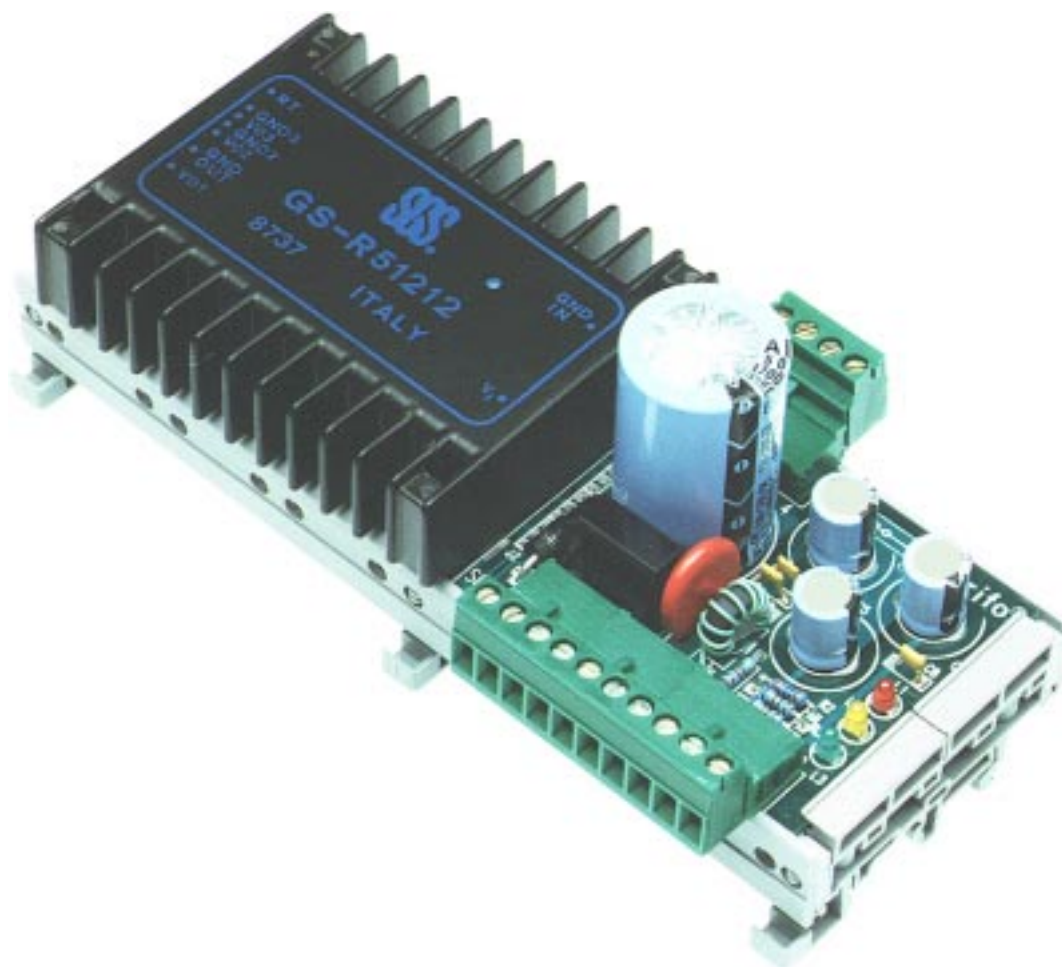


# SBP 01

Switching Block Power

## TECHNICAL MANUAL



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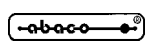
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**SBP 01**

Edition 5.00

Rel. 04 March 2002

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# SBP 01

## Switching Block Power

### TECHNICAL MANUAL

BLOCK format, measuring **170x80x90 mm**, complete of plastic container for omega rails DIN 247277-1 e 247277-3; electrical connection by two comfortable screw terminal, quick release, 4 and 10 pins connectors; up to **3** coloured **LEDs** which indicate the presence of the generated voltages, placed on the front side; noises reduction **filters** on the inputs and outputs; **power failure** digital signal that can be used as **Reset** for the other cards; **sensing** and **regulation** signals available on connector; protection on over temperature, over input and output voltage, over load and short circuit; input for auxiliary voltage from a 12, 24 Vdc battery, for **UPS** function; average efficiency higher than **80%**; required voltage: **6÷32 Vac** or **8÷46 Vdc** (according to selected model); generated voltages are variable according to selected model:

Model	Voltage	Current
<b>SBP 01</b>	5 Vdc	4 A
<b>SBP 01.12</b>	12 Vdc	4 A
<b>SBP 01.15</b>	15 Vdc	4 A
<b>SBP 01.24</b>	24 Vdc	4 A
<b>SBP 01.VT</b>	5÷40 Vdc	4 A
<b>SBP 01.VB</b>	5÷40 Vdc	0.2÷4 A
<b>SBP 01.3T</b>	+5; +12; -12 Vdc	3.5; 0.15; 0.15 A

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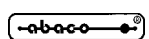
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For specific informations on the components mounted on the card, please refer to the Data Book of the builder or second sources.

### SYMBOLS DESCRIPTION

In the manual could appear the following symbols:

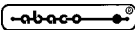


Attention: Generic danger



Attention: High voltage

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## INTRODUCTION

The use of these devices has turned - IN EXCLUSIVE WAY - to specialized personnel.

The purpose of this handbook is to give the necessary information to the cognizant and sure use of the products. They are the result of a continual and systematic elaboration of data and technical tests saved and validated from the manufacturer, related to the inside modes of certainty and quality of the information.

The reported data are destined- IN EXCLUSIVE WAY- to specialized users, that can interact with the devices in safety conditions for the persons, for the machine and for the environment, impersonating an elementary diagnostic of breakdowns and of malfunction conditions by performing simple functional verify operations , in the height respect of the actual safety and health norms.

The informations for the installation, the assemblage, the dismantlement, the handling, the adjustment, the reparation and the contingent accessories, devices etc. installation are destined - and then executable - always and in exclusive way from specialized warned and educated personnel, or directly from the TECHNICAL AUTHORIZED ASSISTANCE, in the height respect of the manufacturer recommendations and the actual safety and health norms.

The devices can't be used outside a box. The user must always insert the cards in a container that respect the actual safety normative. The protection of this container is not threshold to the only atmospheric agents, but specially to mechanic, electric, magnetic, etc. ones.

To be on good terms with the products, is necessary guarantee legibility and conservation of the manual, also for future references. In case of deterioration or more easily for technical updates, consult the AUTHORIZED TECHNICAL ASSISTANCE directly.

To prevent problems during card utilization, it is a good practice to read carefully all the informations of this manual. After this reading, the user can use the general index and the alphabetical index, respectly at the begining and at the end of the manual, to find information in a faster and more easy way.

## CARD VERSION

The present handbook is reported to the **SBP 01** card release **170993** and later. The validity of the bring informations is subordinate to the number of the card release. The user must always verify the correct correspondence among the two denotations. On the card the release number is present in more points both board printed diagram (serigraph) and printed circuit (for example below the switching supply heat sink's bottm right corner on the component side or below connector CN2 on the solder side).

## GENERAL FEATURES

The **SBP 01** module is a complete, low cost, switching power supply with reduced dimension designed to solve all the power supply problems of the automation environment.

It is provided in a plastic container for a direct mounting on omega rails where it has a front dimension of only 80 mm, while two quick release screw terminal connectors allow the connections to external circuits. These features simplify and reduce the required time for mounting, installation, replacement and connection of the same card.

The **SBP 01** generates all the standard voltages required by microprocessor based systems, starting from a single **AC** or **DC** low input voltage, so it respects the security norms.

Some **LEDs** on the front side inform about the presence of the output voltages and they add the possibility to visually diagnose any possible **failure**.

A very important feature of **SBP 01** is an auxiliary input coming from an external battery; in this case it works like an **UPS** (Uninterruptible Power Supply), assuring power to the loads, with no discontinuity, even without external mains voltage.

The **SBP 01** is available in 7 different models that have different generated voltages and different maximum load currents, as described in the following table:

Model	Voltage	Current	Note
<b>SBP 01</b>	5 Vdc	4 A	With Power Failure
<b>SBP 01.12</b>	12 Vdc	4 A	-
<b>SBP 01.15</b>	15 Vdc	4 A	-
<b>SBP 01.24</b>	24 Vdc	4 A	-
<b>SBP 01.VT</b>	5÷40 Vdc	4 A	Voltage adjustable
<b>SBP 01.VB</b>	5÷40 Vdc	0.2÷4 A	Voltage and current adjustable
<b>SBP 01.3T</b>	+5; +12; -12 Vdc	3.5; 0.15; 0.15 A	With Power Failure

The total supplied power is about 60 W in ambient temperature up to 60 °C, but with a proper forced ventilation a power of 120 W can be reached without problems.

- BLOCK format, measuring **170x80x90 mm**, complete of plastic container for omega rails DIN 247277-1 e 247277-3
- Electrical connection by two comfortable screw terminal, quick release, 4 and 10 pins connectors
- Up to **3** coloured **LEDs** which indicate the presence of the generated voltages, placed on the front side
- Noises reduction **filters** on the inputs and outputs
- **Power failure** digital signal that can be used as **Reset** for the other cards
- **Adjust** and **regulation** signals available on connector
- **Protection** on over temperature, over input and output voltage, over load and short circuit
- Input for auxiliary voltage from a 12, 24 Vdc battery, for **UPS** function
- Medium performance higher than **80%**
- Required voltage: **6÷32 Vac** or **8÷46 Vdc** (according to selected model)
- Generated voltages: variable according with selected model (see previous table)

Here follows a description of the board's functional blocks, with an indication of the operations performed by each one. To easily locate these blocks and verify their connections please refer to figure 1.

