Output 1: Active when the power output is on.
- Output 2: Active in case of fault.

6.3 DB15 RS485 connection

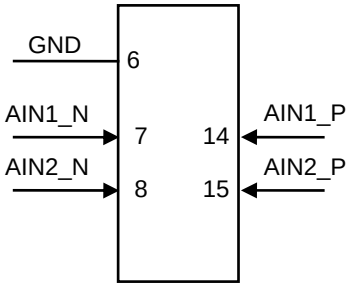


RS485 section

The RS485 section of the interface connector is made up of pin “A” and “B” of the RS485 interface and of a Ground pin. For a proper functioning of the serial communication it’s suggested to insert in a point of the line two resistance of 1K ohm connected as in the diagram.

6.4 DB15 analog connections

DB15 Pin-out
(Analog section)



ANALOG section

The Analog section of the interface connector is made of pin:

- AIN1_P and AIN1_N of the Analog input 1 (Pin 14 and 7)
- AIN2_P and AIN2_N of the Analog input 2 (Pin 15 and 8)
- Reference ground GND (Pin 6)

They are two balanced inputs that can take a maximum voltage of +/- 10V with respect to GND.
Their function, when enabled by appropriate command via RS485, is to set the Voltage (Input 1) and the Current (Input 2).

7. Error and faults signals

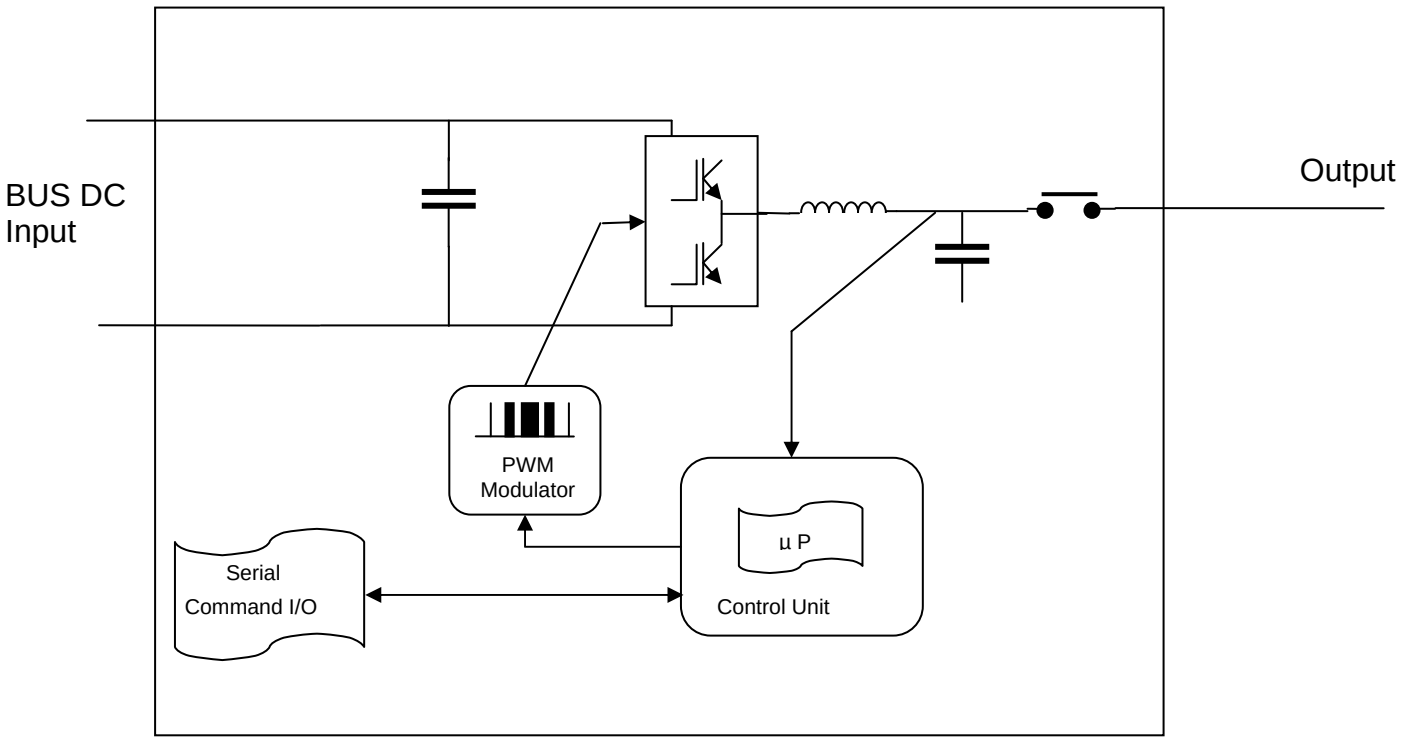
The converters are equipped with self-diagnosis routine, in case of anomalous event they stop the power output and show an error message.

Signal	Cause	Remedy
DSP X FAIL	Communication error between the central processor and the DSP shown by nr. X	Shut off and turn on the equipment; if the error remains contact the assistance
FAIL XX	Generic error	See the display on cards or connect a PC to the equipment and by means of the software “PWMutil” check the table below

signal	Type error	Remedy
1	DC overvoltage	Check the mains voltage, the presence of all three phases and that the regenerator works properly.
2	DC undervoltage	Check the mains voltage, the presence of all three phases and that the regenerator works properly.
3	Over temperature	Shut off the equipment and wait a few minutes. If the phenomenon repeats check the air vents and the operation of the fans.
4	IGBT Error (FAULT)	Contact the assistance
5	Precharge error	Check the precharge relay.
6	Current limitat	Check the load or the parameters settings.
7	NTC error	Contact the assistance.
8	CKS error	
9		
A		
B		
C		
D		
E	Feedback error	
0	Slave T.OUT	

If the fault remains, contact the assistance.

