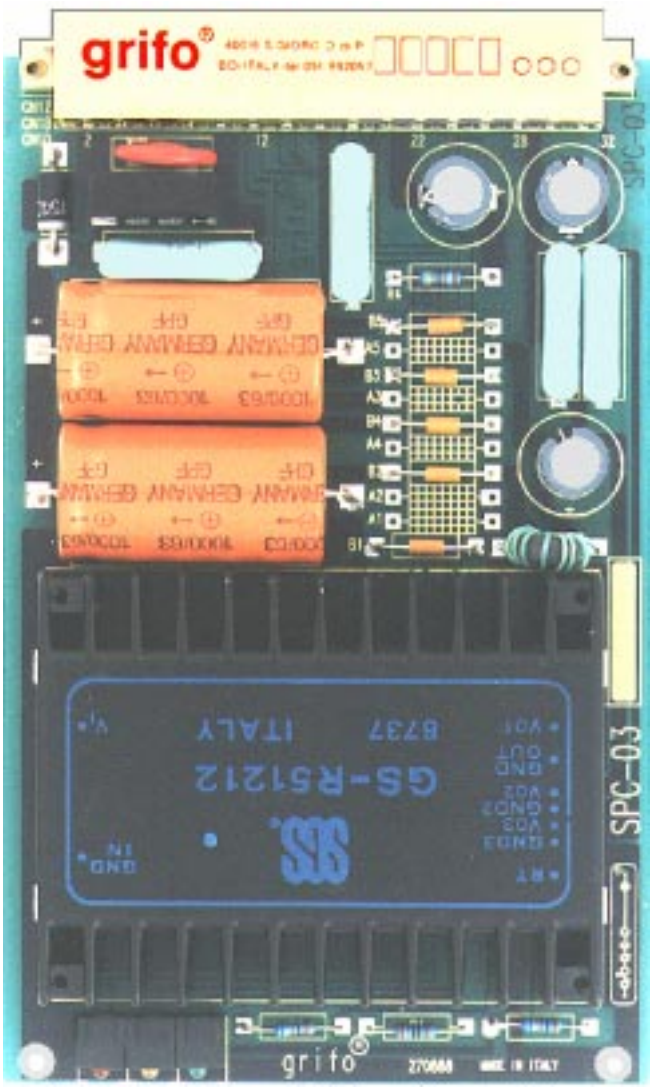
SPC 03

Switching Power Card 3 voltages

TECHNICAL MANUAL



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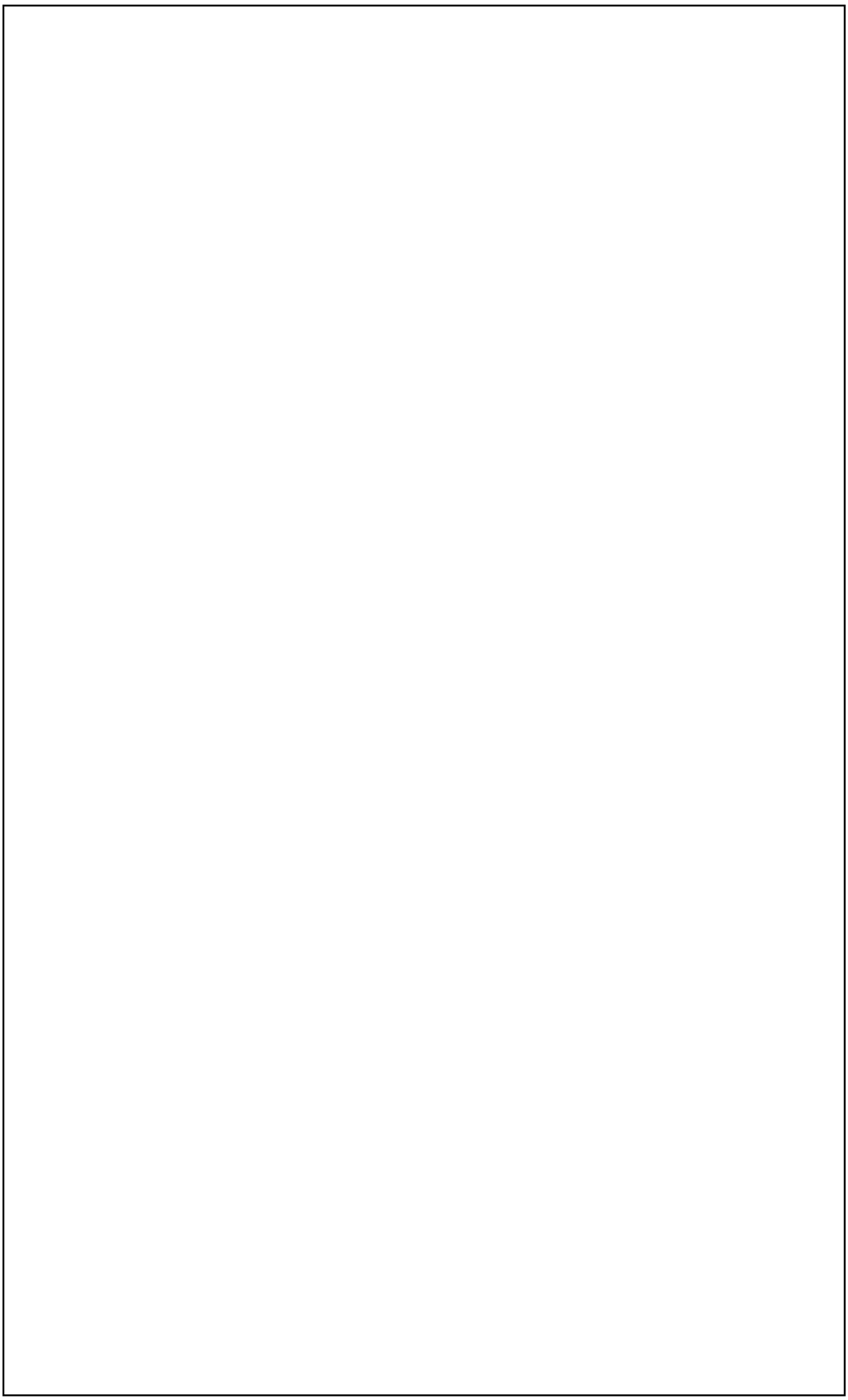
SPC 03 Rel. 5.00 *Edition 18 July 2002*



SPC 03

Switching Power Card 3 voltages

TECHNICAL MANUAL

Single Euro size measuring **100x160x25 mm**; electrical connections by the strong connector **DIN 41612** type **F**. Matching mechanically and electrcally to **YPB 01**, **SPB 04**, **SPB 08**, etc. 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; **reference** and **regolation** signals available on connector. Protection on over temperature, over output voltage and short circuit. Input for auxiliary voltage from a 12, 24 Vdc battery, for **UPS** function. Medium performance higher than **80%**. Required voltage: **8÷28 Vac** or **12÷40 Vdc** (according to selected model). Generated voltages: variable according with selected model as below described:

Model	Voltage	Current
SPC 03	5 Vdc	4 A
SPC 03.12	12 Vdc	4 A
SPC 03.15	15 Vdc	4 A
SPC 03.24	24 Vdc	4 A
SPC 03.VT	5÷40 Vdc	4 A
SPC 03.VB	5÷40 Vdc	0.2÷4 A
SPC 03.3T	+5; +12; -12 Vdc	3.5; 0.15; 0.15 A

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IMPORTANT

Although all the information contained herein have been carefully verified, **grifo®** assumes no responsability for errors that might appear in this document, or for damage to things or persons resulting from technical errors, omission and improper use of this manual and of the related software and hardware.
grifo® reserves the right to change the contents and form of this document, as well as the features and specification of its products at any time, without prior notice, to obtain always the best product.
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

Trade Marks

GENERAL INDEX

FIGURE INDEX

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 enviroment, 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 rispect 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 **SPC 03** card release **270888** 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 on board printed diagram (serigraph) and printed circuit (for example on the bottom edge on the component side, or inside JAF component area on the solder side).

GENERAL FEATURES

The **SPC 03** module is a complete switching power supply with standard **single Europa** size suited for **ABACO®** and **GPC®** cards. This feature allows a direct use inside **3HE Rack** together with the cards it supplies power to and it simplifies the mounting and replacement of the same cards. Moreover it is designed to match to other **motherboards** as **YPB 01, SPB 04, SPB 08,** etc obtaining a significant time reduction for install and link phases.
The **SPC 03** 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 **SPC 03** 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 **SPC 03** 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
SPC 03	5 Vdc	4 A	With Power Failure
SPC 03.12	12 Vdc	4 A	-
SPC 03.15	15 Vdc	4 A	-
SPC 03.24	24 Vdc	4 A	-
SPC 03.VT	5÷40 Vdc	4 A	Voltage regulated
SPC 03.VB	5÷40 Vdc	0.2÷4 A	Voltage and current regulated
SPC 03.3T	+5; +12; -12 Vdc	3.5; 0.15; 0.15 A	With Power Failure

The total supplied power is about 50 W in ambient temperature up to 60 °C, but with a proper forced ventilation a power of 120 W can be reached without problems.

- Single Europa size measuring **100x160x25 mm**
- Electrical connection by the strong connector **DIN 41612** type **F**
- Matching mechanically and electrcally to **YPB 01**, **SPB 04**, **SPB 08**, etc.
- 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
- **Reference** and **regolation** signals available on connector
- Protection on over temperature, over output voltage and short circuit
- Input for auxiliary voltage from a 12, 24 Vdc battery, for **UPS** function
- Medium performance higher than **80%**
- Required voltage: **8÷28 Vac** or **12÷40 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 pleare refer to figure 1.