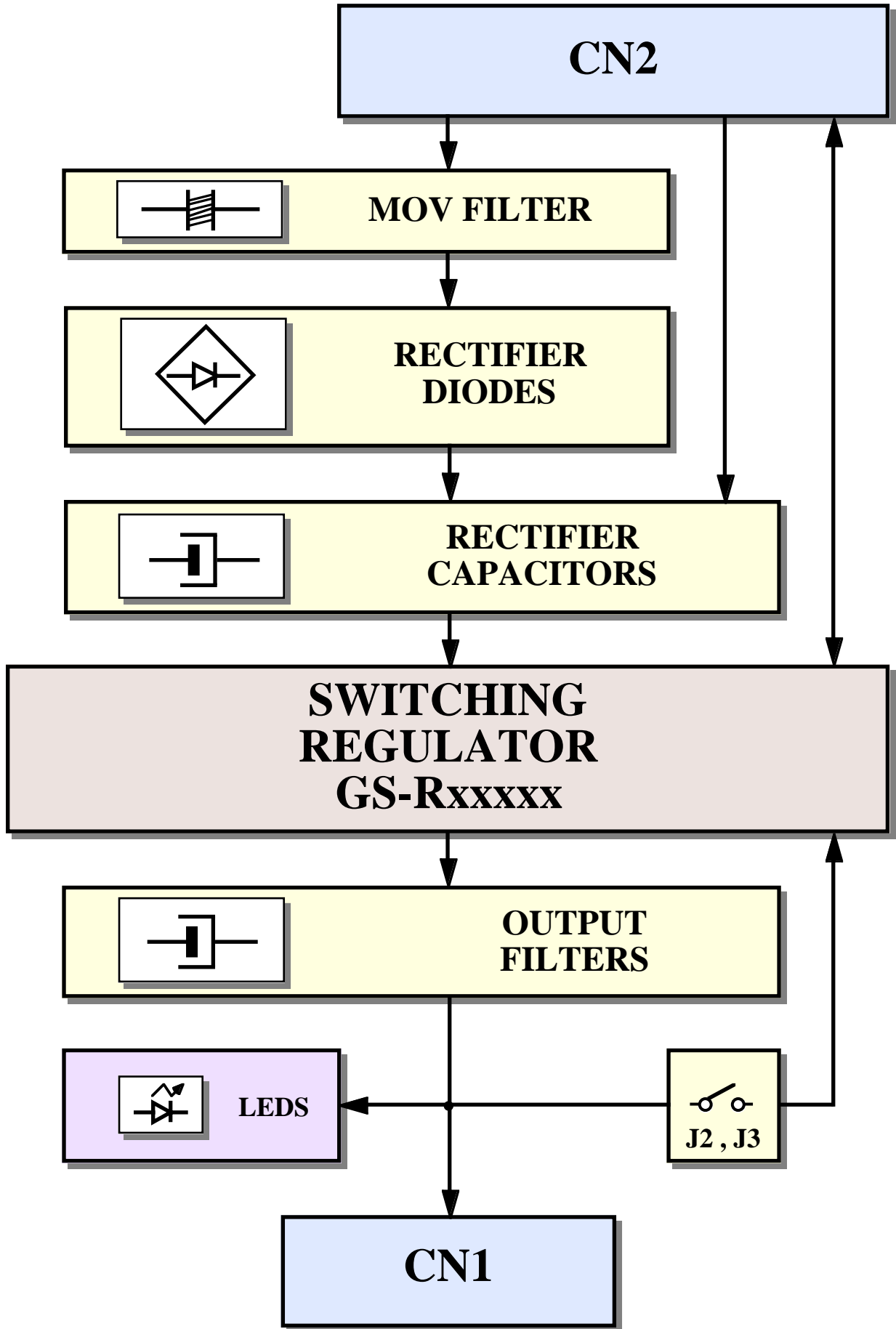


FIGURE 1: BLOCK DIAGRAM

## RECTIFIER SECTION

AC voltage in input to **SBP 01** is filtered through a MOV, which eliminates transients, then it is rectified by the specific rectifying section that generates a DC voltage for the switching power supply. Rectifying section is made of a simple bridge rectifier with capacitors that assure a DC voltage erogation in all the operating conditions of the power supply. Components are selected to reduce the value of ripple on the switching input whatever input voltage or output load is present. Rectifier section is always present but, as indicated in the block diagram, is used only in part if a DC voltage is provided as input. In such condition the bridge rectifier is not used and the input voltage is just filtered by the capacitors.

The presence of two different inputs for AC voltage and DC voltage allows the possibility to use the power supply as an UPS (connected, for example, to a battery) and provides the possibility to have output voltage referred to the same potential as input voltage.

## SWITCHING REGULATOR

**SBP 01** power supplies are based on an efficient switching regulator that performs the task to keep the output voltage under control and limit the output current. The main component of this section is an integrated voltage regulator that belongs to family **GS-Rxxxxx** manufactured by SGS. These modules have been designed specifically to build industrial power supplies of middle-high power with best price/performance rate and a good reliability, due also to its almost total absence of external components. Including all the 7 models of **SBP 01**, the overall features of switching regulation section are:

- soft start after a power on
- high efficiency, up to 80%
- protection against overcurrent or output short circuit
- protection against overheat
- protection against overvoltage in output
- switching frequency is 100 KHz
- step down regulation
- automatic compensation of voltage drop due to connection cables
- generation of /RESET signal for power failure
- huge heatsink
- MTBF greater than 200000 hours
- low noise and reduced output voltage ripple

Also in this section components have been selected to reach maximum efficiency and warrant anyway the maximum output current 4 A for the selected output voltage.

Some components of the regulation section may vary according to the model selected, so the output voltage selection cannot be made by the customer but must be specified in the order.

The following list reports the type of regulator used for each model of **SBP 01** and its differences respect to the above listed features:

MODEL	REGULATOR	/RESET	SENSING
SBP 01	GS-R405S	YES	YES
SBP 01.12	GS-R400V	NO	YES
SBP 01.15	GS-R400V	NO	YES
SBP 01.24	GS-R400V	NO	YES
SBP 01-VT	GS-R400V	NO	YES
SBP 01-VB	GS-R400VB	NO	YES
SBP 01-3T	GS-R51212	YES	NO

FIGURE 2: REGULATORS FAMILY GS-RXXXXX

**OUTPUT SECTION AND FILTERS**

Output section of **SBP 01** simply filters the stabilized voltages generated by the switching regulator through specific capacitors (for high and low frequencies) and visualizes the power supply status by specific LEDs. Some components of this section may vary according to the model selected and, as usual, all components have been selected to assure stability of output voltage under any operating condition.

Another feature of output section is to include two jumpers that allow the possibility to connect the output voltage sensing circuitry directly to the power supply, without any external connection.

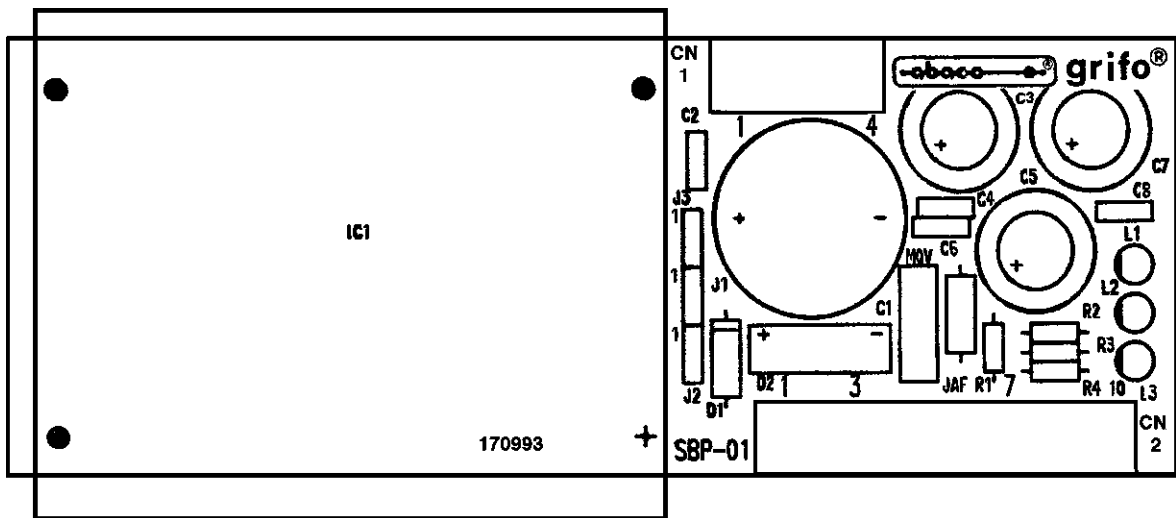


FIGURE 3: COMPONENTS MAP

## TECHNICAL FEATURES

### GENERAL FEATURES

<b>Switching Frequency:</b>	100 KHz
<b>Average efficiency:</b>	80%
<b>Overheat protection:</b>	150 °C, disables output and recovers automatically
<b>Overload protection:</b>	5 A, disables output and recovers automatically
<b>Overvoltage output:</b>	+20% of nominal voltage, disables output and recovers automatically
<b>Visualization:</b>	up to 3 status LEDs
<b>Reset signal duration:</b>	100 msec
<b>Reset signal type:</b>	TTL
<b>Reset activation threshold:</b>	4.75÷4.9 V
<b>Soft start delay:</b>	15÷35 msec
<b>Frequency of AC input:</b>	50÷60 Hz

### PHYSICAL FEATURES

<b>Size:</b>	170 x 80 x 90 mm
<b>Weight:</b>	320 g
<b>Mounting:</b>	Ω rails, DIN 247277-1 and 247277-3
<b>Connectors:</b>	CN1: 4 pins quick release screw terminal connector CN2: 10 pins quick release screw terminal connector
<b>Temperature range:</b>	0÷50 °C
<b>Relative humidity:</b>	20%÷90% (without condense)

## ELECTRIC FEATURES

<b>Input voltages:</b>	<b>SBP 01</b>	= 6÷32 Vac or 8÷46 Vdc
	<b>SBP 01.12</b>	= 12÷32 Vac or 16÷46 Vdc
	<b>SBP 01.15</b>	= 14÷32 Vac or 19÷46 Vdc
	<b>SBP 01.24</b>	= 21÷32 Vac or 29÷46 Vdc
	<b>SBP 01.VT</b>	= 6÷32 Vac or 8÷46 Vdc
	<b>SBP 01.VB</b>	= 7÷32 Vac or 9÷46 Vdc
	<b>SBP 01.3T</b>	= 7÷28 Vac or 9÷40 Vdc
<b>Output voltages:</b>	<b>SBP 01</b>	= 5 Vdc
	<b>SBP 01.12</b>	= 12 Vdc
	<b>SBP 01.15</b>	= 15 Vdc
	<b>SBP 01.24</b>	= 24 Vdc
	<b>SBP 01.VT</b>	= 5÷40 Vdc adjustable by user
	<b>SBP 01.VB</b>	= 5÷40 Vdc adjustable by user
	<b>SBP 01.3T</b>	= 5 Vdc; +12 Vdc; -12 Vdc
<b>Output ripple:</b>	typical 30 mV; maximum 150 mV	
<b>Voltage/temperature variation:</b>	1,6 mV/°C	
<b>Output current (*):</b>	<b>SBP 01</b>	= 4 A
	<b>SBP 01.12</b>	= 4 A
	<b>SBP 01.15</b>	= 4 A
	<b>SBP 01.24</b>	= 4 A
	<b>SBP 01.VT</b>	= 4 A
	<b>SBP 01.VB</b>	= 0,2÷4 A adjustable by user
	<b>SBP 01.3T</b>	= 3,5 A; 0,15 A; 0,15 A
<b>Maximum output current:</b>	0,2 A	
<b>Maximum output power:</b>	120 W	
<b>Voltage adjust regulation:</b>	$0 \leq R_{PRGV} \leq 18 \text{ K}\Omega$	
<b>Current adjust regulation:</b>	$R_{PRGI} \geq 2,2 \text{ K}\Omega$	

(\*) Data here reported are referred to a 20 centigrad degrees environmental temperature.

## INSTALLATION

In this chapter there are the information for a right installation and correct use of the card. The user can find the location and functions of each connectors, jumpers, LEDs and some explanatory diagrams.

### JUMPERS

On **SBP 01** there are two 3 pins solder jumpers for power supply working mode configuration. To easily locate the jumpers please refer to figure 29, while to identify the pin number just remember that pin 1 is always the topmost. Here follows a table that describes jumper connections and their function:

JUMPER	PIN	PURPOSE
J2	1	Connected to positive sensing signal on pin 6 of CN2 (SENSE+).
	2	Connected to output voltage on pin 3 of CN1 (+xx Vdc OUT).
	3	Connected to positive sensing signal of switching regulator.
J3	1	Connected to output ground on pin 2 of CN1 (GND).
	2	Connected to negative sensing signal of switching regulator.
	3	Connected to negative sensing signal on pin 5 of CN2 (SENSE-).

**FIGURE 4: JUMPERS TABLE**

Configuration of the remaining jumper, called J1, is reserved to **grifo**<sup>®</sup> technicians and cannot be changed by the user.

The next paragraphs report the possible connections for the user jumpers and their default connection according to the model of **SBP 01**.

In the paragraph “OUTPUT VOLTAGE LOAD SENSING” is explained in details the connections of jumpers according to the function desired.

### CONNECTIONS

The **SBP 01** power supply has 2 connectors that can be linkeded to other devices or directly to the field, according to system requirements. In this paragraph there are connectors pin out, a short signals description (including the signals direction), connections examples and jumper configuration for each of the 7 models. Connectors view are reported to the external side of power supply and are easily recognizable through their shape and serigraph.

Quick release connectors ease cabling phase, even with thick cables, and allows a faster (eventual) replacement of the whole power supply in case of damage or maintenance.