8. Converter diagram



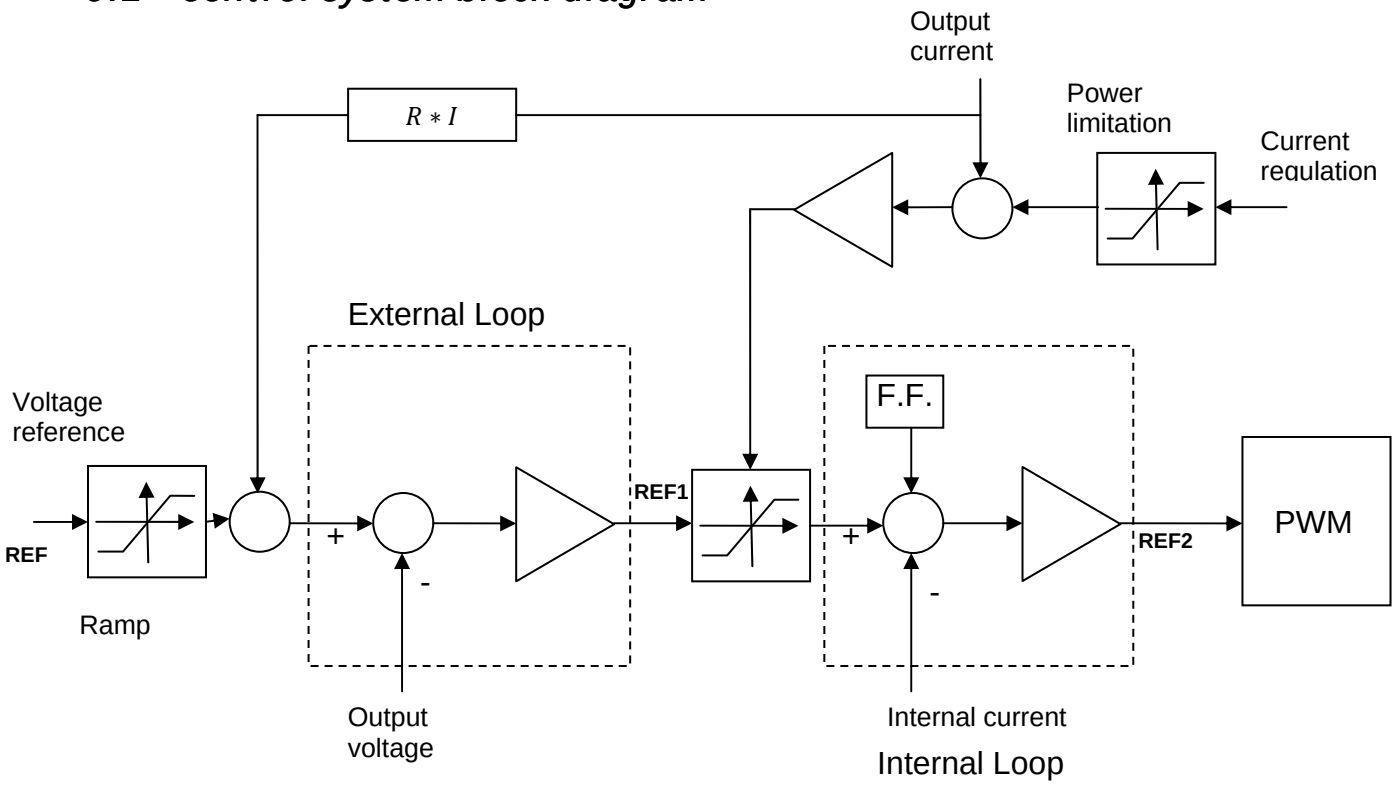
Functional diagram
Power supply/load section

9. Control system

The power supply is equipped with a sophisticated digital control system, which has to keep the voltage and/or the current output constant regardless of load change and mains variations.
The regulation is based on two PID algorithms in sequence and named:
“Internal” with feedback from internal current,
“External” with feedback from the output voltage.

The following figure shows the principle of operation

9.1 Control system block diagram



The control loops are pre-adjusted in production to achieve a good compromise between speed and stability for most loads, in some cases it is necessary to modify some parameters for the following reasons:

- Oscillations due to a load too reactive
- To enhance the generator dynamic performance
- To adapt the generator to the load