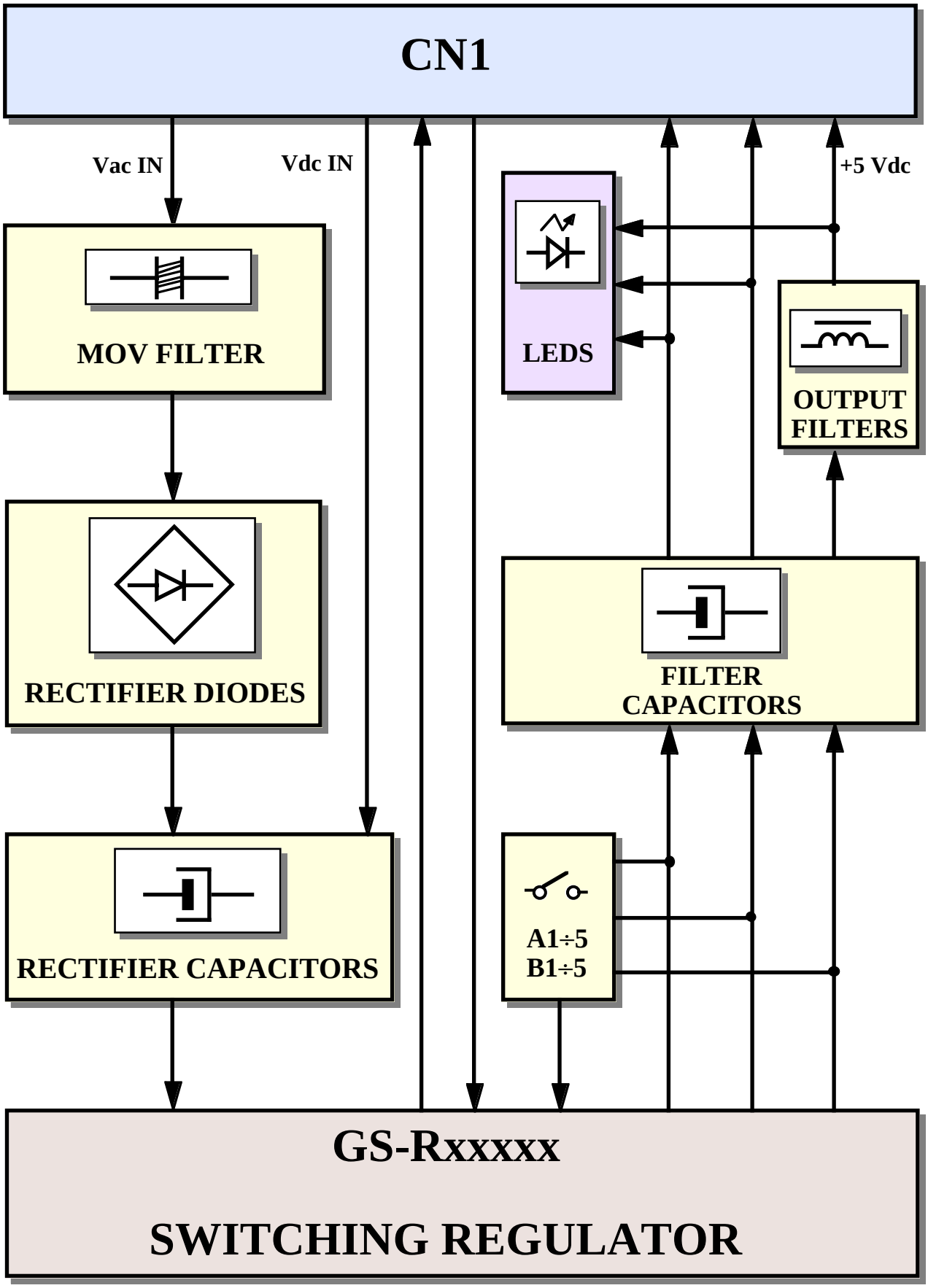

FIGURE 1: BLOCK DIAGRAM

RECTIFIER SECTION

The alternate (AC) input voltage to **SPC 03** is filtered through a MOV, which eliminates transients, then it is rectified by the specific rectifing section that generates a DC voltage for the switching power supply. Rectifing section is made of a simple bridge rectifier with capacitors that assure a direct (DC) voltage erogation in all the operating conditions of the power supply. Components are selected to reduce the value of ripple of the switching regulator input, whatever input voltages or output loads are connected. Rectifier section is always present but, as indicated in the block diagram, it 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 of input voltage.

SWITCHING REGULATOR

SPC 03 power supplies are based on an efficent switching regulator that performs the task to keep the output voltage under control and to 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/peformance rate and a good reliability, due also to its almost total absence of external components. Including all the 7 models of **SPC 03**, the overall features of switching regulation section are:

- soft start of power supply after a power on
- high efficency, up to 80%
- protection against overcurrent or output short circuit
- protection against overheat
- protection against output overvoltage
- 100 KHz switching frequency
- step down regulation
- automatic compensation of voltage drop due to connection cables
- generation of /RESET signal for power failure functionality
- signal (INHIBIT) that disable and enable the regulator
- 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 efficence 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 **SPC 03** and its differences respect to the above listed features:

MODEL	REGULATOR	/RESET	INHIBIT	SENSING
SPC 03	GS-R405S	YES	YES	YES
SPC 03.12	GS-R400V	NO	YES	YES
SPC 03.15	GS-R400V	NO	YES	YES
SPC 03.24	GS-R400V	NO	YES	YES
SPC 03.VT	GS-R400V	NO	YES	YES
SPC 03.VB	GS-R400VB	NO	YES	YES
SPC 03.3T	GS-R51212	YES	NO	NO

FIGURE 2: SWITCHING REGULATORS GS-RXXXXX

OUTPUT SECTION AND FILTERS

Output section of **SPC 03** simply filters the stabilized voltages generated by the switching regulator through specifc 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. As described in the block diagram +5 Vdc output voltage is provided with further filter that reduces high frequency noise.
Another feature of output section is to include some jumpers (A1÷A5 and B1÷B5) that allow the card configuration for the requested model; these jumpers are connected by **grifo®** technicians during mounting phase and they can't be changed by the user.

TECHNICAL FEATURES

GENERAL FEATURES

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

PHYSICAL FEATURES

Size:	100 x 160 x 25 mm
Weight:	320 g
Mounting:	rack 3HE
Connectors:	CN1: DIN 41612 type F; 48 pins on rows d, b, z; male; 90°
Temperature range:	0÷70 °C
Relative humidity:	20%÷90% (without condense)

ELECTRIC FEATURES

Input voltages:	**SPC 03**	= 6÷32 Vac or 8÷46 Vdc
	SPC 03.12	= 12÷32 Vac or 16÷46 Vdc
	SPC 03.15	= 14÷32 Vac or 19÷46 Vdc
	SPC 03.24	= 21÷32 Vac or 29÷46 Vdc
	SPC 03.VT	= 6÷32 Vac or 8÷46 Vdc
	SPC 03.VB	= 7÷32 Vac or 9÷46 Vdc
	SPC 03.3T	= 7÷28 Vac or 9÷40 Vdc
Output voltages:	**SPC 03**	= 5 Vdc
	SPC 03.12	= 12 Vdc
	SPC 03.15	= 15 Vdc
	SPC 03.24	= 24 Vdc
	SPC 03.VT	= 5÷40 Vdc adjustable by user
	SPC 03.VB	= 5÷40 Vdc adjustable by user
	SPC 03.3T	= 5 Vdc; +12 Vdc; -12 Vdc
Output ripple:	typical 30 mV; maximum 150 mV	
Voltage/temperature drift:	1,6 mV/°C	
Output current (*):	**SPC 03**	= 4 A
	SPC 03.12	= 4 A
	SPC 03.15	= 4 A
	SPC 03.24	= 4 A
	SPC 03.VT	= 4 A
	SPC 03.VB	= 0,2÷4 A adjustable by user
	SPC 03.3T	= 3,5 A; 0,15 A; 0,15 A
Minimum output current:	0,2 A	
Maximum output power:	120 W	
Voltage adjust regulation resistor:	$0 \leq R_{PRGV} \leq 18$ KΩ	
Current adjust regulation resistor:	$R_{PRGI} \geq 2,2$ KΩ	

(*) Data here reported are referred to a 20 centigrad degreeeses 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 locations and functions of each connectors, LEDs and some explanatory diagrams that show the best operating conditions and suggested use modalities.

VISUAL FEEDBACK

SPC 03 modules are provided with LEDs to signal status conditions, as described in the following table:

LED	COLOUR	DESCRIPTION
L1	Red	Indicates the presence of +5 Vdc OUT, +15 Vdc OUT, +124 Vdc OUT, +Vdc OUT stabilized voltage connected to pins 16d,b,z or 12d of CN1 (available on all models, except **SPC 03.12**).
L2	Yellow	Indicates the presence of +12 Vdc OUT stabilized voltage connected to pins 24d,b,z of CN1 (available only on **SPC 03.12** and **SPC 03.3T** models).
L3	Green	Indicates the presence of -12 Vdc OUT stabilized voltage connected to pins 32z of CN1 (available only on **SPC 03.3T** model).

FIGURE 3: 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 (**SPC 03.VT** and **SPC 03.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 4.

CONNECTIONS

The **SPC 03** power supply has one connector 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 detailed regulation description, for each one of the 7 models. The following connectors views use standard numeration of pins: such numeration is easily recognizable by connector internal print or board printed serigraph.
DIN 41612 type F connector, that can be connected directly to **grifo®** cards like **YPB 01**, **SPB 04**, **SPB 08**, simplifies cabling phase and allows a faster replacement of the whole power supply in case of possible damage or manteinance. Moreover, the wide contact surface assures a good transport of power provided and fetched. Value of input voltages and powers varies in a wide range as described in paragraphs “ELECTRIC FEATURES” and “POWER PROVIDED”.