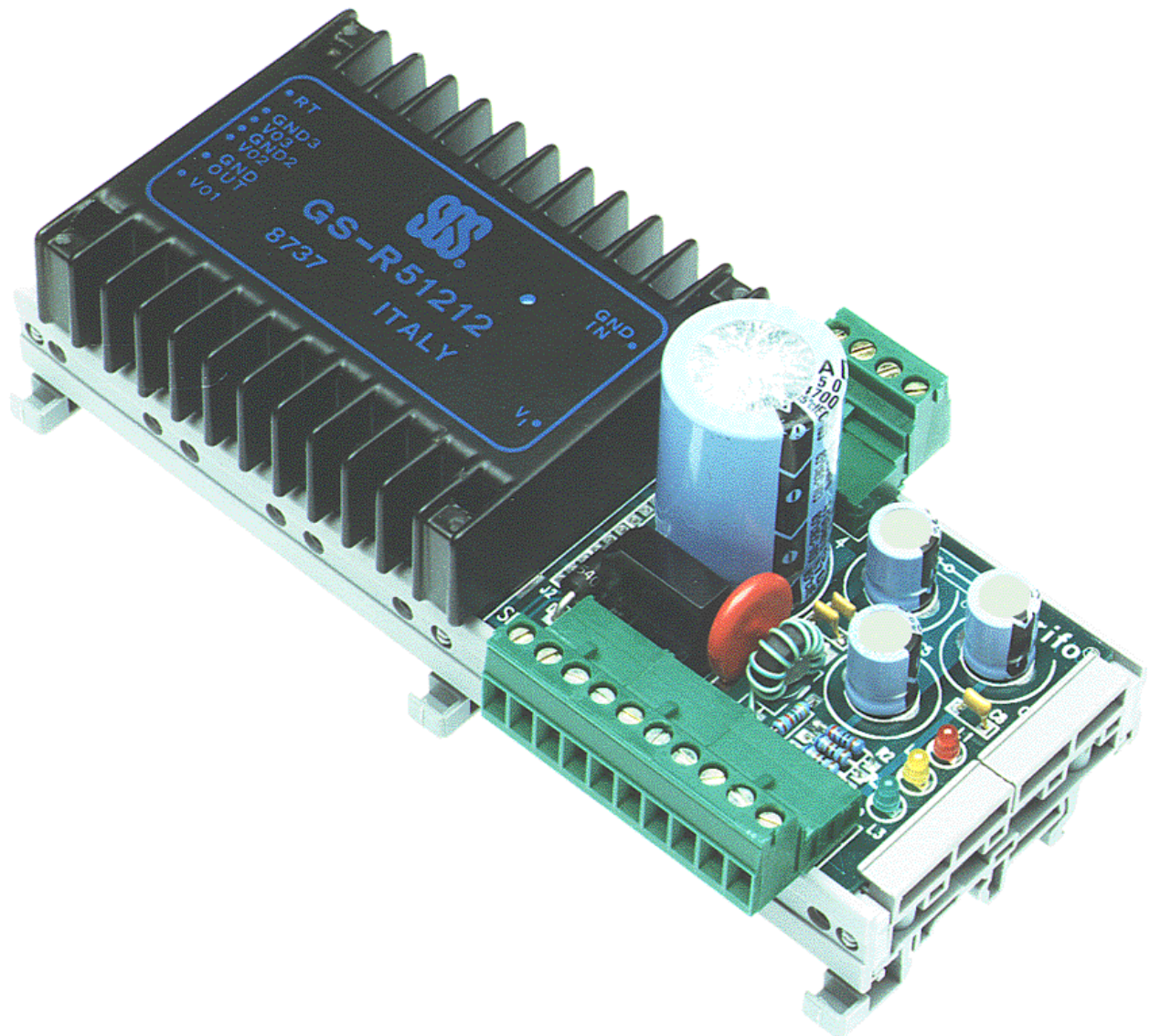


FIGURE 5: SBP 01 PHOTO

## SBP 01

### JUMPERS SBP 01

JUMPER	POSSIBILE CONNECTIONS	DEFAULT CONNECTION
J2	1-3 or 2-3	2-3
J3	2-3 or 1-2	1-2

FIGURE 6: JUMPERS SBP 01

### CN 1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01

CN1 is a 4 pins screw terminal connector, 5 mm pitch.

CN1 allows to fetch the regulated output voltage to connect it to the external device to supply.

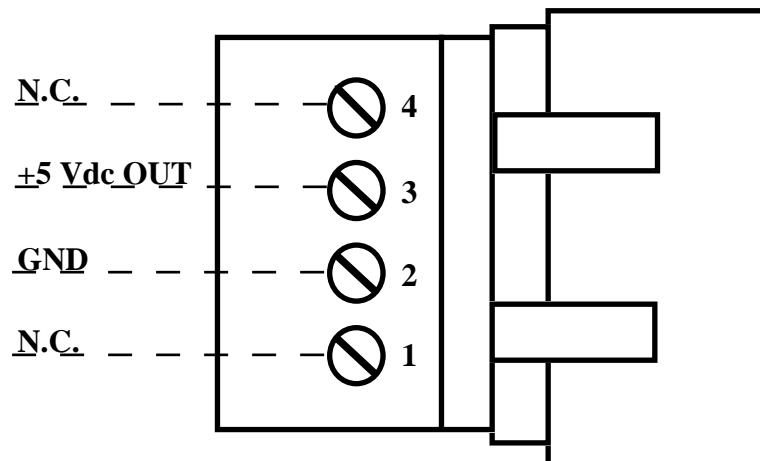


FIGURE 7: CN1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01

Signals description:

- +5 Vdc OUT** = O - Positive terminal of +5 Vdc regulated output voltage
- GND** = - Negative terminal of regulated output voltage
- N. C.** = - Negative terminal of regulated output voltage

## CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01

CN2 is a 10 pins quick release screw terminal connector 5 mm pitch.

Through CN2 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage to **SBP 01**.

In addition some signals related to /RESET and sensing circuitry are present, their connection depends on user choice.

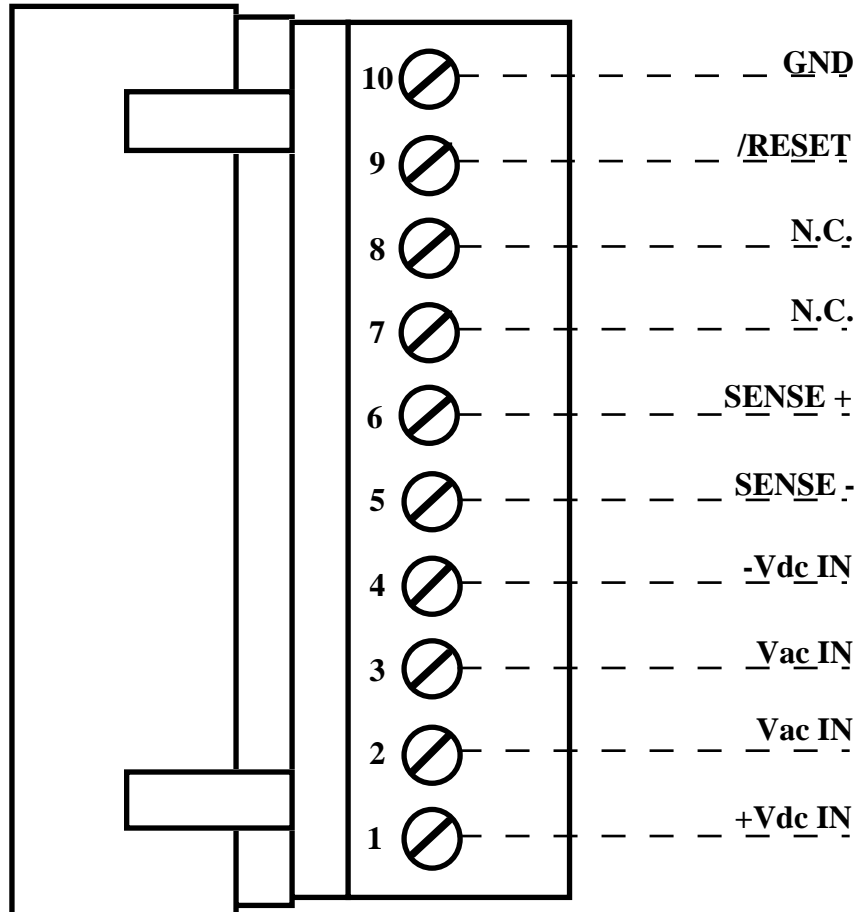


FIGURE 8: CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01

Signals description:

Vac IN	=	I	- AC input voltage lines
+Vdc IN	=	I	- Positive terminal of DC input voltage
-Vdc IN	=		- Negative terminal of DC input voltage
SENSE+	=	I	- Positive terminal of sensing signal
SENSE-	=	I	- Negative terminal of sensing signal
/RESET	=	O	- Valid output voltage signal, in TTL
GND	=		- Negative terminal of regulated output voltage
N.C.	=		- Not connected

The value of input voltage varies in a wide range as described in the previous paragraph “ELECTRIC FEATURES”. Power of input signal must, of course, be enough to provide the required power to output signal as described in the successive paragraph “POWER PROVIDED”.

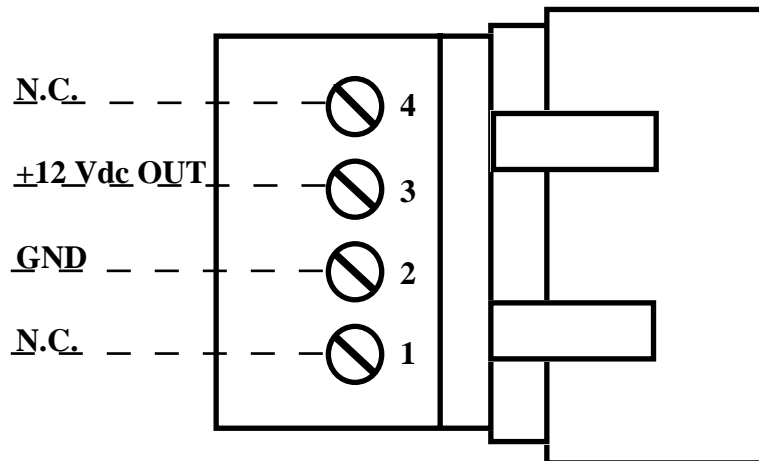
**SBP 01-12**
**JUMPERS SBP 01-12**

JUMPER	POSSIBILE CONNECTIONS	DEFAULT CONNECTION
J2	1-3 or 2-3	2-3
J3	2-3 or 1-2	1-2

**FIGURE 9: JUMPERS SBP 01-12**
**CN1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01-12**

CN1 is a 4 pins screw terminal connector, 5 mm pitch.

CN1 allows to fetch the regulated output voltage to connect it to the external device to supply.


**FIGURE 10: CN1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01-12**

Signals description:

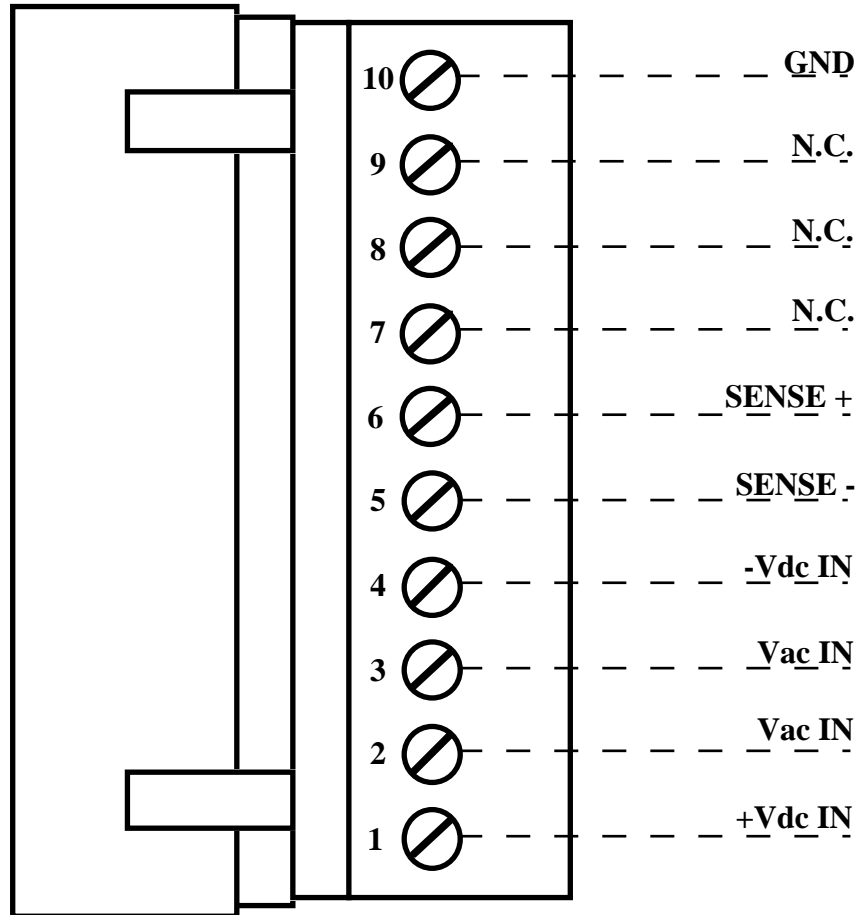
**+12 Vdc OUT** = O - Positive terminal of +12 Vdc regulated output voltage  
**GND** = - Negative terminal of regulated output voltage  
**N. C.** = - Not connected

**CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01-12**

CN2 is a 10 pins quick release screw terminal connector 5 mm pitch.