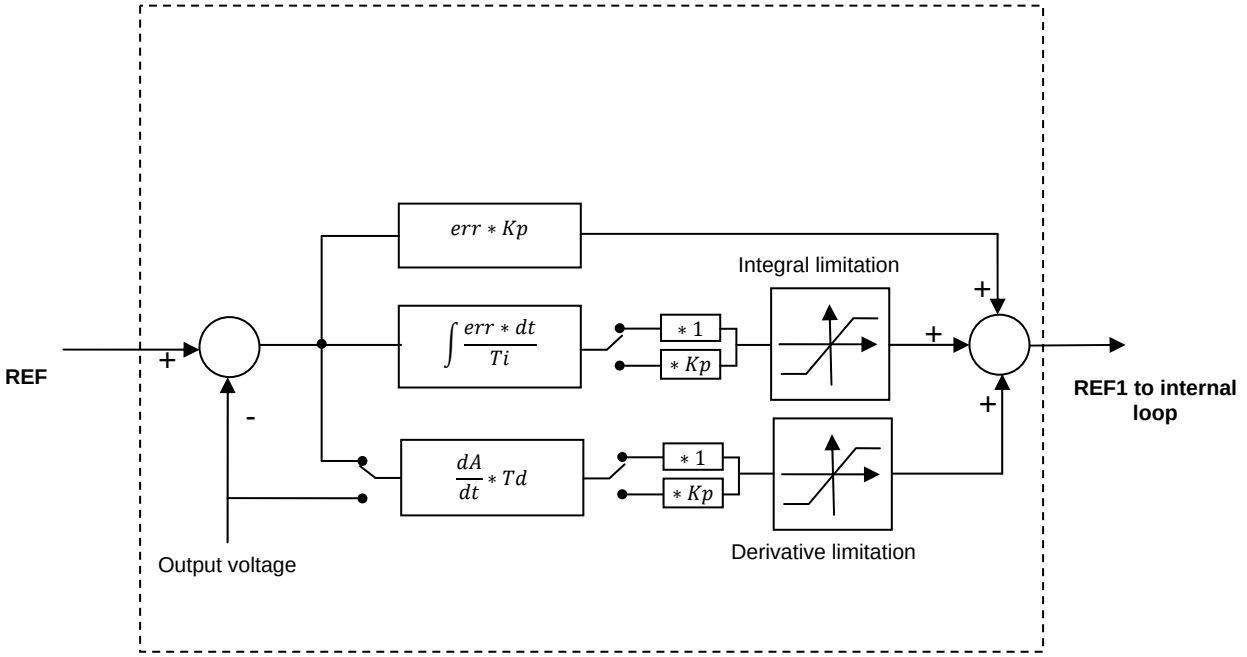
9.2 Control system description

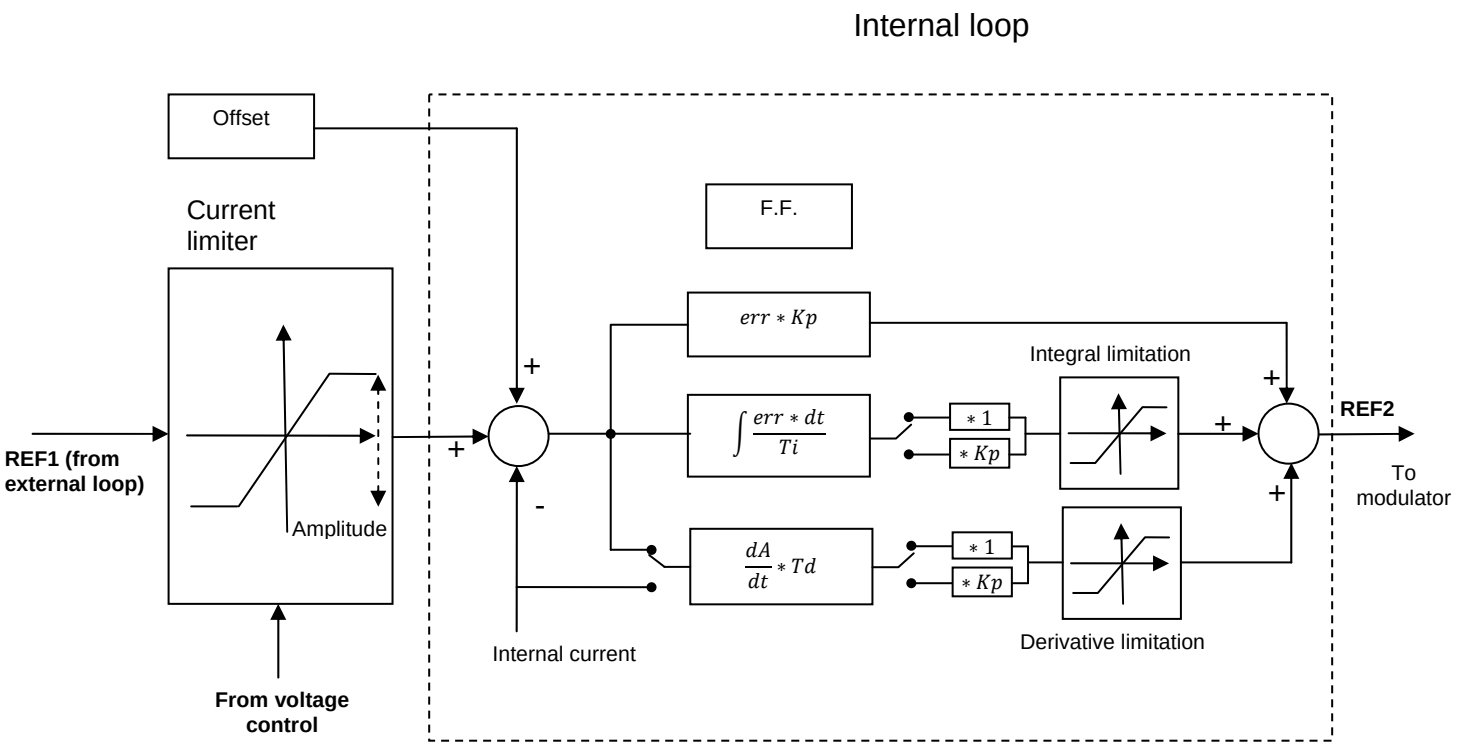
The control system is based on two PID loops in sequence, named “Internal” and “External”.

The internal loop is the fastest and regulates the current in the load. It takes input the external loop reference properly adapted by the current regulation.

The external loop regulates the output voltage, reacts more slowly and provides the value of current to the internal loop. It takes at the input the main reference and the feedback comes from the output voltage of the power supply.