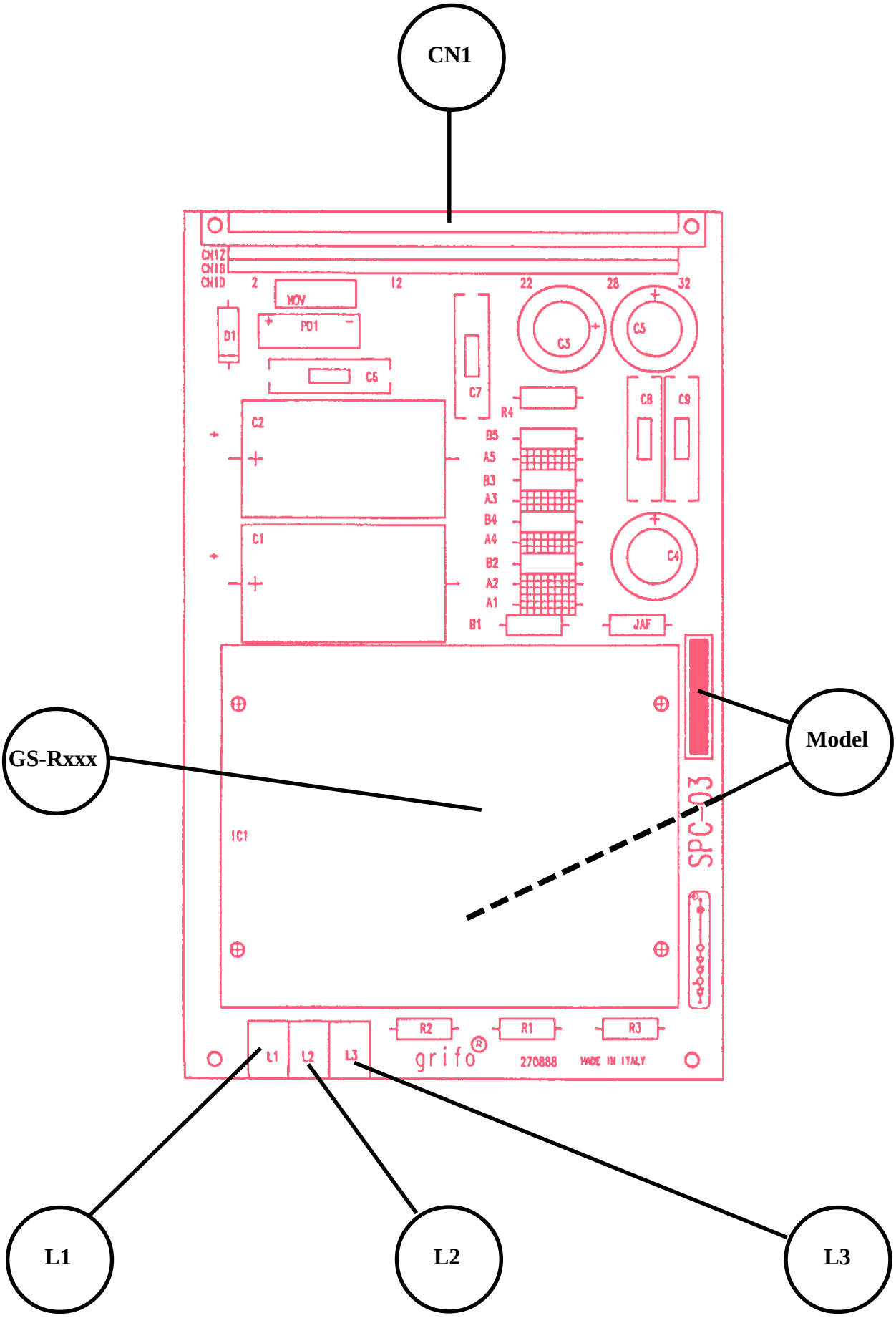

FIGURE 4: LEDS, CONNECTORS, ETC., LOCATION

SPC 03

CN1 - CONNECTION CONNECTOR OF SPC 03

CN1 is a DIN 41612 type F connector; with 48 pins placed on rows d, b, z; male; 90 °.
Through CN1 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage. It also allows to take the regulated output voltage that can be connected to the external device to supply. Finally it has some signals related to sensing and control circutery of switching section.

PIN	Row d	Row b	Row z	PIN
2	+Vdc IN	+Vdc IN	+Vdc IN	2
4	Vac1 IN	Vac1 IN	Vac1 IN	4
6	Vac1 IN	Vac1 IN	Vac1 IN	6
8	Vac2 IN	Vac2 IN	Vac2 IN	8
10	Vac2 IN	Vac2 IN	Vac2 IN	10
12	N.C.	N.C.	/RESET	12
14	N.C.	N.C.	INHIBIT	14
16	+5 Vdc OUT	+5 Vdc OUT	+5 Vdc OUT	16
18	SENSE+	N.C.	SENSE-	18
20	-Vdc IN , GND +5	-Vdc IN , GND +5	-Vdc IN , GND +5	20
22	-Vdc IN , GND +5	-Vdc IN , GND +5	-Vdc IN , GND +5	22
24	N.C.	N.C.	N.C.	24
26	N.C.	N.C.	N.C.	26
28	N.C.	N.C.	N.C.	28
30	N.C.	N.C.	N.C.	30
32	N.C.	N.C.	N.C.	32

FIGURE 5: CN1 - SPC 03 CONNECTOR

Signals description:

Vac1 IN	=	I	- AC input voltage.
Vac2 IN	=	I	- AC input voltage.
+Vdc IN	=	I	- Positive terminal of DC input voltage.
-Vdc IN	=		- Negative terminal of DC input voltage.
+5 Vdc OUT	=	O	- Positive terminal of +5 Vdc regulated output voltage.
GND +5	=		- Negative terminal of regulated output voltage.
SENSE+	=	I	- Positive terminal of sensing signal.
SENSE-	=	I	- Negative terminal of sensing signal.
/RESET	=	O	- Valid +5 Vdc output voltage signal.
INHIBIT	=	I	- Signal that disable switching section.
N.C.	=		- Not connected.

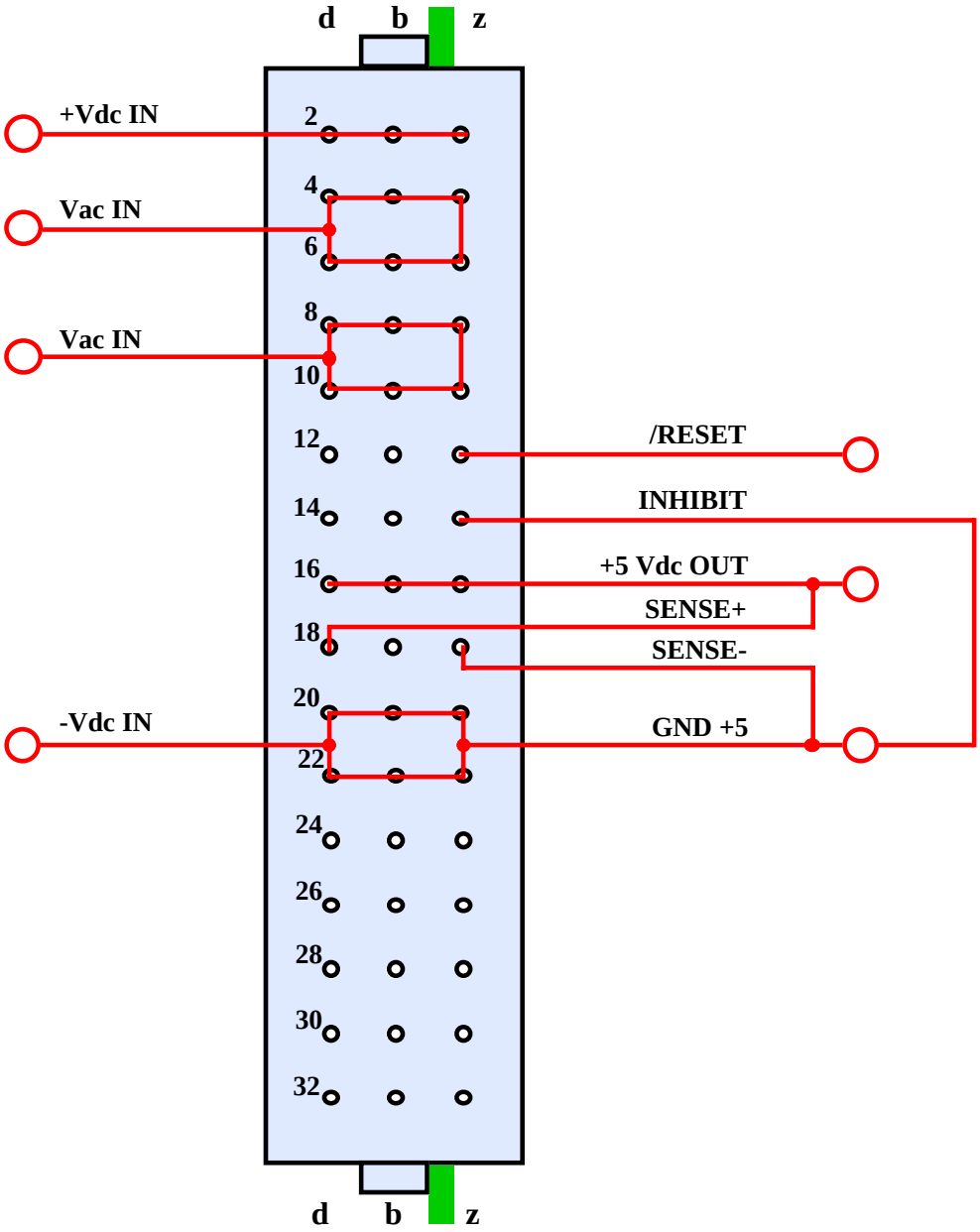

FIGURE 6: CN1 CONNECTION EXAMPLE ON SPC 03

SPC 03.12

CN1 - CONNECTION CONNECTOR OF SPC 03.12

CN1 is a DIN 41612 type F connector; with 48 pins placed on rows d, b, z; male; 90 °.
Through CN1 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage. It also allows to take the regulated output voltage that can be connected to the external device to supply. Finally it has some signals related to sensing and control circutery of switching section.

PIN	Row d	Row b	Row z	PIN
2	+Vdc IN	+Vdc IN	+Vdc IN	2
4	Vac1 IN	Vac1 IN	Vac1 IN	4
6	Vac1 IN	Vac1 IN	Vac1 IN	6
8	Vac2 IN	Vac2 IN	Vac2 IN	8
10	Vac2 IN	Vac2 IN	Vac2 IN	10
12	N.C.	N.C.	N.C.	12
14	N.C.	N.C.	INHIBIT	14
16	N.C.	N.C.	N.C.	16
18	N.C.	N.C.	N.C.	18
20	N.C.	N.C.	N.C.	20
22	N.C.	N.C.	N.C.	22
24	+12 Vdc OUT	+12 Vdc OUT	+12 Vdc OUT	24
26	SENSE-	N.C.	SENSE+	26
28	-Vdc IN , GND +12	-Vdc IN , GND +12	-Vdc IN , GND +12	28
30	-Vdc IN , GND +12	-Vdc IN , GND +12	-Vdc IN , GND +12	30
32	N.C.	N.C.	N.C.	32

FIGURE 7: CN1 - SPC 03.12 CONNECTOR

Signals description:

Vac1 IN	=	I	- AC input voltage.
Vac2 IN	=	I	- AC input voltage.
+Vdc IN	=	I	- Positive terminal of DC input voltage.
-Vdc IN	=		- Negative terminal of DC input voltage.
+12 Vdc OUT	=	O	- Positive terminal of +12 Vdc regulated output voltage.
GND +12	=		- Negative terminal of regulated output voltage.
SENSE+	=	I	- Positive terminal of sensing signal.
SENSE-	=	I	- Negative terminal of sensing signal.
INHIBIT	=	I	- Signal that disable switching section.
N.C.	=		- Not connected.