Through CN2 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage to **SBP 01-12**.

In addition some signals related to sensing circuitry are present, their connection depends on user choice.



**FIGURE 11: CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01-12**

Signals description:

- Vac IN** = I - AC input voltage lines
- +Vdc IN** = I - Positive terminal of DC input voltage
- Vdc IN** = I - Negative terminal of DC input voltage
- SENSE+** = I - Positive terminal of sensing signal
- SENSE-** = I - Negative terminal of sensing signal
- GND** = I - Negative terminal of regulated output voltage
- N.C.** = I - Not connected

The value of input voltage varies in a wide range as described in the previous paragraph “ELECTRIC FEATURES”. Power of input signal must, of course, be enough to provide the required power to output signal as described in the successive paragraph “POWER PROVIDED”.

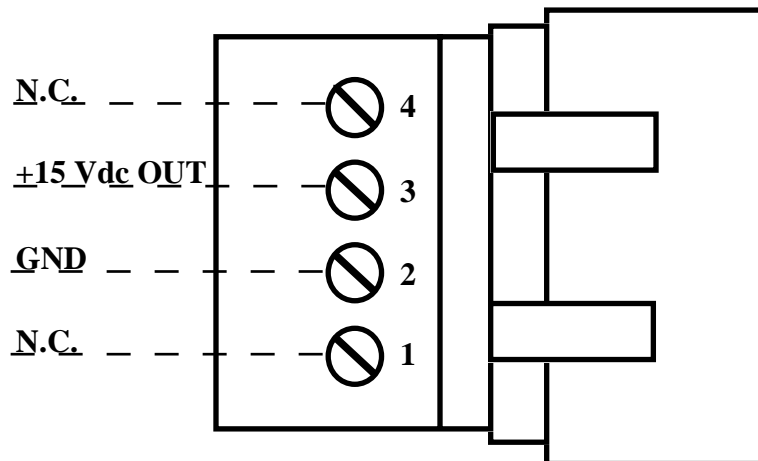
**SBP 01-15**
**JUMPERS SBP 01-15**

JUMPER	POSSIBILE CONNECTIONS	DEFAULT CONNECTION
J2	1-3 or 2-3	2-3
J3	2-3 or 1-2	1-2

**FIGURE 12: JUMPERS SBP 01-15**
**CN1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01-15**

CN1 is a 4 pins screw terminal connector, 5 mm pitch.

CN1 allows to fetch the regulated output voltage to connect it to the external device to supply.


**FIGURE 13: CN1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01-15**

Signals description:

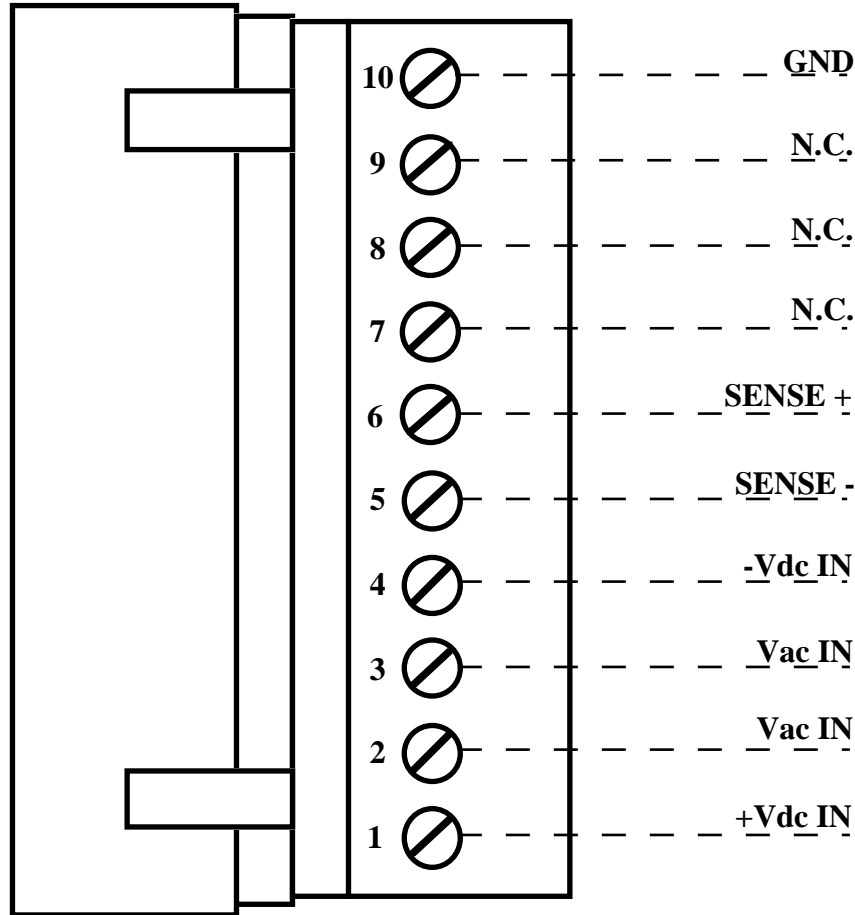
**+15 Vdc OUT** = O - Positive terminal of +15 Vdc regulated output voltage  
**GND** = - Negative terminal of regulated output voltage  
**N. C.** = - Not connected

**CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01-15**

CN2 is a 10 pins quick release screw terminal connector 5 mm pitch.

Through CN2 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage to **SBP 01-15**.

In addition some signals related to sensing circuitry are present, their connection depends on user choice.



**FIGURE 14: CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01-15**

Signals description:

- Vac IN** = I - AC input voltage lines
- +Vdc IN** = I - Positive terminal of DC input voltage
- Vdc IN** = - Negative terminal of DC input voltage
- SENSE+** = I - Positive terminal of sensing signal
- SENSE-** = I - Negative terminal of sensing signal
- GND** = - Negative terminal of regulated output voltage
- N.C.** = - Not connected

The value of input voltage varies in a wide range as described in the previous paragraph “ELECTRIC FEATURES”. Power of input signal must, of course, be enough to provide the required power to output signal as described in the successive paragraph “POWER PROVIDED”.

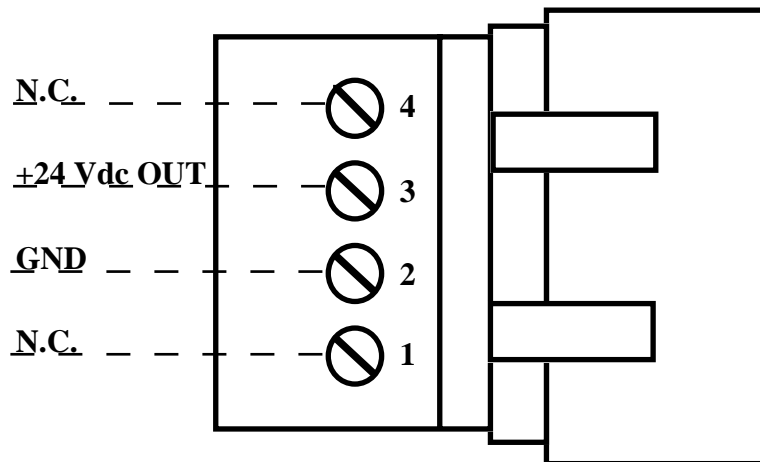
**SBP 01-24**
**JUMPERS SBP 01-24**

JUMPER	POSSIBILE CONNECTIONS	DEFAULT CONNECTION
J2	1-3 or 2-3	2-3
J3	2-3 or 1-2	1-2

**FIGURE 15: JUMPERS SBP 01-24**
**CN 1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01-24**

CN1 is a 4 pins screw terminal connector, 5 mm pitch.

CN1 allows to fetch the regulated output voltage to connect it to the external device to supply.


**FIGURE 16: CN1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01-24**

Signals description:

**+24 Vdc OUT** = O - Positive terminal of +24 Vdc regulated output voltage  
**GND** = - Negative terminal of regulated output voltage  
**N. C.** = - Not connected

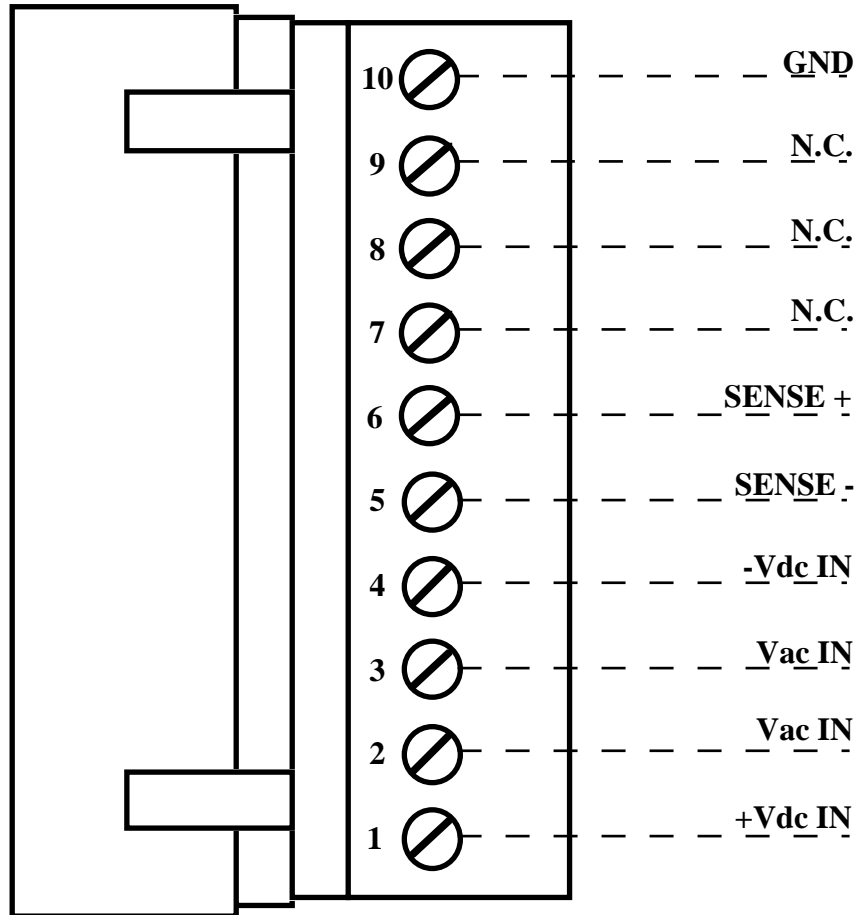


**CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01-24**

CN2 is a 10 pins quick release screw terminal connector 5 mm pitch.

Through CN2 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage to **SBP 01-24**.

In addition some signals related to sensing circuitry are present, their connection depends on user choice.