External loop





9.3 Parameters definition and function

Kp: **range 0 ÷ 10000**
It's the proportional gain of the regulation loop (it causes the output to change according to the input error)

Ti: **range *dt* ÷ 32000µS; 0 = integral disabled**
It's the integration time of the regulation loop in microseconds, can be applied directly or multiplied by the parameter ***Kp*** (causes the output to change with a speed proportional to the error, sets the regulation point canceling out the offset).

Td: **range *dt* ÷ 32000µS; 0 = derivative disabled**
It's the derivative time of the regulation loop in microseconds, can be applied directly or multiplied by the parameter ***Kp*** (causes the output to change proportionally to the rate of change of the input, reduces the system response time).

dt **machine cycle time not changeable.**

Positive integral limitation: range 0 ÷ 100%
It's the maximum value the variable integral can take

Negative integral limitation: range 0 ÷ 100%
It's the minimum value the variable integral can take

Positive derivative limitation: **range 0 ÷ 100%**
It's the maximum value the variable derivative can take

Negative derivative limitation: **range 0 ÷ 100%**
It's the minimum value the variable derivative can take

F.F. Feed forward **range 0 ÷ 20**
It's the anticipation value on the current output, is used to speed the voltage recovery during the load variations.

9.4 Fine-tuning procedure for the control system

Note: To change the control parameters it's necessary to have a PC connected to the serial port of the console and the software program "PWMutil". (Look at paragraph "PWMutil software")

The following paragraph provides only a guide for the fine tuning of the PID regulation loops since in many cases a unique rule it's not applicable and regulations are made on the bases of personal experience.

Note: Eventual parameters modifications must be done by specialized personnel only because these modifications could cause malfunctions and/or generator damages.

Note: Before making any change to the regulation parameters it's advisable to take note of the existing parameters so to restore the initial setup.

In most cases, in particular when the equipment must be adapted to the load, it's sufficient to make slight changes to some parameters following simple rules:

In case of sever capacitive load, lower the Kp coefficients and increase the integration time Ti.

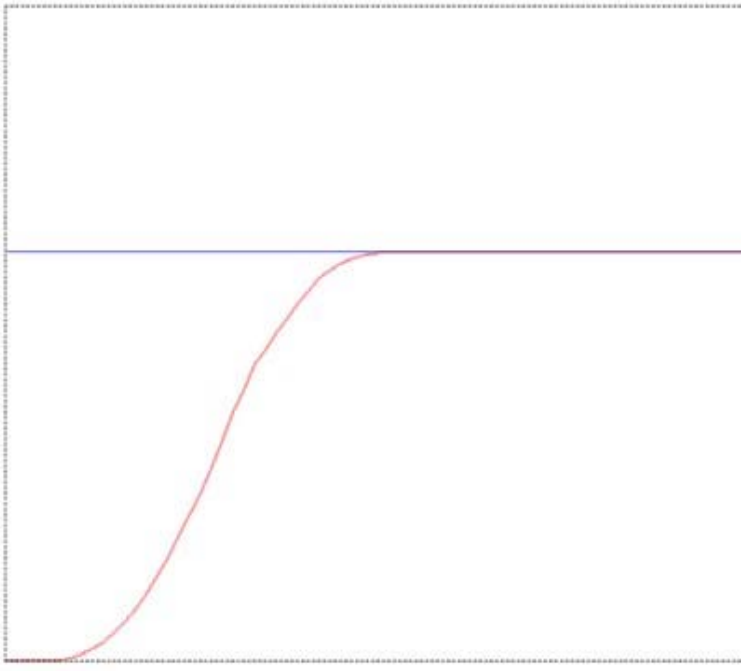
In case of sever inductive load, increase the Kp coefficients and lower the integration time Ti.

9.5 Technique for fine tuning the loops

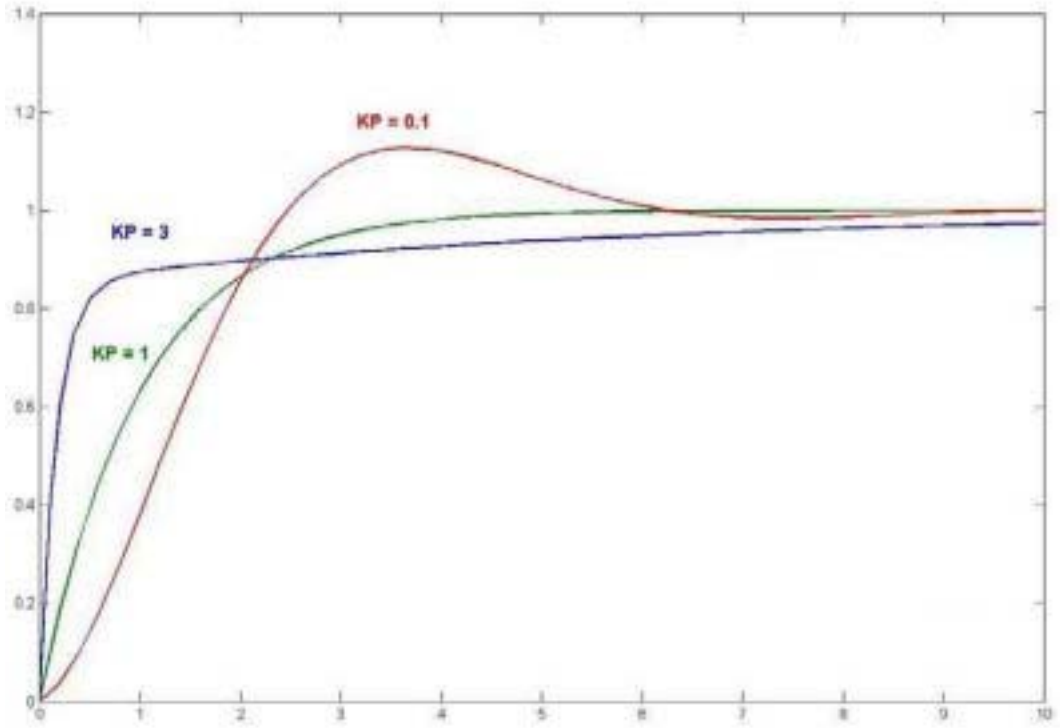
The fine tuning of the PID loops must be done in two phases, first the internal one and then the external.