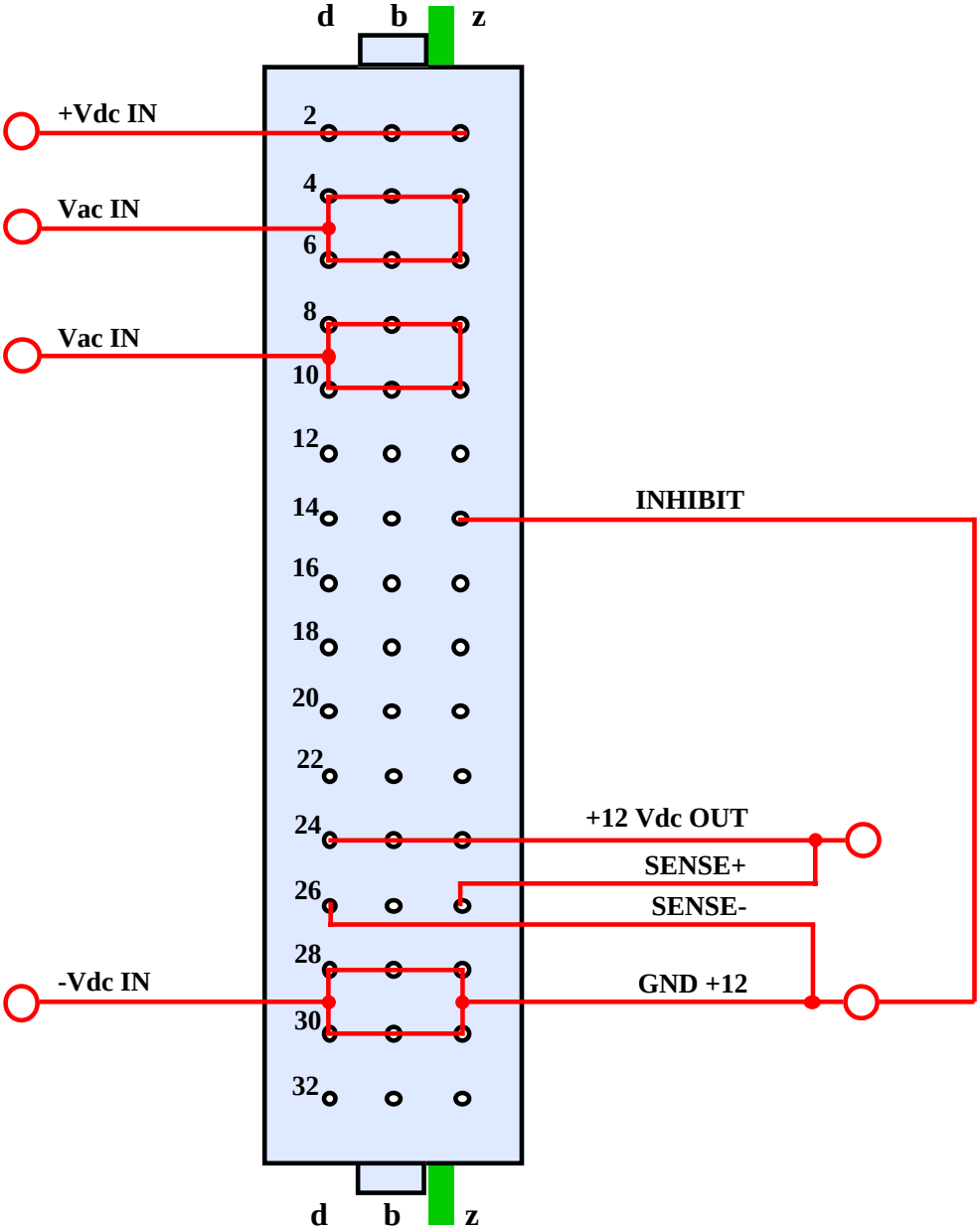

FIGURE 8: CN1 CONNECTION EXAMPLE ON SPC 03.12

SPC 03.15

CN1 - CONNECTION CONNECTOR OF SPC 03.15

CN1 is a DIN 41612 type F connector; with 48 pins placed on rows d, b, z; male; 90 °.
Through CN1 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage. It also allows to take the regulated output voltage that can be connected to the external device to supply. Finally it has some signals related to sensing and control circutery of switching section.

PIN	Row d	Row b	Row z	PIN
2	+Vdc IN	+Vdc IN	+Vdc IN	2
4	Vac1 IN	Vac1 IN	Vac1 IN	4
6	Vac1 IN	Vac1 IN	Vac1 IN	6
8	Vac2 IN	Vac2 IN	Vac2 IN	8
10	Vac2 IN	Vac2 IN	Vac2 IN	10
12	+15 Vdc OUT	N.C.	N.C.	12
14	N.C.	N.C.	INHIBIT	14
16	N.C.	N.C.	N.C.	16
18	SENSE+	N.C.	SENSE-	18
20	-Vdc IN , GND +15	-Vdc IN , GND +15	-Vdc IN , GND +15	20
22	-Vdc IN , GND +15	-Vdc IN , GND +15	-Vdc IN , GND +15	22
24	N.C.	N.C.	N.C.	24
26	N.C.	N.C.	N.C.	26
28	N.C.	N.C.	N.C.	28
30	N.C.	N.C.	N.C.	30
32	N.C.	N.C.	N.C.	32

FIGURE 9: CN1 - SPC 03.15 CONNECTOR

Signals description:

Vac1 IN	=	I	- AC input voltage.
Vac2 IN	=	I	- AC input voltage.
+Vdc IN	=	I	- Positive terminal of DC input voltage.
-Vdc IN	=		- Negative terminal of DC input voltage.
+15 Vdc OUT	=	O	- Positive terminal of +15 Vdc regulated output voltage.
GND +15	=		- Negative terminal of regulated output voltage.
SENSE+	=	I	- Positive terminal of sensing signal.
SENSE-	=	I	- Negative terminal of sensing signal.
INHIBIT	=	I	- Signal that disable switching section.
N.C.	=		- Not connected.

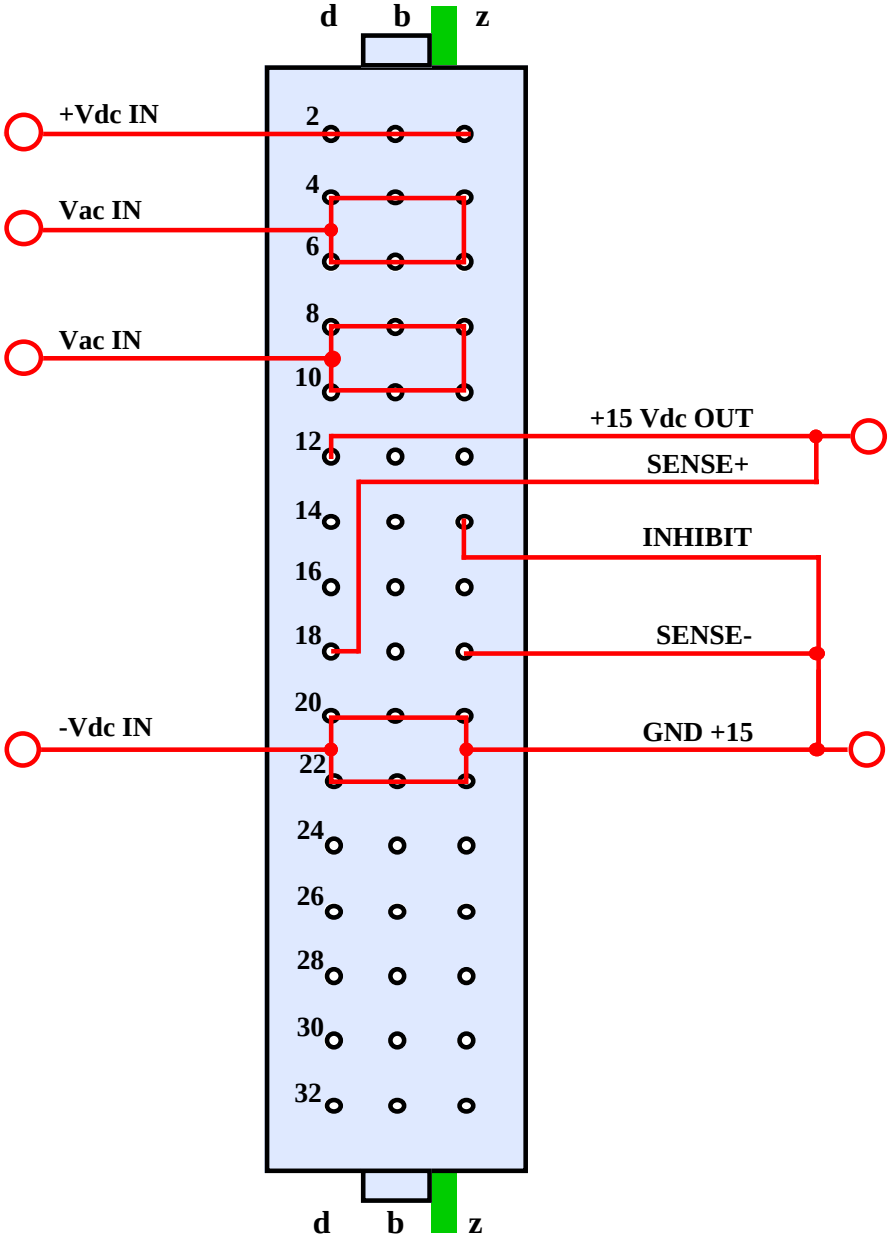

FIGURE 10: CN1 CONNECTION EXAMPLE ON SPC 03.15

SPC 03.24

CN1 - CONNECTION CONNECTOR OF SPC 03.24

CN1 is a DIN 41612 type F connector; with 48 pins placed on rows d, b, z; male; 90 °.
Through CN1 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage. It also allows to take the regulated output voltage that can be connected to the external device to supply. Finally it has some signals related to sensing and control circutery of switching section.

PIN	Row d	Row b	Row z	PIN
2	+Vdc IN	+Vdc IN	+Vdc IN	2
4	Vac1 IN	Vac1 IN	Vac1 IN	4
6	Vac1 IN	Vac1 IN	Vac1 IN	6
8	Vac2 IN	Vac2 IN	Vac2 IN	8
10	Vac2 IN	Vac2 IN	Vac2 IN	10
12	+24 Vdc OUT	N.C.	N.C.	12
14	N.C.	N.C.	INHIBIT	14
16	N.C.	N.C.	N.C.	16
18	SENSE+	N.C.	SENSE-	18
20	-Vdc IN , GND +24	-Vdc IN , GND +24	-Vdc IN , GND +24	20
22	-Vdc IN , GND +24	-Vdc IN , GND +24	-Vdc IN , GND +24	22
24	N.C.	N.C.	N.C.	24
26	N.C.	N.C.	N.C.	26
28	N.C.	N.C.	N.C.	28
30	N.C.	N.C.	N.C.	30
32	N.C.	N.C.	N.C.	32

FIGURE 11: CN1 - SPC 03.24 CONNECTOR

Signals description:

Vac1 IN	=	I	- AC input voltage.
Vac2 IN	=	I	- AC input voltage.
+Vdc IN	=	I	- Positive terminal of DC input voltage.
-Vdc IN	=		- Negative terminal of DC input voltage.
+24 Vdc OUT	=	O	- Positive terminal of +24 Vdc regulated output voltage.
GND +24	=		- Negative terminal of regulated output voltage.
SENSE+	=	I	- Positive terminal of sensing signal.
SENSE-	=	I	- Negative terminal of sensing signal.
INHIBIT	=	I	- Signal that disable switching section.
N.C.	=		- Not connected.