**FIGURE 17: CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01-24**

Signals description:

- Vac IN** = I - AC input voltage lines
- +Vdc IN** = I - Positive terminal of DC input voltage
- Vdc IN** = - Negative terminal of DC input voltage
- SENSE+** = I - Positive terminal of sensing signal
- SENSE-** = I - Negative terminal of sensing signal
- GND** = - Negative terminal of regulated output voltage
- N.C.** = - Not connected

The value of input voltage varies in a wide range as described in the previous paragraph “ELECTRIC FEATURES”. Power of input signal must, of course, be enough to provide the required power to output signal as described in the successive paragraph “POWER PROVIDED”.

## SBP 01-VT

### JUMPERS SBP 01-VT

JUMPER	POSSIBILE CONNECTIONS	DEFAULT CONNECTION
J2	1-3 or 1-2-3	1-2-3
J3	2-3 or 1-2	1-2

FIGURE 18: JUMPERS SBP 01-VT

### OUTPUT VOLTAGE ADJUST FOR SBP 01-VT

The regulated output voltage +Vdc OUT can be adjusted through a resistor  $R_{PRGV}$  connected on pin 6 of CN2 (SENSE+) and the specific pin 8 of CN2 (PRG V). The value of such resistance is given by:  $R_{PRGV} = 2.67 * ((+Vdc OUT / 5.1) - 1) K\Omega$  so may vary in the range 0÷18 K $\Omega$  corresponding to a variable output voltage in the range 5÷40 Vdc. To obtain an adjustable output voltage power supply it is enough to connect a 18 K $\Omega$  potentiometer or trimmer, as rheostat, between pins 6 and 8 of CN2, as described in figure 27.

### CN 1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01-VT

CN1 is a 4 pins screw terminal connector, 5 mm pitch.

CN1 allows to fetch the regulated output voltage to connect it to the external device to supply.

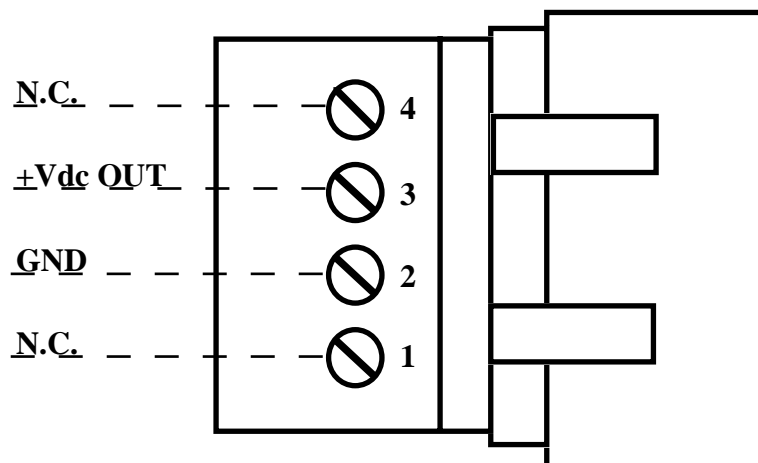


FIGURE 19: CN1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01-VT

Signals description:

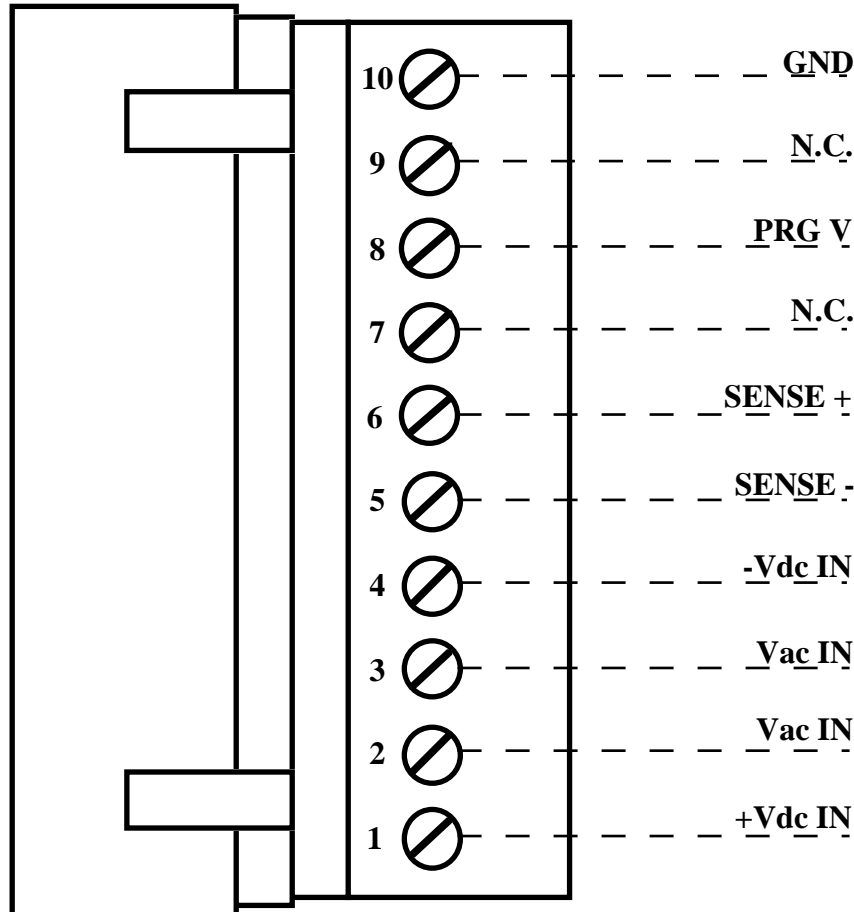
+Vdc OUT = O - Positive terminal of 5÷40 Vdc adjustable regulated output voltage  
 GND = - Negative terminal of regulated output voltage  
 N. C. = - Not connected

**CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01-VT**

CN2 is a 10 pins quick release screw terminal connector 5 mm pitch.

Through CN2 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage to **SBP 01-VT**.

In addition some signals related to adjustment and sensing circuitry are present, their connection depends on user choice.



**FIGURE 20: CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01-VT**

Signals description:

- Vac IN** = I - AC input voltage lines
- +Vdc IN** = I - Positive terminal of DC input voltage
- Vdc IN** = - Negative terminal of DC input voltage
- SENSE+** = I - Positive terminal of sensing signal
- SENSE-** = I - Negative terminal of sensing signal
- PRG V** = I - Output voltage adjust signal
- GND** = - Negative terminal of regulated output voltage
- N.C.** = - Not connected

The value of input voltage varies in a wide range as described in the previous paragraph “ELECTRIC FEATURES”. Power of input signal must, of course, be enough to provide the required power to output signal as described in the successive paragraph “POWER PROVIDED”.

## SBP 01-VB

### JUMPERS SBP 01-VB

JUMPER	POSSIBLE CONNECTIONS	DEFAULT CONNECTION
J2	1-3 or 1-2-3	1-2-3
J3	2-3 or 1-2-3	1-2-3

FIGURE 21: JUMPERS SBP 01-VB

### OUTPUT VOLTAGE ADJUST FOR SBP 01-VB

The regulated output voltage +Vdc OUT can be adjusted through a resistor  $R_{PRGV}$  connected on pin 6 of CN2 (SENSE+) and the specific pin 8 of CN2 (PRG V). The value of such resistance is given by:  $R_{PRGV} = 2.67 * ((+Vdc OUT / 5.1) - 1) K\Omega$

so may vary in the range 0÷18 K $\Omega$  corresponding to a variable output voltage in the range 5÷40 Vdc.

The maximum current before overload protection intervenes can be adjusted through a resistor  $R_{PRGI}$  connected on pin 5 of CN2 (SENSE-) and the specific pin 7 of CN2 (PRG I). The value of such resistance is given by:  $R_{PRGI} = 5.08 * IPROT + 1.18 K\Omega$

so must be greater than 2.2 K $\Omega$  corresponding to the minimum output current 0.2 A.

To obtain an adjustable output voltage and current power supply it is enough to connect two potentiometers or trimmers, as rheostats: one 18 K $\Omega$  between pins 6 and 8 of CN2, one 22 K $\Omega$  between pins 5 and 7 of CN2, as described in figure 27.

### CN 1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01-VB

CN1 is a 4 pins screw terminal connector, 5 mm pitch.

CN1 allows to fetch the regulated output voltage to connect it to the external device to supply.

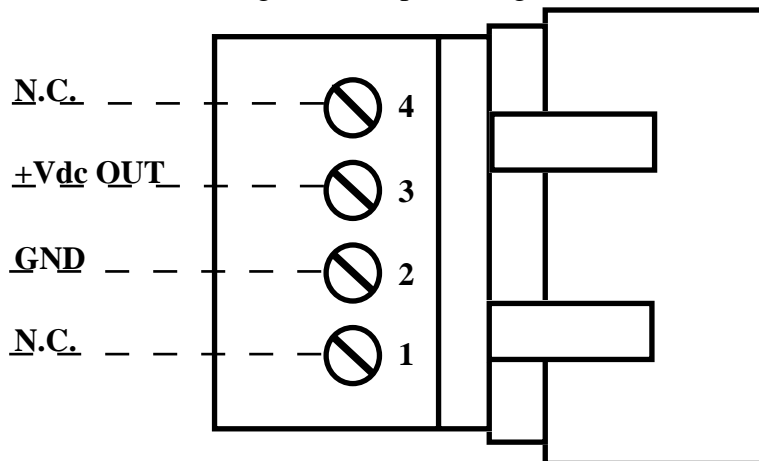


FIGURE 22: CN1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01-VB

Signals description:

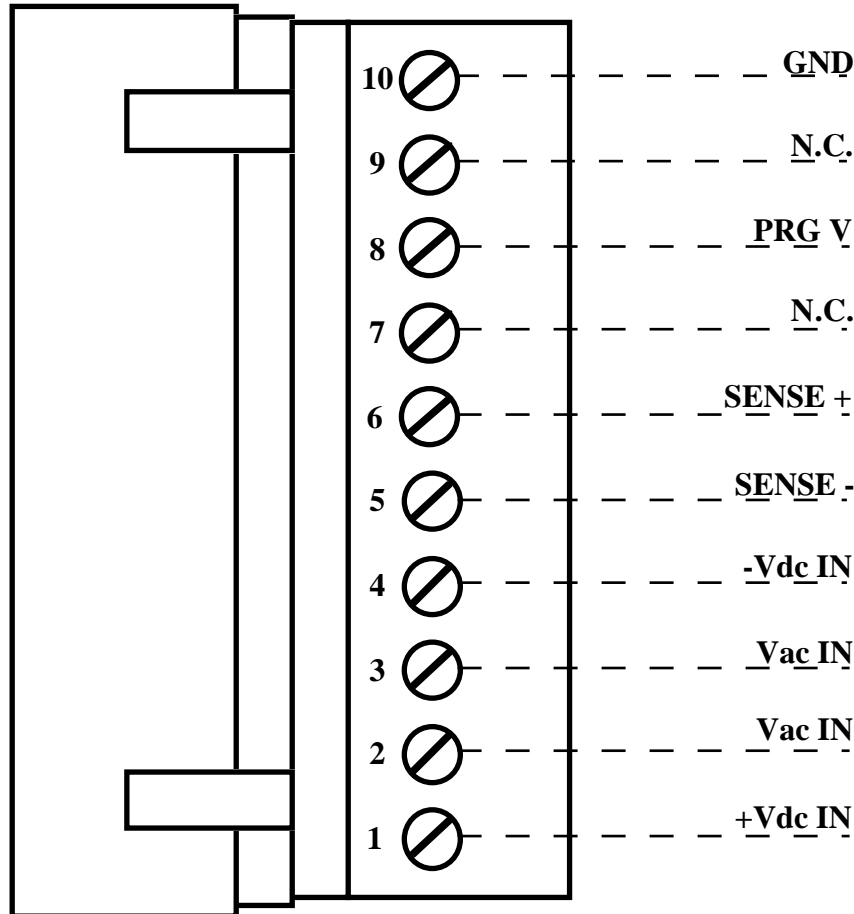
+Vdc OUT = O - Positive terminal of 5÷40 Vdc adjustable regulated output voltage  
 GND = - Negative terminal of regulated output voltage  
 N. C. = - Not connected

**CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01-VB**

CN2 is a 10 pins quick release screw terminal connector 5 mm pitch.