In order to fine tune and verify the dynamic performances of the generator, it's better to set the references with an external generator connected to the proper input, using a square waveform with the following parameters:
Frequency > 0 < 50Hz
Amplitude 0 ÷ V <5V
or have an external dynamic load

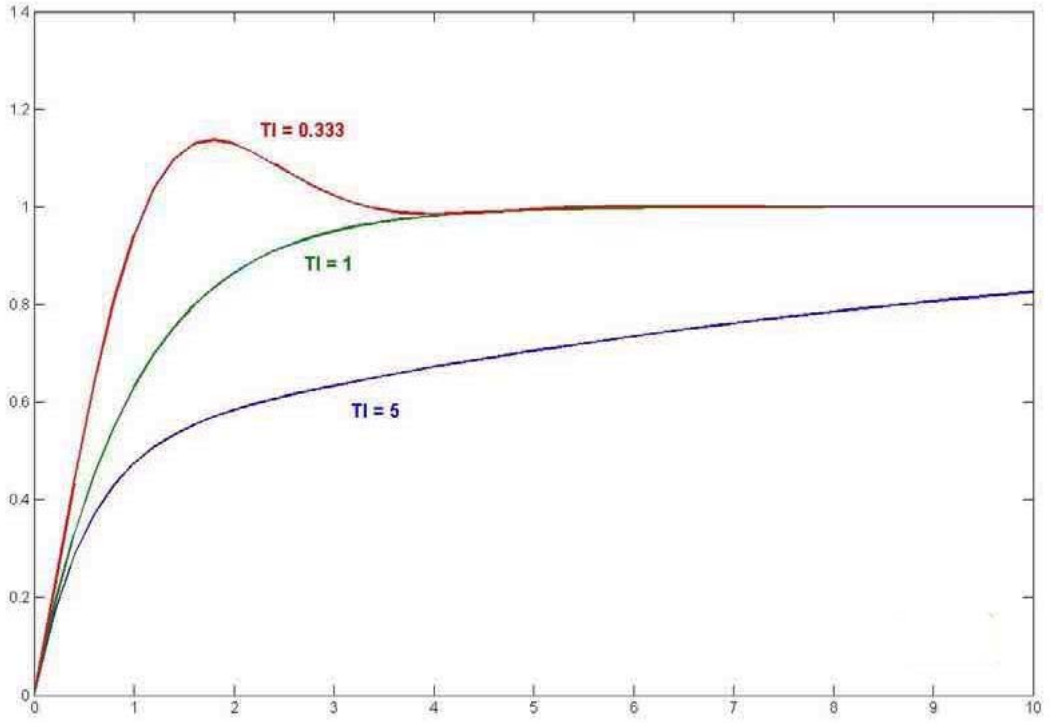
Under these conditions freeze the external loop and adjust the parameters *Kp, Ti* and *Td* of the internal loop to get maximum performance.
Once the internal loop has been fine tuned, the parameters *Kp, Ti* and *Td* of the external loop can be adjusted so to optimize the global performance.