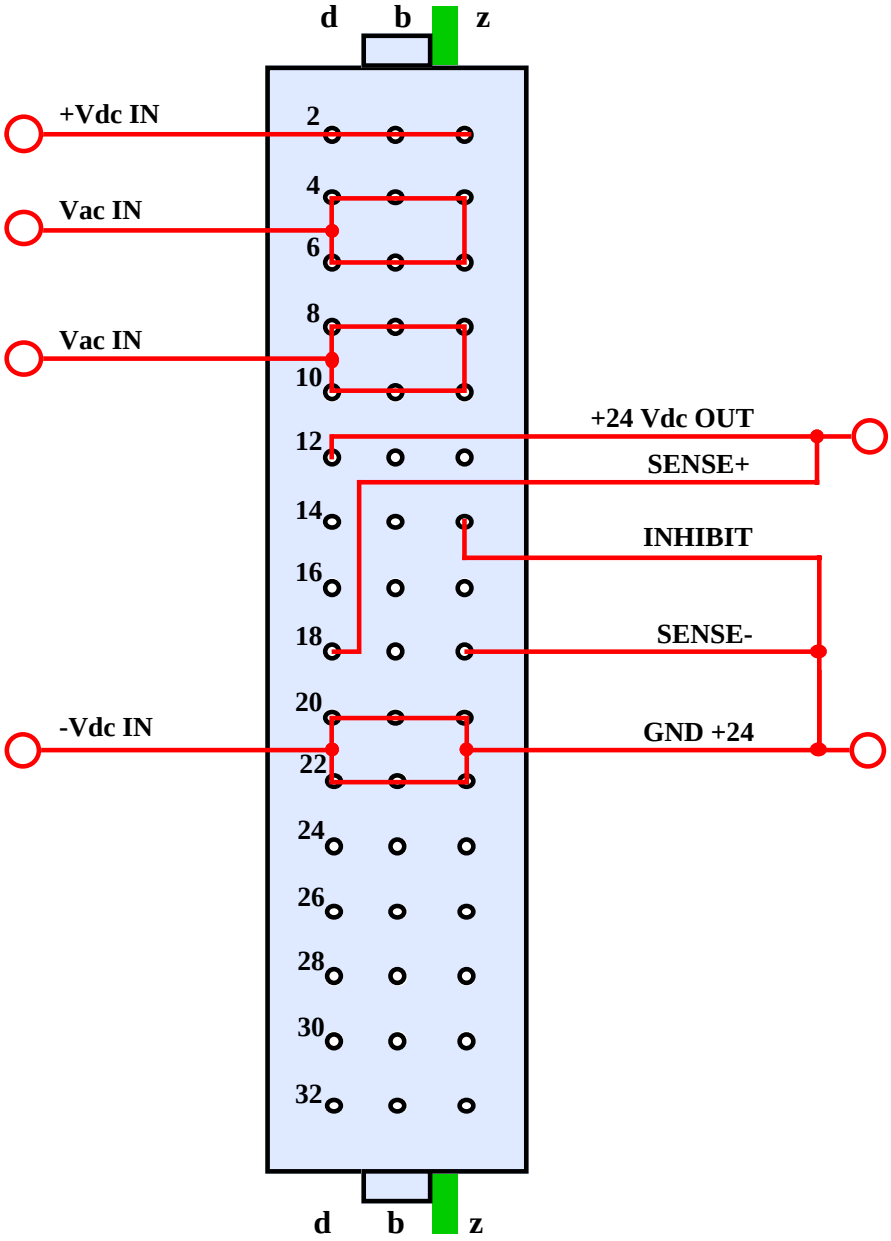

FIGURE 12: CN1 CONNECTION EXAMPLE ON SPC 03.24

SPC 03.VT

CN1 - CONNECTION CONNECTOR OF SPC 03.VT

CN1 is a DIN 41612 type F connector; with 48 pins placed on rows d, b, z; male; 90 °.
Through CN1 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage. It also allows to take the regulated output voltage that can be connected to the external device to supply. Finally it has some signals related to sensing and control circutery of switching section.

PIN	Row d	Row b	Row z	PIN
2	+Vdc IN	+Vdc IN	+Vdc IN	2
4	Vac1 IN	Vac1 IN	Vac1 IN	4
6	Vac1 IN	Vac1 IN	Vac1 IN	6
8	Vac2 IN	Vac2 IN	Vac2 IN	8
10	Vac2 IN	Vac2 IN	Vac2 IN	10
12	+Vdc OUT	N.C.	N.C.	12
14	PRG V	N.C.	INHIBIT	14
16	N.C.	N.C.	N.C.	16
18	SENSE+	N.C.	SENSE-	18
20	-Vdc IN , GND	-Vdc IN , GND	-Vdc IN , GND	20
22	-Vdc IN , GND	-Vdc IN , GND	-Vdc IN , GND	22
24	N.C.	N.C.	N.C.	24
26	N.C.	N.C.	N.C.	26
28	N.C.	N.C.	N.C.	28
30	N.C.	N.C.	N.C.	30
32	N.C.	N.C.	N.C.	32

FIGURE 13: CN1 - SPC 03.VT CONNECTOR

Signals description:

Vac1 IN	=	I	- AC input voltage.
Vac2 IN	=	I	- AC input voltage.
+Vdc IN	=	I	- Positive terminal of DC input voltage.
-Vdc IN	=		- Negative terminal of DC input voltage.
+Vdc OUT	=	O	- Positive terminal of regulated output voltage, adjustable 5÷40 Vdc.
GND	=		- Negative terminal of regulated output voltage.
SENSE+	=	I	- Positive terminal of sensing signal.
SENSE-	=	I	- Negative terminal of sensing signal.
INHIBIT	=	I	- Signal that disable switching section.
PRG V	=	I	- Signal that adjust and derfines output voltage.
N.C.	=		- Not connected.

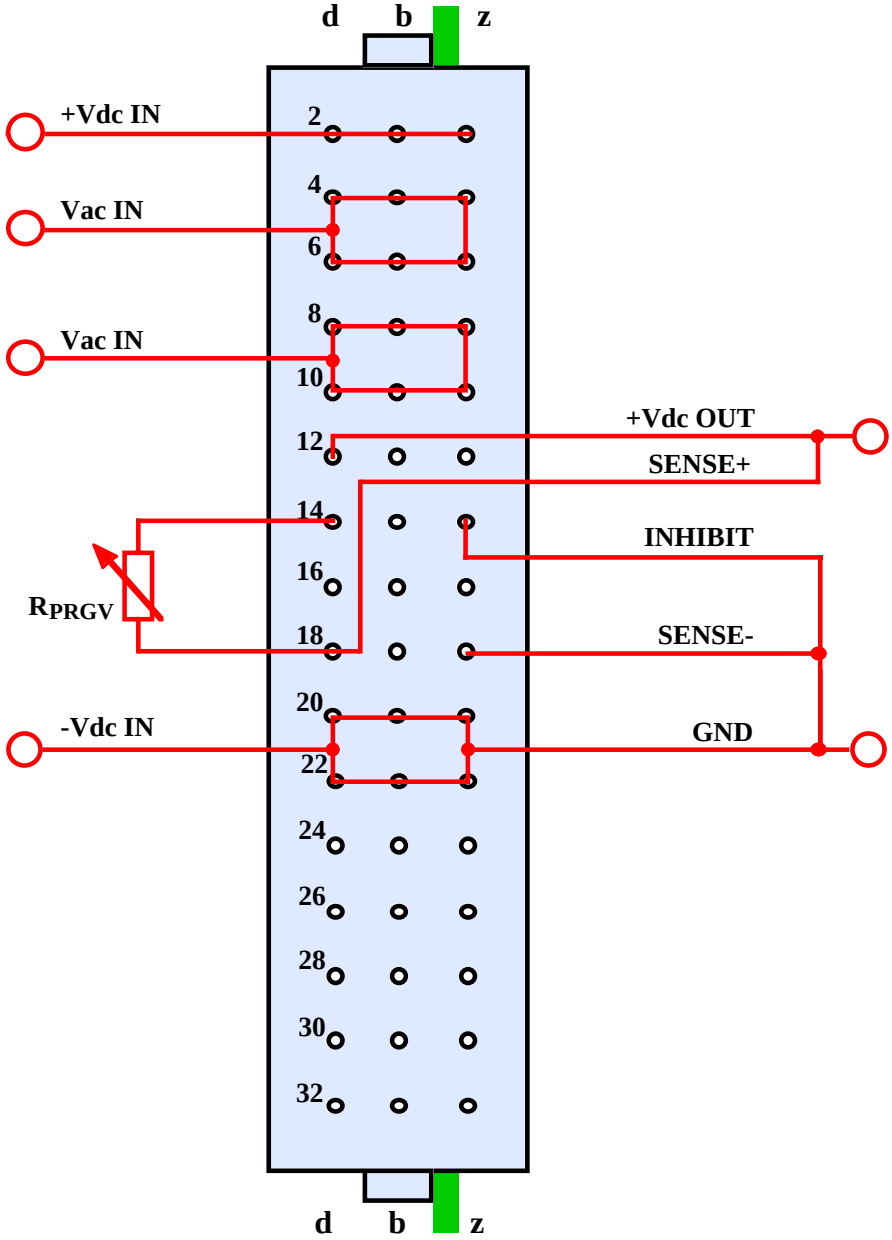

FIGURE 14: CN1 CONNECTION EXAMPLE ON SPC 03.VT

OUTPUT VOLTAGE ADJUST FOR SPC 03.VT

The regulated output voltage +Vdc OUT can be adjusted through a resistor R_{PRGV} connected on pin 18d (SENSE+) and the specific pin 14d (PRG V) of CN1. The value of such resistor is obtained by the following formula: **R_{PRGV} =2.67*((+Vdc OUT/5.1)-1) KΩ**
so it may vary in the range 0÷18 KΩ corresponding to a variable output voltage in the range 5÷40 Vdc. To obtain an adjustable output voltage power supply it is sufficient to connect a 18 KΩ potentiometer or trimmer, as rheostat, between pins 14d and 18d of CN1, as descirbed on figure 14.