Through CN2 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage to **SBP 01-VB**.

In addition some signals related to adjustment and sensing circuitry are present, their connection depends on user choice.



**FIGURE 23: CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01-VB**

Signals description:

- Vac IN** = I - AC input voltage lines
- +Vdc IN** = I - Positive terminal of DC input voltage
- Vdc IN** = - Negative terminal of DC input voltage
- SENSE+** = I - Positive terminal of sensing signal
- SENSE-** = I - Negative terminal of sensing signal
- PRG V** = I - Output voltage adjust signal
- PRG I** = I - Maximum output current adjust signal
- GND** = - Negative terminal of regulated output voltage
- N.C.** = - Not connected

The value of input voltage varies in a wide range as described in the previous paragraph “ELECTRIC FEATURES”. Power of input signal must, of course, be enough to provide the required power to output signal as described in the successive paragraph “POWER PROVIDED”.

## SBP 01-3T

### JUMPERS SBP 01-3T

JUMPER	POSSIBILE CONNECTIONS	DEFAULT CONNECTION
J2	Not Connected	Not Connected
J3	Not Connected	Not Connected

FIGURE 24: JUMPERS SBP 01-VB

### CN 1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01-3T

CN1 is a 4 pins screw terminal connector, 5 mm pitch.

CN1 allows to fetch the three regulated output voltages to connect them to the external device to supply.

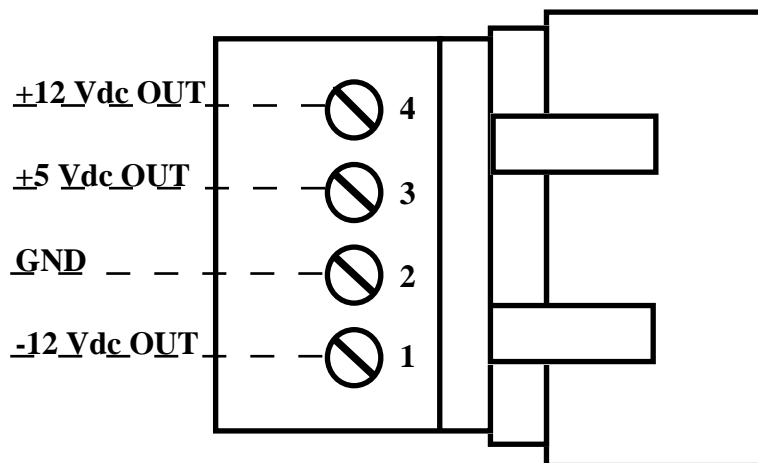


FIGURE 25: CN1 - OUTPUT VOLTAGE CONNECTOR OF SBP 01-3T

Signals description:

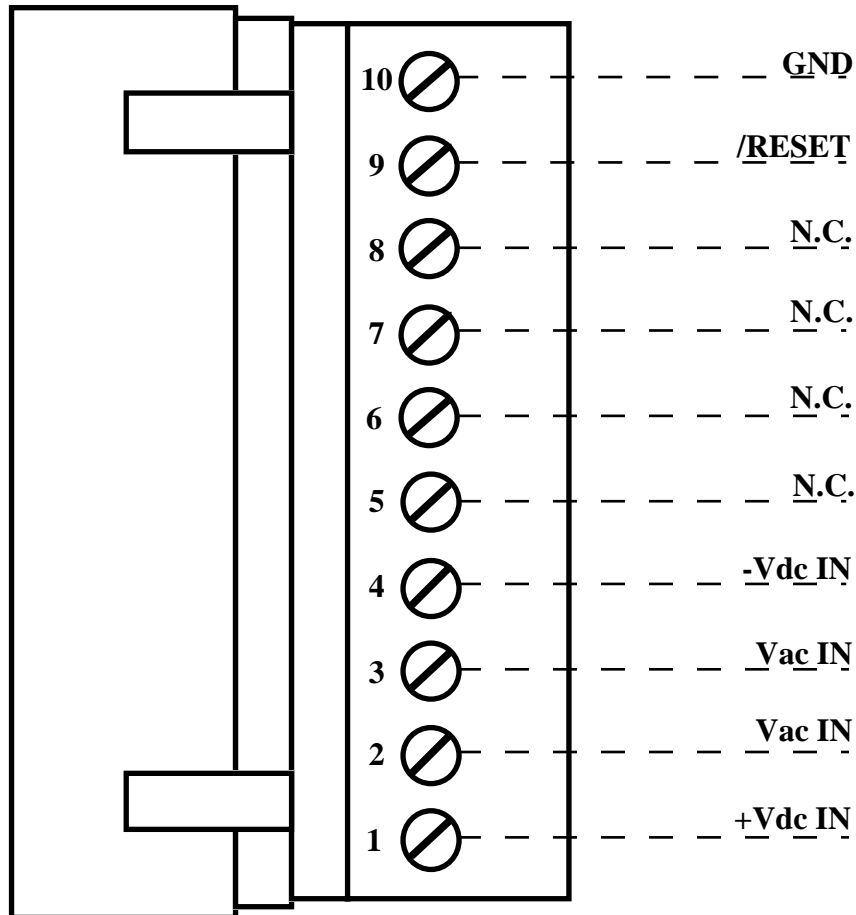
- +5 Vdc OUT** = O - Positive terminal of +5 Vdc regulated output voltage
- +12 Vdc OUT** = O - Positive terminal of +12 Vdc regulated output voltage
- 12 Vdc OUT** = O - Positive terminal of -12 Vdc regulated output voltage
- GND** = - Negative terminal of regulated output voltage

**CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01-3T**

CN2 is a 10 pins quick release screw terminal connector 5 mm pitch.

Through CN2 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage to **SBP 01-3T**.

In addition some signals related to adjustment and sensing circuitry are present, their connection depends on user choice.



**FIGURE 26: CN2 - INPUT VOLTAGE AND OTHER SIGNALS CONNECTOR FOR SBP 01-3T**

Signals description:

- Vac IN** = I - AC input voltage lines
- +Vdc IN** = I - Positive terminal of DC input voltage
- Vdc IN** = - Negative terminal of DC input voltage
- SENSE+** = I - Positive terminal of sensing signal
- SENSE-** = I - Negative terminal of sensing signal
- /RESET** = O - Valid output voltage signal, in TTL
- GND** = - Negative terminal of regulated output voltage
- N.C.** = - Not connected

The value of input voltage varies in a wide range as described in the previous paragraph “ELECTRIC FEATURES”. Power of input signal must, of course, be enough to provide the required power to output signal as described in the successive paragraph “POWER PROVIDED”.

## OUTPUT VOLTAGE LOAD SENSING

Every power supply model, except **SBP01 3T**, is provided with a professional sensing circuitry that allows to work correctly also in critical connections situations. This feature allows the power supply to compensate autonomously the eventual voltage drop across the connection cables that carry the regulated tension to the load.

As previously described, jumpers J2 and J3 allow to choose whether the sensing circuitry connection is made on the module board or externally. In detail:

### **SENSING CIRCUITRY CONNECTED ON THE MODULE BOARD:**

J2 in position 2-3 and J3 in position 1-2	<b>SBP 01,SBP 01-12,SBP 01-15,SBP 01-24</b>
J2 in position 1-2-3 and J3 in position 1-2	<b>SBP 01-VT</b>
J2 in position 1-2-3 and J3 in position 1-2-3	<b>SBP 01-VB</b>

In this working condition the sensing circuitry has no effect because there is no voltage drop on the module's tracks. It must be used when external connections allow it: diameter of cables large enough, non-inductive load, short distance connection, etc. The three positions connections of models **VT** and **VB** are essential to bring to connector CN2 the signals needed to adjust output voltage and current and correspond to sensing signals SENSE+ and SENSE-.

To allow an immediate use of power supply, we would want to remark that sensing circuitry is connected on the module board by default.

### **SENSING CIRCUITRY CONNECTED TO EXTERNAL LOAD:**

J2 in 2-3 and J3 in 1-2	<b>SBP 01,SBP 01-12,SBP 01-15,SBP 01-24,SBP-01-VT,SBP 01-VB</b>
-------------------------	---

In this working condition the sensing signals SENSE+ and SENSE- of CN2 must be connected respectively to signals +xx Vdc OUT and GND of CN1 directly on the load supplied that is on the farthest point from SBP01. Figure 27 shows the suggested external load connection for sensing signals.

Connections of jumpers J2 and J3 is made soldering a piece of wire on the correct positions; if configuration must be changed, first cut the wire with a sharpened tools, then desolder the wire with a low power soldering tool and perform the connection needed with low power soldering tool using a new piece of wire and non-corrosive tin.

## /RESET AND POWER FAILURE

Switching section of models **SBP 01** and **SBP 01-3T** generates a /RESET signal that informs eventual users of regulated output voltage validity. In detail /RESET is a digital TTL signal that can have two possible status.

/RESET = +5 Vdc	->	Regulated output voltage is valid
/RESET = GND	->	Regulated output voltage not valid because input voltage is too low or output voltage is out of range

The sections warrants at least 100 msec of duration for the signal to provide enough intervent time to the external circuitry.

Previous description shows that /RESET signal acts also as power failure and can be matched to microprocessor-based boards with the same signal with no problem.



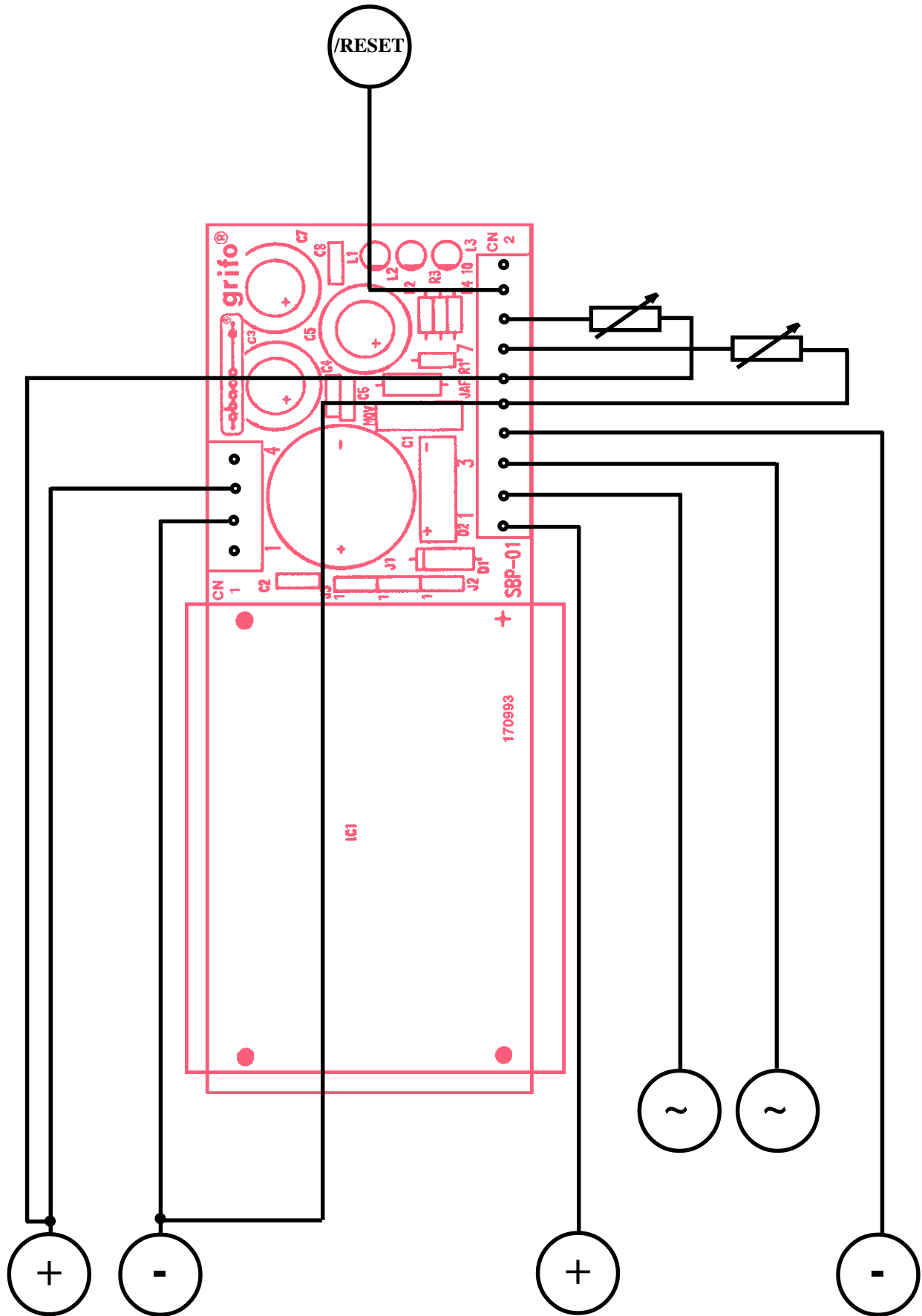


FIGURE 27: CONNECTION OF EXTERNAL LOAD SENSING, VARIATION, /RESET, ETC.