Ideal system response to a step function

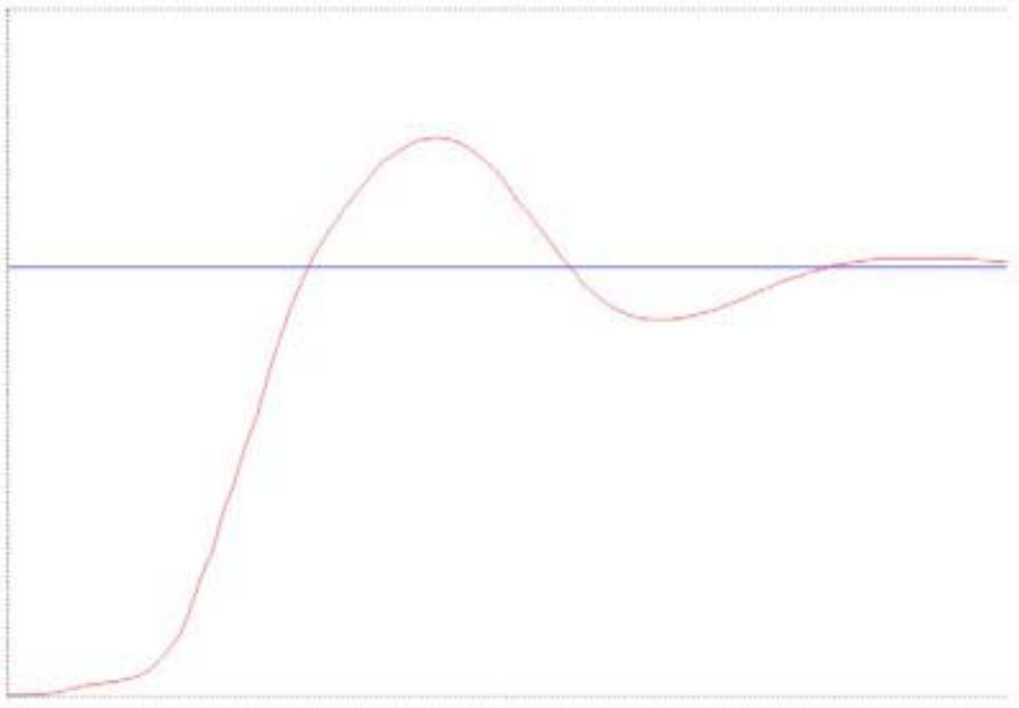


Step function response varying Kp with Ti constant



Step function response varying Ti with Kp constant

Step function response with Kp too high



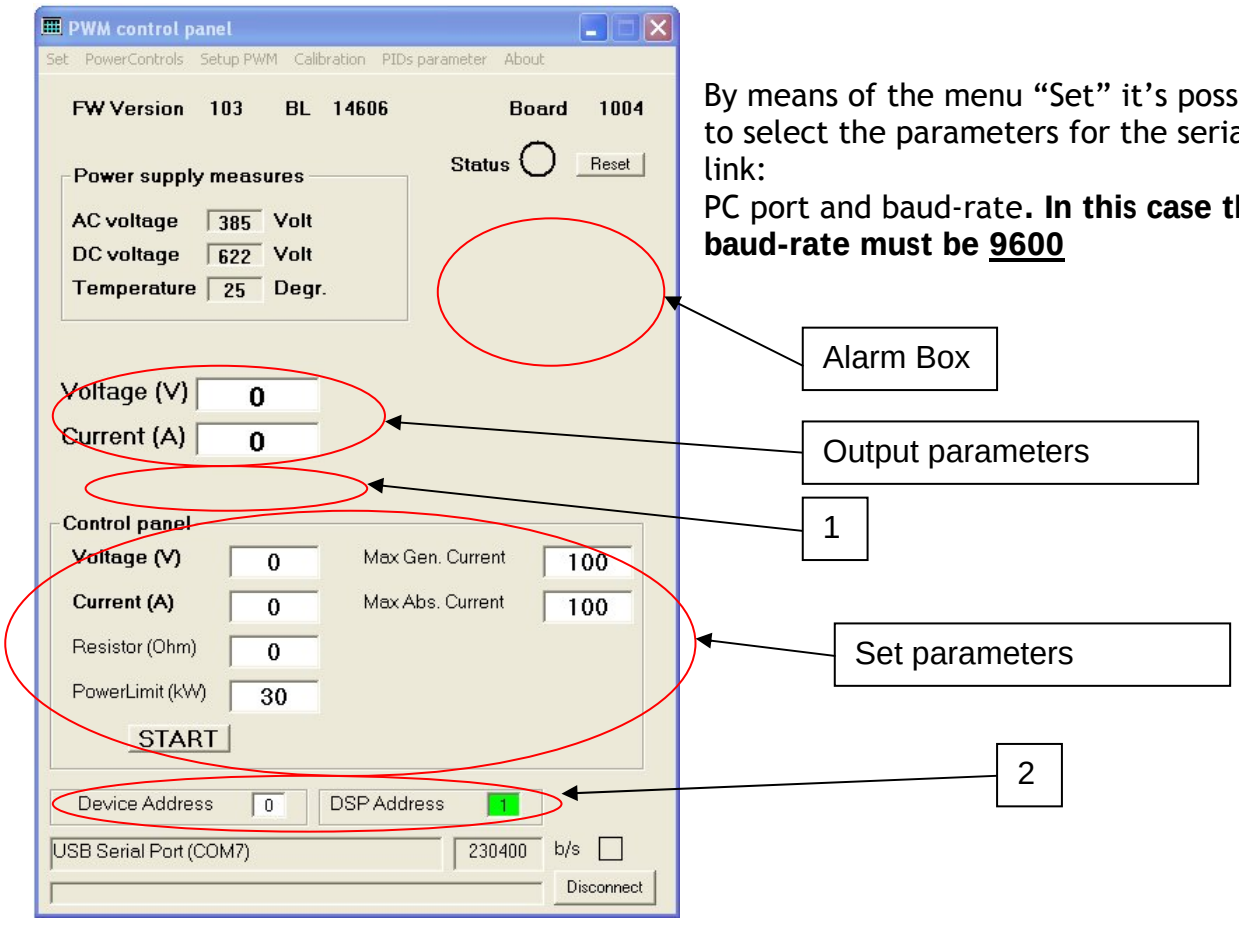
Step function response with Kp and Ti too small

10. Software PWMutil

The "PWMutil" software is compatible with WINDOWS XP systems and allows to set up some important parameters of the power supply; it must be installed on a suitable PC and executed.
Such software is designed to set up the parameters of different equipment types we produce, therefore it's possible that are displayed some parameters that have no function for this specific power supply.