SPC 03.VB

CN1 - CONNECTION CONNECTOR OF SPC 03.VB

CN1 is a DIN 41612 type F connector; with 48 pins placed on rows d, b, z; male; 90 °.
Through CN1 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage. It also allows to take the regulated output voltage that can be connected to the external device to supply. Finally it has some signals related to sensing and control circutery of switching section.

PIN	Row d	Row b	Row z	PIN
2	+Vdc IN	+Vdc IN	+Vdc IN	2
4	Vac1 IN	Vac1 IN	Vac1 IN	4
6	Vac1 IN	Vac1 IN	Vac1 IN	6
8	Vac2 IN	Vac2 IN	Vac2 IN	8
10	Vac2 IN	Vac2 IN	Vac2 IN	10
12	+Vdc OUT	N.C.	N.C.	12
14	PRG V	PRG I	INHIBIT	14
16	N.C.	N.C.	N.C.	16
18	SENSE+	N.C.	SENSE-	18
20	-Vdc IN , GND	-Vdc IN , GND	-Vdc IN , GND	20
22	-Vdc IN , GND	-Vdc IN , GND	-Vdc IN , GND	22
24	N.C.	N.C.	N.C.	24
26	N.C.	N.C.	N.C.	26
28	N.C.	N.C.	N.C.	28
30	N.C.	N.C.	N.C.	30
32	N.C.	N.C.	N.C.	32

FIGURE 15: CN1 - SPC 03.VB CONNECTOR

Signals description:

Vac1 IN	=	I	- AC input voltage.
Vac2 IN	=	I	- AC input voltage.
+Vdc IN	=	I	- Positive terminal of DC input voltage.
-Vdc IN	=		- Negative terminal of DC input voltage.
+Vdc OUT	=	O	- Positive terminal of regulated output voltage, adjustable 5÷40 Vdc.
GND	=		- Negative terminal of regulated output voltage.
SENSE+	=	I	- Positive terminal of sensing signal.
SENSE-	=	I	- Negative terminal of sensing signal.
INHIBIT	=	I	- Signal that disable switching section.
PRG V	=	I	- Signal that adjust and derfines output voltage.
PRG I	=	I	- Signal that adjust and derfines maximum output current.
N.C.	=		- Not connected.

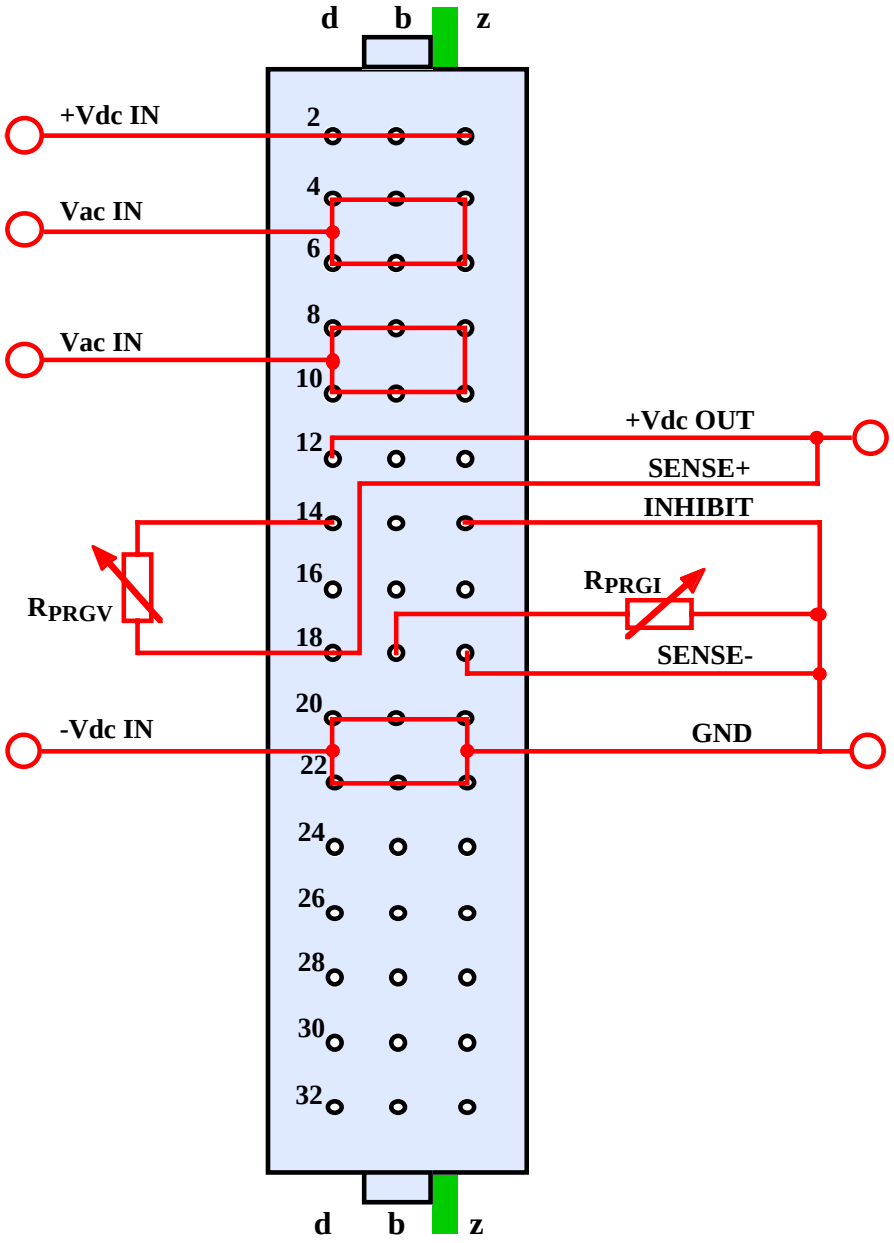

FIGURE 16: CN1 CONNECTION EXAMPLE ON SPC 03.VB

OUTPUT VOLTAGE AND CURRENT ADJUST FOR SPC 03.VB

The regulated output voltage +Vdc OUT can be adjusted through a resistor R_{PRGV} connected on pin 18d (SENSE+) and the specific pin 14d (PRG V) of CN1. The value of such resistor is obtained by the following formula: **R_{PRGV} =2.67*((+Vdc OUT/5.1)-1) KΩ**
so it may vary in range 0÷18 KΩ corresponding to a variable output voltage in the range 5÷40 Vdc.
The maximum current before overload protection intervents can be adjusted through another resistor R_{PRGI} connected on pin 18z (SENSE-) and the specific pin 18b (PRG I) of CN1. The value of such resistor is given by: **R_{PRGI} =5.08*IPROT+1.18 KΩ**
so must be greater than 2,2 KΩ corresponding to the minimum 0.2 A output current.
To obtain an adjustable output voltage and current power supply it is enough to connect two potentiometers or trimmers, as rheostats: a 18 KΩ between pins between pins 14d and 18d of CN1, a 2,2 KΩ between pins 18z and 18b of CN1, as descirbed on figure 16.

SPC 03.3T

CN1 - CONNECTION CONNECTOR OF SPC 03.3T

CN1 is a DIN 41612 type F connector; with 48 pins placed on rows d, b, z; male; 90 °.
Through CN1 any kind of external generator (like a transformer, a battery, another power supply, etc.) can provide AC or DC input voltage. It also allows to take the regulated output voltage that can be connected to the external device to supply. Finally it has some signals related to sensing and control circutery of switching section.

PIN	Row d	Row b	Row z	PIN
2	+Vdc IN	+Vdc IN	+Vdc IN	2
4	Vac1 IN	Vac1 IN	Vac1 IN	4
6	Vac1 IN	Vac1 IN	Vac1 IN	6
8	Vac2 IN	Vac2 IN	Vac2 IN	8
10	Vac2 IN	Vac2 IN	Vac2 IN	10
12	N.C.	N.C.	/RESET	12
14	N.C.	N.C.	N.C.	14
16	+5 Vdc OUT	+5 Vdc OUT	+5 Vdc OUT	16
18	N.C.	N.C.	N.C.	18
20	-Vdc IN , GND +5	-Vdc IN , GND +5	-Vdc IN , GND +5	20
22	-Vdc IN , GND +5	-Vdc IN , GND +5	-Vdc IN , GND +5	22
24	+12 Vdc OUT	+12 Vdc OUT	+12 Vdc OUT	24
26	N.C.	N.C.	N.C.	26
28	GND +12	GND +12	GND +12	28
30	GND +12	GND +12	GND +12	30
32	GND -12	N.C.	-12 Vdc OUT	32

FIGURE 17: CN1 - SPC 03.3T CONNECTOR

Signals description:

Vac1 IN	=	I	- AC input voltage.
Vac2 IN	=	I	- AC input voltage.
+Vdc IN	=	I	- Positive terminal of DC input voltage.
-Vdc IN	=		- Negative terminal of DC input voltage.
+5 Vdc OUT	=	O	- Positive terminal of +5 Vdc regulated output voltage.
GND +5	=		- Negative terminal of +5 Vdc regulated output voltage.
+12 Vdc OUT	=	O	- Positive terminal of +12 Vdc regulated output voltage.
GND +12	=		- Negative terminal of +12 Vdc regulated output voltage.
-12 Vdc OUT	=	O	- Positive terminal of -12 Vdc regulated output voltage.
GND -12	=		- Negative terminal of -12 Vdc regulated output voltage.
/RESET	=	O	- Valid +5 Vdc output voltage signal.
N.C.	=		- Not connected.