## VISUAL FEEDBACK

**SBP 01** modules are provided with LEDs to signal status conditions, as described in the following table:

LED	COLOUR	DESCRIPTION
L1	Red	When lit, indicates the presence of +5 Vdc OUT, +12 Vdc OUT, +15 Vdc OUT, +24 Vdc OUT, +Vdc OUT stabilized voltage in output on pin 3 of CN1 (all models).
L2	Yellow	When lit, indicates the presence of +12 Vdc OUT stabilized voltage in output on pin 4 of CN1 ( <b>SBP 01-3T</b> only).
L3	Green	When lit, indicates the presence of -12 Vdc OUT stabilized voltage in output on pin 1 of CN1 ( <b>SBP 01-3T</b> only).

**FIGURE 28: VISUAL FEEDBACK TABLE**

The main purpose of these LEDs is to give a visual indication of the board status, making easier the operations of system working verify. In the models with adjustable output voltage (**SBP 01-VT** and **SBP 01-VB**), brightness of LED L1 is directly proportional to output voltage, so it will be weakly bright or even OFF for the minimum +5 Vdc voltage.

To easily locate these LEDs on the board, please refer to figure 9.

## PROTECTIONS

Modules **SBP 01** feature the typical protections that allow to save them against improper uses and contemporarily assure that the power supply remains in the range of nominal working values. In detail the power supply is provided with 5 different protections:

Overheat	Switching regulation section keeps under control its own working temperature so when this latter exceeds <b>150 °C</b> it disables the output voltage to allow the temperature to decrease. Output is automatically restored when the temperature value get lower than 130 °C, the 20 °C hysteresis prevents instable output conditions.
Overload	Switching regulation section keeps under control output current on CN2 so when current exceeds <b>5 A</b> it disables the output voltage. After this, current is automatically restored softly. Soft start delay assures a limitation on output current in case the overload condition is still present.
Short circuit	Considered as overload condition.
Overvoltage in input	Input section is provided with a MOV filter that suppresses some noise and keeps AC input voltage (to rectifire section) under 39 Vac to protect switching regulator. In case the overvoltage in input persists, MOV filter can damage and must be replaced.

Overvoltage in output

Switching regulation section keeps under control output voltage; should this latter exceed **20%** of nominal value it disables the output voltage. To restore the output, switching regulator must be turned off and any input voltage must be removed.

After protection intervent, output voltage restore is always performed gradually (soft start), with gradual power increase.

**NOTE**

It is always a good idea to consider to put an opportunely dimensioned protection fuse on input voltage, both AC and DC, to keep safe the power source.

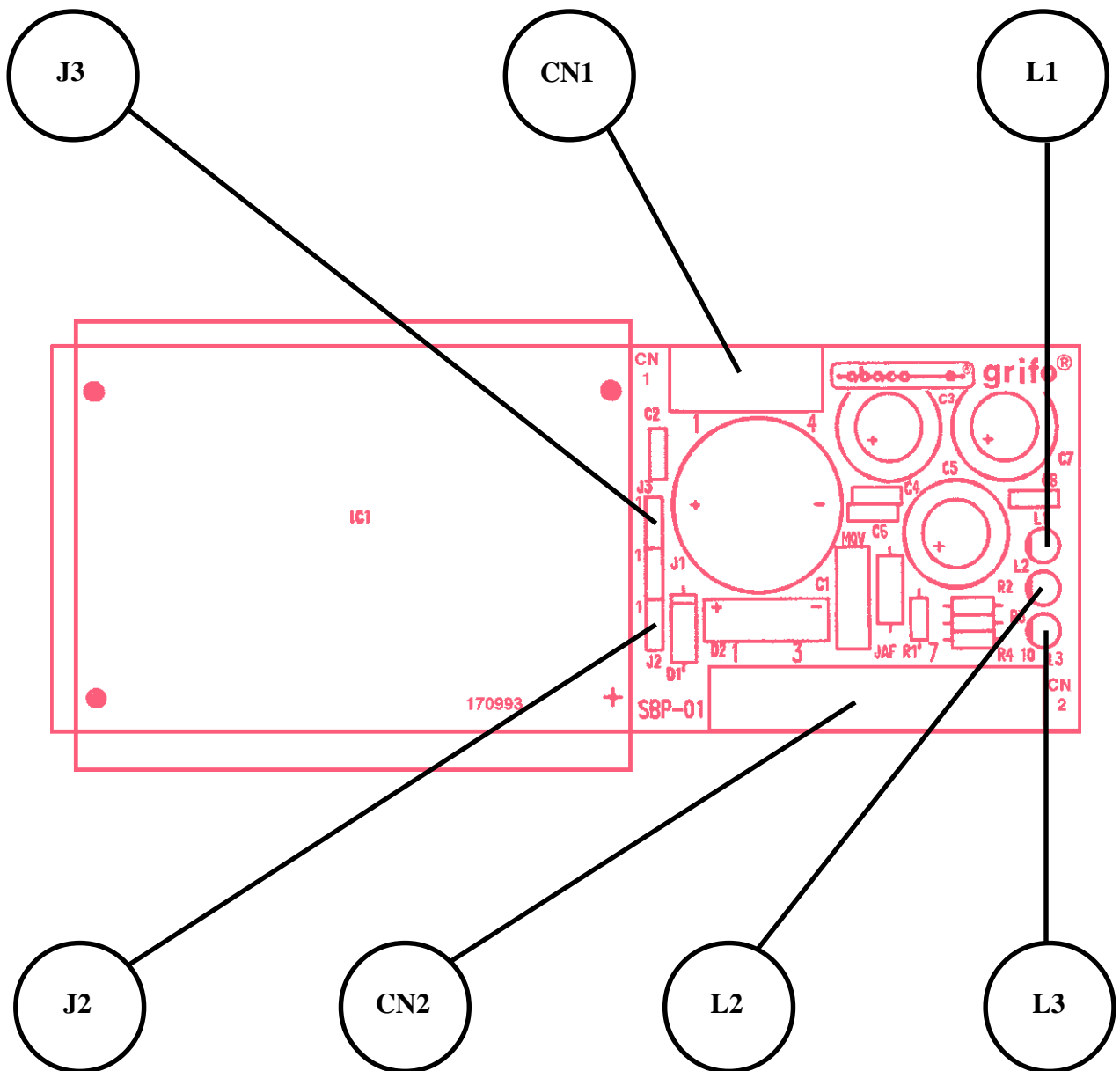


FIGURE 29: LEDs, CONNECTORS, JUMPERS, ETC. LOCATION

## INPUT VOLTAGES AND UPS

Connector CN1 features two pins for AC input voltage and two separated pins for DC input voltage; these should be used only in the possible combinations described here:

- 1) unique AC voltage on pins 2 and 3 of CN2;
- 2) AC voltage on pins 2 and 3 of CN1 and back up DC voltage on pins 1 and 4 of CN2;
- 3) DC voltage on pins 2 and 3 of CN1 and back up DC voltage on pins 1 and 4 of CN2;

Please remark that GND signal of CN1 is physically connected to -Vdc IN signal of CN2 to warrant the same ground potential between output voltage and DC input voltage; differently, in case 3 ground of DC input voltage is not physically connected to ground of regulated output voltage. In fact the two grounds differ of about 1.5 V, typical difference of potential due to the bridge rectifier.

In cases 2 and 3 **SBP 01** acts as an UPS, that is should the voltage on pins 2 and 3 black out the regulated output voltage is still present through back up input voltage, which is usually provided by an opportune battery.

## POWER PROVIDED

Power supply **SBP 01** can provide a maximum power that changes according to the model, as described in the following table:

MODEL	Vac Vdc IN	Power IN	Vdc OUT	Power OUT
<b>SBP 01</b>	6÷32 Vac or 8÷46 Vdc	27,5 W	5 Vdc	20 W
<b>SBP 01.12</b>	12÷32 Vac or 16÷46 Vdc	66,0 W	12 Vdc	48 W
<b>SBP 01.15</b>	14÷32 Vac or 19÷46 Vdc	82,5 W	15 Vdc	60 W
<b>SBP 01.24</b>	21÷32 Vac or 29÷46 Vdc	132,0 W	24 Vdc	96 W
<b>SBP 01-VT</b>	6÷32 Vac or 8÷46 Vdc	165,0 W	5÷40 Vdc	120 W
<b>SBP 01-VB</b>	7÷32 Vac or 9÷46 Vdc	165,0 W	5÷40 Vdc	120 W
<b>SBP 01-3T</b>	7÷28 Vac or 9÷40 Vdc	29,0 W	+5;+12;-12 Vdc	17,5;1,8;1,8 W

**FIGURE 30: POWER FOR EACH MODEL TABLE**

Values of input power reported are referred to average efficiency of power supply (80%) and increased of 10%. For safety it is always opportune to choose a greater power and an input voltage close to the maximum value reported. To obtain maximum output power it is essential to provide an input voltage with the features specified in figure 30 considering that such values are referred to an environmental temperature of 20 °C. Changes of this temperature may influence remarkably both maximum output power and output voltage: the user must employ all techniques to keep temperature in admitted range. Should thermal dissipation be insufficient, an additional heatsink can be mounted directly on IC1 switching regulator, fastening it the four holes in the top corner of the module. SBP 01 features components and circuits designed to reduce noise sensibility and increase efficiency; also, the lay out has been carefully tracked to carry the generated power in the best way possible, avoiding mass rings, instability, emissions, etc.

## EXTERNAL DEVICES FOR SBP 01

The seven models of **SBP 01** can supply most of **grifo®** cards, or many systems of other companies. Most common applications are to provide power supply to mother boards, galvanically isolated input and output sections, or to many **GPC® xxx** control cards. As an example here is reported a list with a short description of overall performances; for further information please consult specific documentation.

### **MB3 01 , MB4 01 , MB8 01 , WMB 12 , WMB 16 , MMB 21**

Mother Board 3, 4, 8, 12, 16, 21 slots

Motherboard with 3, 4, 8, 12, 16, or 21 slots of **ABACO®** industrial BUS industriale; slot pitch 4 or 5 TE; standardized power supply connectors; LEDs for supply visual feed back; local reset key; termination resistors on signals; holes for docking to rack 3 HE.

### **ABB 03**

**ABACO®** Block BUS 3 slots

3 slots **ABACO®** mother board; 4 TE pitch connectors; **ABACO®** I/O BUS connector; screw terminal for power supply; connection for DIN C type and  $\Omega$  rails.