10.1 Connection to a PC

The equipment must be connected to the PC trough the serial port of the console by means of the specific cable.
After the connection has been done and the program PWMutil is executed, the following mask will appear:



By means of the menu "Set" it's possible to select the parameters for the serial link:
PC port and baud-rate**. In this case the baud-rate must be <u>9600</u>**

The PWMutil can work in two ways:

- directly on modulation board (ZEL1004)
- through digital card (ZEL0901)

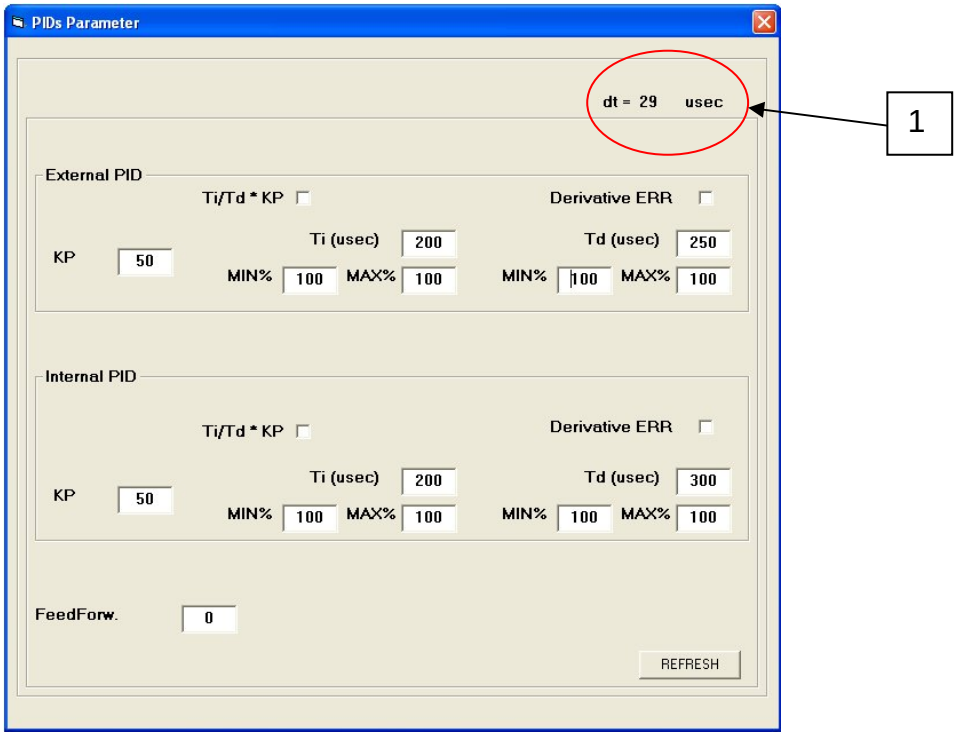
10.2 Connection through digital card

Enter the following parameters in position "2":

- "Device Address": serial address of the power supply
- "DSP Address": serial address of the power module (**if more power modules are present: 1 for module 1, 2 for module 2, etc..; in case of one module only, enter 1)**

Once the parameters have been set-up as shown above, push the button "Connect" to start the connection.
In this situation the mask will appear as shown above and it's possible:

- display the machine state with the readings of Output voltage, Output current, AC mains voltage, DC BUS voltage, temperature of heat sink and the state of the alarms. With the RESET button it's possible to reset some stored alarms.
- In quadrant 1 appear the box "Enabe control panel", if checked is possible to set parameter in the appropriate boxes. **This if the power supply is in off state (this function excludes all other controls front panel, analog input, ecc)**
- By means of the button "PIDs parameter" to step into the next mask where the PWM parameters are shown and could eventually be changed.



The sampling timing “dt” is shown at point “1”.
In order to change any parameter just overwrite it and press ENTER on the keyboard.
The button “REFRESH” provides an over-reading of the parameters stored in the memory module.

Warning: in case of more power modules, the regulation parameters must be the same for each module.

11. AL Manager software

The “AL Manager” software allows the total control of the power supplies AL2000M and AL2000BX series.
AL Manager software can handle up to 32 power supplies AL2000 series.

11.1 Software installation

The “AL Manager” software is compatible with Windows XP and is supplied in a compressed package.
For the installation just click over the proper icon and accept the license agreement terms.
The “AL Manager” program is supplied with free license for the ZENONE ELETTRONICA equipments users and its disclosure it’s forbidden.

Note: ZENONE ELETTRONICA disclaims any liability for incompatibilities or conflicts with other software and operating systems.

12. Communication protocol VXX

Communication protocol

It's possible to communicate with the device (send commands and get replies) by means of the RS485 serial interface, according to a half-duplex communication protocol.
The settings of the communication port is:

Device address:	from 1 to 32	(assigned with appropriate software)
Baud-rate:	9600 b/s	
Number of bits:	8	
Stop bit:	1	
Parity:	None	

Each command and each reply are preceded by a start (STX) and the address (IND) of the device we intend to communicate with, followed by a stop (ETX) and a checksum (CKSUM) for the data correctness verification.

STX	IND	Command or reply	ETX	CKSUM

STX = Start character, Hexadecimal value 0x02
IND = Device address, added to the hexadecimal value 0x80
(ex. Address 1 = character 0x81)
ETX = Stop character, Hexadecimal value 0x03
CKSUM = Control checksum, it's a character sum of all characters of the command, Inclusive of STX and ETX characters, module 256.

Each command that carries a parameter receives a reply with a result character (**ESI**) that can have the following values:

"0" = Command executed.
"1" = Command not executed.

General information commands and device options

Device serial number request

Command		Reply		
0x10	**"S"**	**0x10**	**"S"**	Serial number

Device firmware version request

Command		Reply		
0x10	**"F"**	**0x10**	**"F"**	Firmware version

Device name request

Command		Reply		
0x10	**"N"**	**0x10**	**"N"**	Device name

Request and setting device setup mode

Command		Reply		
0x10	**"M"**	**0x10**	**"M"**	Setup mode

Command			Reply		
0x11	**"M"**	Setup mode setting	**0x11**	**"M"**	**ESI**

"0"	Setup and start from panel
"1"	
"2"	
"3"	
“4”	Setup and external start

Note: In case of remote mode (look at appropriate command 0x15 “M”), this command has effect only for the start.