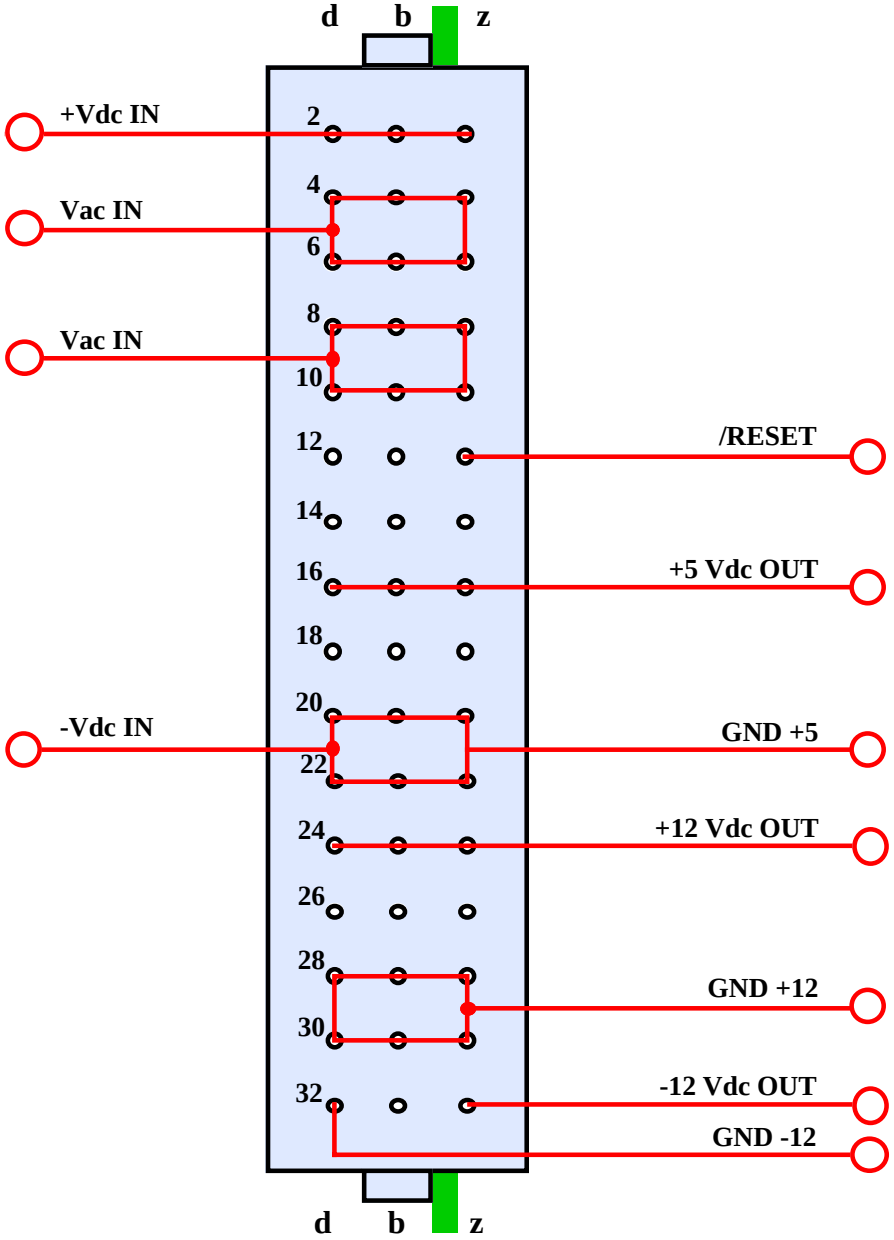

FIGURE 18: CN1 CONNECTION EXAMPLE ON SPC 03.3T

OUTPUT VOLTAGE LOAD SENSING

Every power supply model, except **SPC 03. 3T**, is provided with a professional sensing circuitery that allows to work correctly also in critical connections situations. This feature allows the power supply to compensate autonomously the possible voltage drop across the connection cables that carry the regulated tension to the load.
The sensing signals SENSE+ and SENSE- must be connected respectively to positive signal (+xx Vdc OUT) and negative signal (GND xx) of the regulated output voltage, directly on the supplied load at the farest distance from **SPC 03**. This connection must be always performed: if the connection is uncomfortable or useless it is simply possible to short circuit the described signals directly on CN1 connector, as below described:

18d to **16d** and **18z** to **20z**	on **SPC 03**
26z to **24z** and **26d** to **28z**	on **SPC 03.12**
18d to **12d** and **18z** to **20z**	on **SPC 03.15**, **SPC 03.24**, **SPC 03.VT**, **SPC 03.VB**

by granting that external conditions allow this special connections (sufficient cable size, not inductive load, short distance connection, etc.).
Please remark that **grifo®** mother boards already make the connection of sensing signals directly on the printed circuit board.
Previous figures with connection example for each models, show the suggested connection for sensing signals.

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) Single AC voltage on pins Vac1 IN and Vac2 IN of CN1;
2) AC voltage on pins Vac1 IN and Vac2 IN and back up DC voltage on pins +Vdc IN and -Vdc IN of CN1;
3) DC voltage on pins Vac1 IN and Vac2 IN of CN1 and back up DC voltage on pins +Vdc IN and -Vdc IN of CN1;

Pleasse remark that -Vdc IN signal is physically connected to GND xxx signal 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, that is the typical difference of potential due to the bridge rectifier.
In cases 2 and 3 **SPC 03** acts as an UPS (Uninterruptible Power Supply): when the voltage on pins Vac1 IN and Vac2 IN is no more available the regulated output voltages are still present through back up input voltage, which is usually provided by a suitable battery.

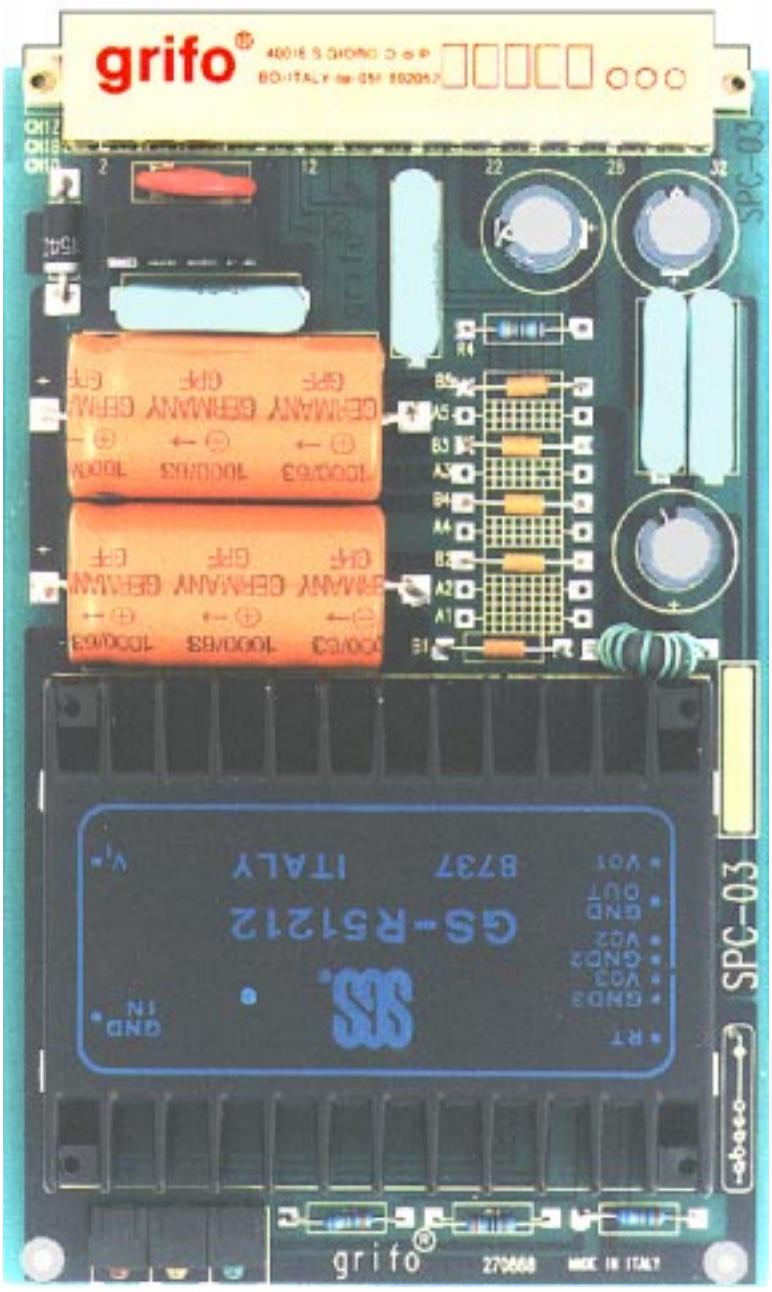

FIGURE 19: SPC 03 PHOTO

PROTECTIONS

Modules **SPC 03** 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 **150 °C** it disables the output voltage to allow the temperature to decrease. Output is automatically restored when the temperature value get lower than 130 °C, so the 20 °C hysteresis prevents instable output conditions.
Overlaod	Switching reguation section keeps under control output current on CN1 so when current exceeds **5 A** 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	Managed as overlaod condition.
Input overvoltage	Input section is provided with a MOV filter that suppresses some noises and keeps AC input voltage (supplied to rectifire section) under 39 Vac to protect switching regulator. In case the input overvoltage persists, MOV filter can damage and must be replaced.
Output overvoltage	Switching reguation section keeps under control output voltage; when this latter exceed **20%** of nominal value it disables the output voltage. To restore the output, switching regulator must be turned off by removing any input voltage.

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

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

/RESET AND POWER FAILURE

Switching section of models **SPC 03** and **SPC 03.3T** 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 stautus.

/RESET = +5 Vdc	->	+5 Vdc regulated output voltage is valid
/RESET = GND	->	+5 Vdc 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 connected circuits.
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. As usual, **grifo®** mother boards already connect /RESET signal to the corresponding signal on CPU board (/R.T.), directly on the printed circuit.