### **OBI 01 - OBI 02**

Opto BLOCK Input NPN-PNP

Interface between 16 NPN, PNP optocoupled and displayed input lines, with screw terminal and **ABACO®** standard I/O 20 pins connector; power supply section; connection for DIN  $\Omega$  rails.

### **OBI N8 - OBI P8**

Opto BLOCK Input NPN-PNP

Interface between 8 NPN, PNP optocoupled and displayed input lines, with screw terminal and **ABACO®** standard I/O 20 pins connector; power supply section; connection for DIN  $\Omega$  rails.

### **TBO 01 - TBO 08**

Transistor BLOCK Output

Interface for **ABACO®** standard I/O 20 pins connector; 16 or 8 transistor output lines 45 Vdc 3 A open collector; screw terminal; optocoupled and displayed lines; connection for DIN 247277-1 and 3 rails.

### **RBO 08 - RBO 16**

Relé BLOCK Output

Interface for **ABACO®** standard I/O 20 pins connector; 8 or 16 displayed Relays 3A with MOV; screw terminal; connection for DIN Ctype and  $\Omega$  rails.

### **XBI 01**

miXed BLOCK Input Output

Interface for **ABACO®** standard I/O 20 pins connector; 8 transistor output lines 45 Vdc 3A; 8 input lines; screw terminal; optocoupled and displayed I/O lines; connection for DIN 247277-1 and 3 rails.

### **XBI R4 - XBI T4**

miXed BLOCK Input-Output

Interface for **ABACO®** standard I/O 20 pins connector; 4 Relays 3A with MOV or 4 optocoupled Transistors 3A open collectors; 4 input lines optocoupled; screw terminal; connection for DIN Ctype and  $\Omega$  rails.

**FBC xxx**

Flat Block Contactxxx pins

This interconnection system "wire to board" allows the connection to many type of flat cable connectors to terminal for external connections. Connection for DIN  $\Omega$  rails.  
for DIN 247277-1 and 3 rails; 4 type dimension.

**CI/O R16**

16 Coupled Input Output Relé

16 optocoupled input with  $\pi$ -filter; input voltage 24 Vdc. 16 micro-relays 1 A with disturb suppression by MOV 24 Vac. I/O visualized through LEDs; 8 bit BUS; standard addressing.

**PCI 01**

32 Peripheral Coupled Input

16 optocoupled input with  $\pi$ -filter; input voltage 24 Vdc; I/O visualized through LEDs; 8 or 16 bit BUS; standard addressing.

**JMS 34**

Jumbo Multifunction Support for axis control

Smart peripheral for axis control; 3 optocoupled inputs for acquisition of incremental bidirectional encoders; zero sign; 4 D/A converter channels 12 bits; output range  $\pm 10$  V; 8 NPN optocoupled inputs; 8 Open Collector transistor outputs 45 Vdc, 500 mA; all I/O visualized through LEDs; 8 bit BUS; extended addressing.

**GPC® 188F**

General Purpose Controller 80C188

80C188  $\mu$ P 20MHz; 1 RS 232 line; 1 RS 232, RS 422-485 or Current Loop line; 24 TTL I/O lines; 1M EPROM or 512K FLASH; 1M RAM Lithium battery backed; 8K serial EEPROM; RTC; Watch Dog; 8 Dip switch; 3 Timer Counter; 8 13 bit A/D lines; Power failure; activity LEDs; single power supply +5Vdc.

**GPC® 554**

General Purpose Controller 80C552

Microprocessor 80C552 at 22 MHz; implementation completely CMOS; 32K EPROM; 32 K SRAM; 32 K EEPROM or SRAM; EEPROM; 2 RS 232 serial lines; 16 I/O TTL; 2 PWM lines; 16 bits Timer/Counter; Watch Dog; 6 signals A/D converter with resolution 10 bit; interface for **ABACO®** I/O BUS.

**GPC® 154**

"4" Type General Purpose Controller Z80

84C15  $\mu$ P, 10÷16 MHz; Full CMOS; 1 RS 232 line; 1 RS 232 or RS 422-485 line; 16 TTL I/O lines; 2÷4 Timers Counters; 512K EPROM or FLASH; 512K RAM and RTC backed; 8K serial EEPROM; Watch dog; 2 readable DIPs; LCD Interface; Abaco® I/O BUS; 5Vdc Power supply; Size: 100x50 mm.

**IPC 52**

Intelligent Peripheral Controller, 24 analogic input

This intelligent peripheral card acquires 24 independent analogic input lines: 8 PT 100 or PT 1000 sensors, 8 J,K,S,T termocouples, 8 analog input  $\pm 2$ Vdc or 4÷20mA; 16 bits + sign A/D section; 0.1 °C resolution; 32K RAM for local data logging; buzzer; 16 TTL I/O lines; 5 or 8 conversion per second; facility of networking up to 127 IPC 52 cards using serial line. BUS interfacing or through RS 232, RS 422, RS 485 or current loop line. Only 5Vdc power supply.

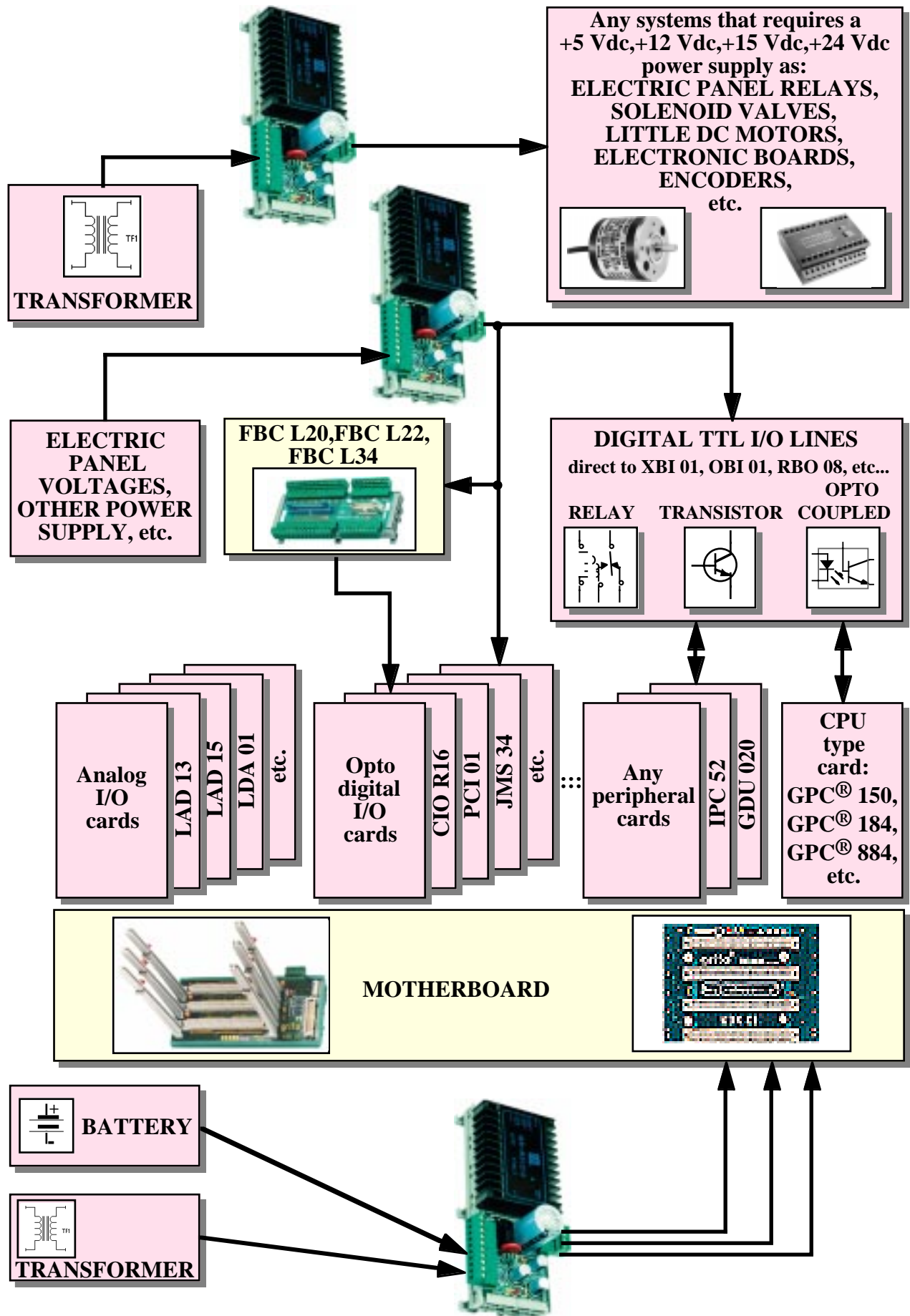


FIGURE 31: POSSIBLE CONNECTIONS DIAGRAM

## BIBLIOGRAPHY

In this chapter there is a complete list of technical books, where the user can find all the necessary documentations on the components mounted on **SBP 01**.

Manuals SGS: *Power supply application manual*  
*GS-R modules application manual*

Manual Motorola semiconductor: *Rectifiers and zener diodes data book*

Manual Harris: *Passive components data book*

For further information and upgrades please refer to specific internet web pages of the manufacturing companies.



## APPENDIX A: ALPHABETICAL INDEX

**SYMBOLS**

+12 VDC 12, 22  
+15 VDC 14  
+24 VDC 16  
+5 VDC 10, 22  
-12 VDC 22

**A**

ADJUSTABLE CURRENT 2, 20  
ADJUSTABLE VOLTAGE 2, 18

**B**

BLOCK FORMAT 2  
BRIDGE RECTIFIER 4

**C**

CARD VERSION 1  
CONNECTORS 6

**SBP 01**

CN1 10  
CN2 11

**SBP 01-12**

CN1 12  
CN2 13

**SBP 01-15**

CN1 14  
CN2 15

**SBP 01-24**

CN1 16  
CN2 17

**SBP 01-3T**

CN1 22  
CN2 23

**SBP 01-VB**

CN1 20  
CN2 21

**SBP 01-VT**

CN1 18  
CN2 19

CURRENT ADJUST REGULATION 7

**E**

EFFICENCE 4, 6

**F**

FILTERS 2, 5

FREQUENCY OF AC INPUT 6

**G**

GS-RXXXXX 4

**I**

INPUT VOLTAGES 7

**J**

JUMPERS 8

J2 10, 12, 14, 16, 18, 20, 22, 24

J3 10, 12, 14, 16, 18, 20, 22, 24

**L**

LEDS 2, 6, 26

**M**

MAXIMUM OUTPUT CURRENT 7

MAXIMUM OUTPUT POWER 7

MOUNTING 6

MOV 4

MTBF 4

**O**

OMEGA RAILS 2

OUTPUT CURRENT 2, 7

OUTPUT RIPPLE 7

OUTPUT SECTION 5

OUTPUT VOLTAGE 2, 7

OVERHEAT 6, 26

OVERLOAD 26

OVERLOAD 6

OVERVOLTAGE 6, 26

IN INPUT 26

IN OUTPUT 27

**P**

POWER FAILURE 2, 24  
POWER PROVIDED 28  
PRG I 21  
PRG V 19, 21  
PROTECTION 2, 4, 26  
PROTECTION FUSE 27

**R**

RELATIVE HUMIDITY 6  
RESET 2, 24  
RESET ACTIVATION 6  
RESET DURATION 6  
RESET TYPE 6

**S**

SENSE+ 8, 11, 13, 15, 17, 19, 21, 23  
SENSE- 8, 11, 13, 15, 17, 19, 21, 23  
SENSING 24  
SHORT CIRCUIT 26  
SIZE 6  
SOFT START 4  
SOFT START DELAY 6  
SWITCHING FREQUENCY 6  
SWITCHING REGULATOR 4

**T**

TEMPERATURE RANGE 6

**U**

UPS 2, 28

**V**

VOLTAGE ADJUST REGULATION 7

**W**

WEIGHT 6