Commands for test main setup

Request and setting voltage value

Command

0x12	"M"	IDX

Reply if IDX ok

0x12	"M"	IDX	UMIS	Voltage value *

Reply if IDX not ok

0x12	"M"	ESI

Command

0x13	"M"	IDX	UMIS	Voltage value *

Reply

0x13	"M"	ESI

IDX	= 0x81 (Fixed value)

UMIS	= “1” (Fixed value)

* For the allowed ranges refer to equipment specifications

Request and setting current value

Command

0x12	"E"	IDX

Reply if DX OK

0x12	"E"	IDX	UMIS	Current value *

Reply if IDX not OK

0x12	"E"	ESI

Command

0x13	"E"	IDX	UMIS	Current value *

Reply

0x13	"E"	ESI

IDX	= 0x81 (Fixed value)

UMIS	= “1” (fixed value) Ampere

* For the allowed ranges refer to equipment specifications

Request and setting maximum power value

Command			Reply		
0x12	**"X2"**		**0x12**	**“X2”**	Power

Command			Reply	
0x13	**"X2"**	Power	**0x13**	**ESI**

Power is in Watt from: 0 to f.s.

Request and setting internal resistance

Command			Reply		
0x12	**"X1"**		**0x12**	**"X1"**	Resistor

Command			Reply	
0x13	**"X1"**	Resistor	**0x13**	**ESI**

Resistor is in Ohm from: 0.001 to 1000

Request and setting reference sources.

Command

0x20	**"C"**	**RIF**

Reply

0x20	**"C"**	**RIF**	**SRC**

Reply if RIF not OK

0x20	**"C"**	**ESI**

Command

0x21	**"C"**	**RIF**	**SRC**

Reply

0x21	**"C"**	**ESI**	**RIF2**

Reference values and associated source

RIF		**SRC**		
		"0"	**"1"**	**"2"**
"0"	Voltage	Pot. 1	Input AN1	From serial
"1"	Current	Pot. 2	Input AN2	From serial
"2"	Source of START	Panel	Input IN1	From serial
"3"	Not used	Pot. 2	Input AN2	From serial
"4"	RESISTANCE reference	Fixed 0 ohm	Input IN1	From serial
"5"	POWER LIMITATION reference	Fixed MAX	Input AN2	From serial

Nota: This command **ESI** can take also value "2". In this case means that SRC you want to use is already used by the reference RIF2.

Request end sending RAMP timing

Command

0x12	**"T"**	**IDX**

Reply if IDX OK

0x12	**"T"**	**IDX**	**UMIS**	RAMP timing (ms)

Reply if IDX not OK

0x12	**"T"**	**ESI**

Command

0x13	**"T"**	**IDX**	**UMIS**	RAMP timing (milliseconds)

Reply

0x13	**"T"**	**ESI**

IDX	= 0x81 (Fixed value)

UMIS	= "0" (Fixed value)

Request and sending Ramp mode

Command

0x12	**"R"**	**IDX**

Reply if IDX OK

0x12	**"R"**	**IDX**	Mode

Reply if IDX not OK

0x12	**"R"**	**ESI**

Command

0x13	**"R"**	**IDX**	Mode

Reply

0x13	**"R"**	**ESI**

IDX = 0x81 (Valore fisso)

Mode

"0"	No ramp
"1"	Linear ramp

Commands for reading the actual values

Reading the actual state

Command

0x14	**"E"**

Reply

0x14	**"E"**	State or test result

Test state

"0"	Halt
"1"	Running
"2"	
"3"	
"4"	
"5"	
"6"	Fail (failure or malfunction)
"7"	
"A"	

Reading the actual voltage

Command

0x14	**“M”**	**FA**

Reply

0x14	**“M”**	**UMIS**	Actual value

FA	Necessary in the three-phases devices. Select the phase to read (“1”,”2”,”3”), if omitted it means “1”

UMIS

“0”		Millivolt
“1”		Volt

Reading the actual current

Command

0x14	**“S”**	**FA**

Reply

0x14	**“S”**	**UMIS**	Actual value

FA	Necessary in the three-phases devices. Select the phase to read (“1”,”2”,”3”), if omitted it means “1”

UMIS

“0”	Millivolt	Milliampere
“1”	Volt	Ampere

Reading the remote connection state

Command

0x14	**"L"**

Reply

0x14	**"L"**	Connection state

Connection state

“L”	Not ACTIVE
“R”	Active

Test Start and Stop commands

Enables remote mode

Command

0x15	**"M"**	Mode

Reply

0x15	**"M"**	**ESI**

Remote mode

"L"	Not active
"R"	Active

In "Remote" mode the output values are defined via SERIAL link. The start can be given from SERIAL link or from PANEL/EXTERNAL according to the appropriate command (0x11 "M").

Supply start

Command

0x15	**"R"**

Reply

0x15	**"R"**	**ESI**

Note: It's possible to start the supply only if in remote mode and start from selected PANEL/EXTERNAL.
The positive result of the command means that it was accepted but, in order to be sure the start has taken place, it's necessary to read the device state (Command 14E).

Supply stop

Command

0x15	**"S"**

Reply

0x15	**"S"**	**ESI**

Note: It's possible to stop the supply only if in remote mode and stop from selected PANEL/EXTERNAL.
The positive result of the command means that it was accepted but, in order to be sure the stop has taken place, it's necessary to read the device state (Command 14E).

Address assignment

Command

0x15	**"A"**	IND

Reply

0x15	**"A"**	**ESI**