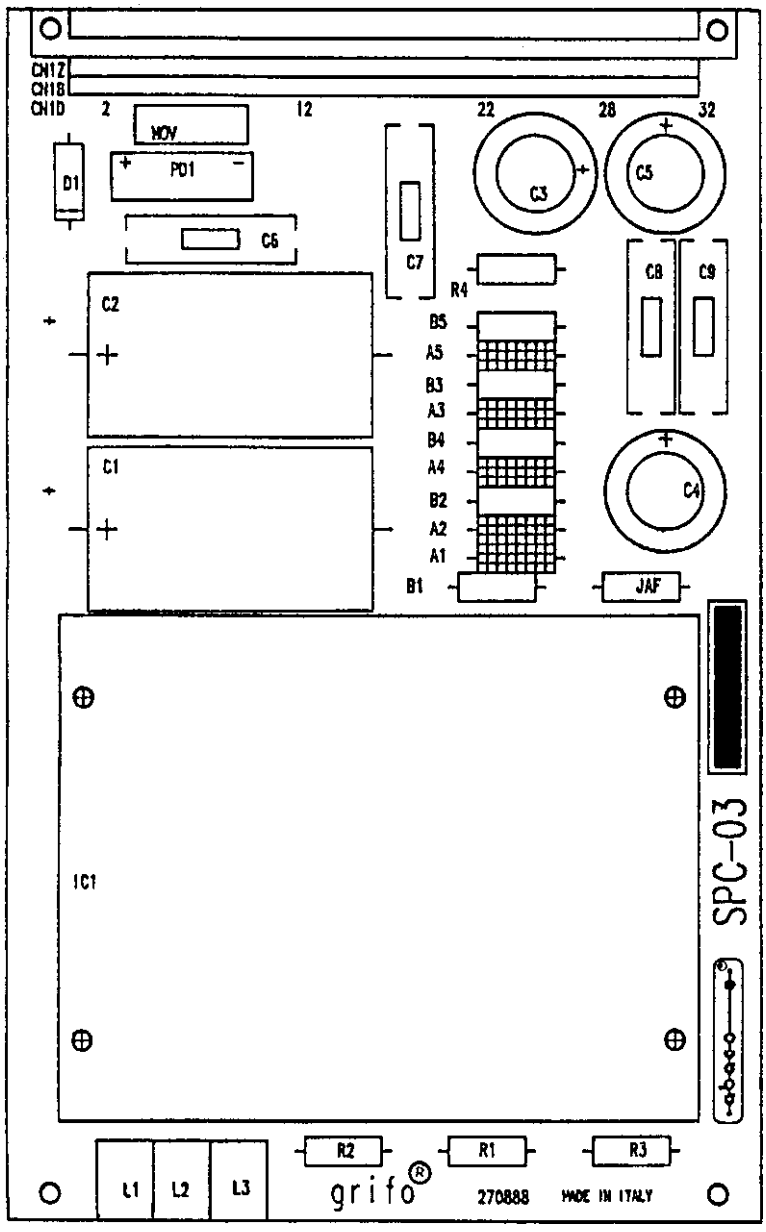

FIGURE 20: COMPONENTS MAP

POWER PROVIDED

Power supply **SPC 03** 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
SPC 03	6÷32 Vac or 8÷46 Vdc	27,5 W	5 Vdc	20 W
SPC 03.12	12÷32 Vac or 16÷46 Vdc	66,0 W	12 Vdc	48 W
SPC 03.15	14÷32 Vac or 19÷46 Vdc	82,5 W	15 Vdc	60 W
SPC 03.24	21÷32 Vac or 29÷46 Vdc	132,0 W	24 Vdc	96 W
SPC 03.VT	6÷32 Vac or 8÷46 Vdc	165,0 W	5÷40 Vdc	120 W
SPC 03.VB	7÷32 Vac or 9÷46 Vdc	165,0 W	5÷40 Vdc	120 W
SPC 03.3T	7÷28 Vac or 9÷40 Vdc	29,0 W	+5; +12; -12 Vdc	17,5; 1,8; 1,8 W

FIGURE 21: POWER TABLE FOR EACH MODEL

Values of input power reported are referred to average efficency 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 21 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 techinques to keep temperature in admitted range. Should thermal dissipation be insufficent, an additional heatsink can be mounted directly on IC1 swithcing regulator, fastening it the four holes in the top corner of the module.
SPC 03 features components and circuites designed to reduce noise sensibility and increase efficence; also, the lay out has been carefully tracked to carry thegenerated power in the best way possible, avoiding mass rings, instability, emissions, etc.

MODEL IDENTIFICATION

The seven different models of **SPC 03** can be easily recognized through two proper areas placed on printed circuit serigraphy: one on component side near the right side of the switching regulator and one on solder side in the specific table under IC1. After the preparation and the testing phase in both these areas are manually noted the realized model, so the user can immediately identify it, without errors.
Figure 4 of this manual shows the location of the model identification areas.

EXTERNAL DEVICES FOR SPC 03

The seven models of **SPC 03** 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.

SPB 04 , **SPB 08**

Switching Power BUS 4, 8 slots

Motherboard with 4 or 8 slots of **ABACO®** industrial BUS; slot pitch 5 TE; one slot for power supply; standardized power supply connectors; local reset key; termination resistors on signals; holes for mounting on 3 HE rack.

YPB 01

Switching Power BUS 1 slots

Motherboard with one slot for power supply; standardized power supply connectors; holes for mounting on 3 HE rack.

RBO 08 - RBO 16

Relé BLOCK Output

Interface for I/O **ABACO®** standard 20 pins connector; 8 or 16 displayed outputs with 3A relays provided of MOV; screw terminal connector; mounting for for Ω rails, type DIN 247277-1 and 3.

OBI 01 - OBI 02 - OBI N8 - OBI P8

Opto BLOCK Input NPN-PNP

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

PIO 01

Peripheral Input Output

96 I/O lines at TTL level divided in 12 ports by 8 bits; six I/O **ABACO®** standard 20 pins connectors; lines driven by four PPI 82C55; watch dog with selectable modality and intervent time.

IPC 52

Intelligent Peripheral Controller, 24 analogic input

This intelligent peripheral card acquires 24 indipendent analogic input lines: 8 PT 100 or PT 1000 sensors, 8 J,K,S,T termocouples, 8 analog input ±2Vdc 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.

PCI 01

32 Peripheral Coupled Input

32 optocoupled input with π-filter; input voltage 24 Vdc. Input visualized through LEDs; 8 or 16 bit BUS; standard addressing.

PCO 01

32 Peripheral Coupled Output

32 transistor outputs, open collector type, 45 Vdc, 500 mA; standard output connectors; outputs are optocoupled and displayed by LEDs. 8 or 16 bit BUS; standard addressing.

CI/O R16

16 Coupled Input Output Relé

16 optocoupled input with π-filter; input voltage 24 Vdc. 16 micro-relays outputs,1 A, with noisy suppression circuit based on MOV 24 Vac. I/O visualized through LEDs; 8 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 ±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.

RKD LT

Remote Keyboard Display controller

Video terminal able to manage many different graphics LCD or alphanumeric LCD or fluorescent displays; matrix keyboard input up to 56 keys; parallel **ABACO®** BUS or serial interface (RS 232, RS 422, RS 485, current loop); serial EEPROM for set up; buzzer; 8 external LEDs driving circuit; on board firmware that manage primary graphic objects drawing.

GPC® 188F

General Purpose Controller 80C188

80C188 µP 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 SRAM 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.

GPC® 15A

General Purpose Controller 84C15

Full CMOS card, 10÷20 MHz 84C15 CPU; 512K EPROM or FLASH EPROM; 128K RAM; RTC backed through on board and external battery; 4M serial FLASH; 8K serial EEPROM; 1 RS 232 serial line; 1 RS 232 or RS 422, RS 485 or current loop line; 40 TTL I/O lines; 2 counter timer; 2 watch dog; 2 dip switches, buzzer.

GPC® 150

General Purpose Controller 84C15

Z80 microprocessor at 16 MHz; full CMOS implementation; 512K EPROM or FLASH EPROM; 512K SRAM; 8K RAM plus RTC backed; 8K serial EEPROM; 1 RS 232 serial line; 1 RS 232 or RS 422, RS 485 or current loop line; 32 or 40 TTL I/O lines; counter timer CTC; Watch Dog; dip switch; activity LED; 8 A/D converter lines with 12 bits resolution.

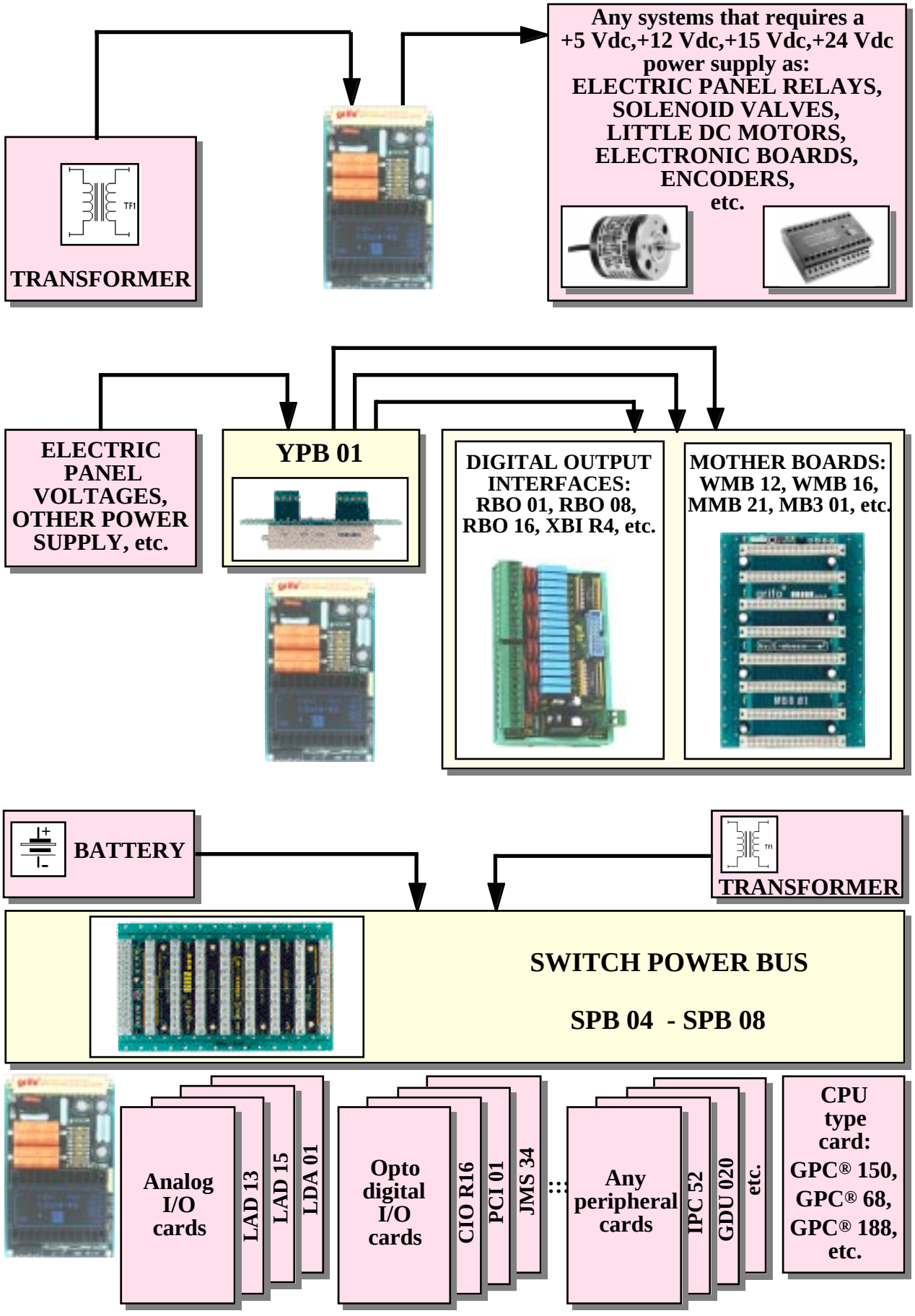

FIGURE 22: CONNECTIONS EXAMPLE DIAGRAM

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 **SPC 03**.

SGS manuals:	*Power supply application manual* *GS-R modules application manual*
Motorola semiconductor manual:	*Rectifiers and zener diodes data book*
Harris manual:	*Passive components data book*

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

APPENDIX A: ALPHABETICAL INDEX