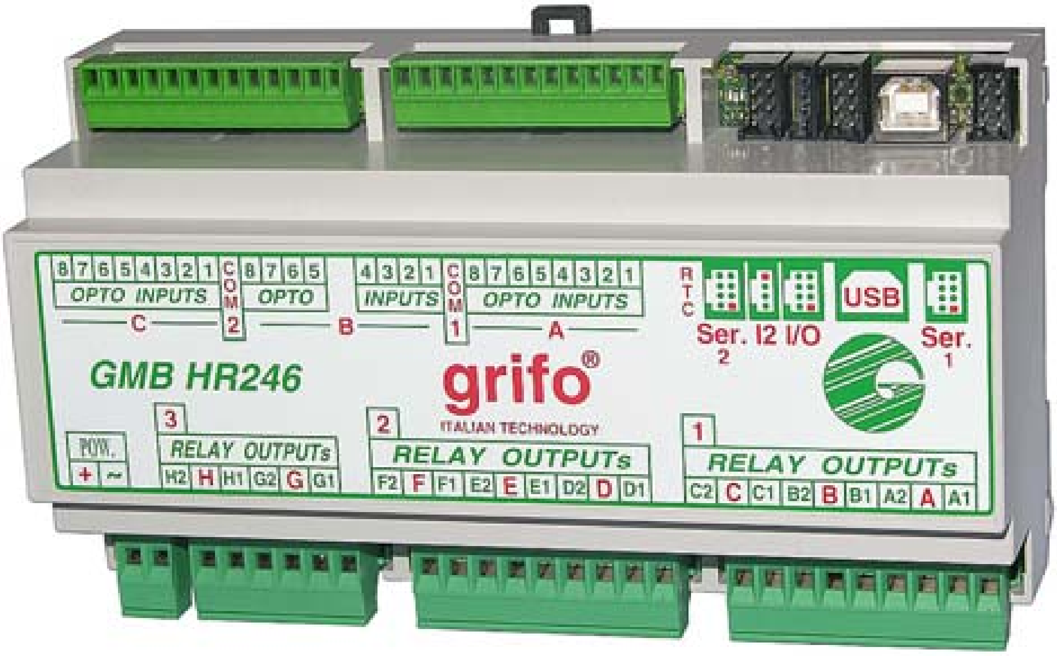
GMB HR246

grifo® Mini BLOCK Housing
24 Opto Inputs, 16 Relays Outputs

TECHNICAL MANUAL



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GMB HR246 Rel. 5.00 *Edition 27 January 2007*

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Interface module of the **Mini Block** series, provided of modular plastic **Container DIN 50022 Modulbox**, model **M9 HC53**. Size: frontal **90x158 mm**; height **58 mm**. Mounting on **Omega** rails **DIN 46277-1** e **DIN 46277-3**. **40 pins** socket for the insertion of all the **grifo® Mini Modules** as: **GMM ACB**, **GMM AM32**, **GMM 4620**, **CAN AVR**, etc. **24 Optocoupled** inputs that can be indifferently **NPN** or **PNP** type. Power supply of inputs selectable by user, according with his requirements, and displayed by **LEDs** with **Different Colours**. Status of **24** inputs visualized by **24 LEDs**. **Isolated DC/DC Converter** capable to generate power supply voltage for all the Optocoupled inputs; each digital inputs must be connected to **Pure Contacts**. Some inputs can act as **Counter** and **Interrupts**. **16 Relays** outputs capable to drive loads up to **5 A**, **35 Vdc**. Status of **16 Outputs** visualized through **16 LEDs**. **2** serial lines in **RS 232**, **RS 422** , **RS 485**, **Current Loop** and **TTL**. **Real Rime Clock** backed by **Lithum Battery**, capable to manage autonomously time and date. **240 Bytes** of **Backed SRAM**, available for the user. **1 A/D** line with selectable input ranges. Up to **5 I/O** lines at **TTL** level, one of these is driven by **RTC**, acts as an **Alarm** output and it displayed by proper **LED**. Connection of all the signals through **Comfortable Connectors**, with standard pin outs.
I2C BUS line available for external devices, on dedicated connector and Connectors for **CAN** and **USB** interfaces of **Mini Module**.
On board **Switching** power supply; protection aganist voltage peaks by **TransZorb**. Single power supply variable in **AC** and **DC** wide ranges: 1**0÷38Vdc** or **8÷24Vac**.

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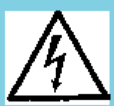
IMPORTANT

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

Attention: ESD sensitive device

Trade Marks

GENERAL INDEX

FIGURES INDEX

INTRODUCTION

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

This device is not a **safe component** as defined in directive **98-37/CE**.

Pins of module are not provided with any kind of ESD protection. Many pins of the card are directly connected to their respective pins of on board's components and these last are sensitive to electrostatic noises. So personnel who handles the product/s is invited to take all necessary precautions that avoid possible damages caused by electrostatic discharges.

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, installation, etc. are destined - and then executable - always and in exclusive way from specialized warned and educated personnel, or directly from the AUTHORIZED TECHNICAL 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 information 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.

VERSION

This handbook make reference to printed circuit version **121205** and following ones. The validity of the information contained in this manual is subordinated to the version number on the used card, and so the user must always verify the correct correspondence between the notations. The version number is reported in several places on the electronic part of the product, and following figure shows the most accessible one. Obviously if the version must be checked, then the circuit must be first extracted from the plastic container.

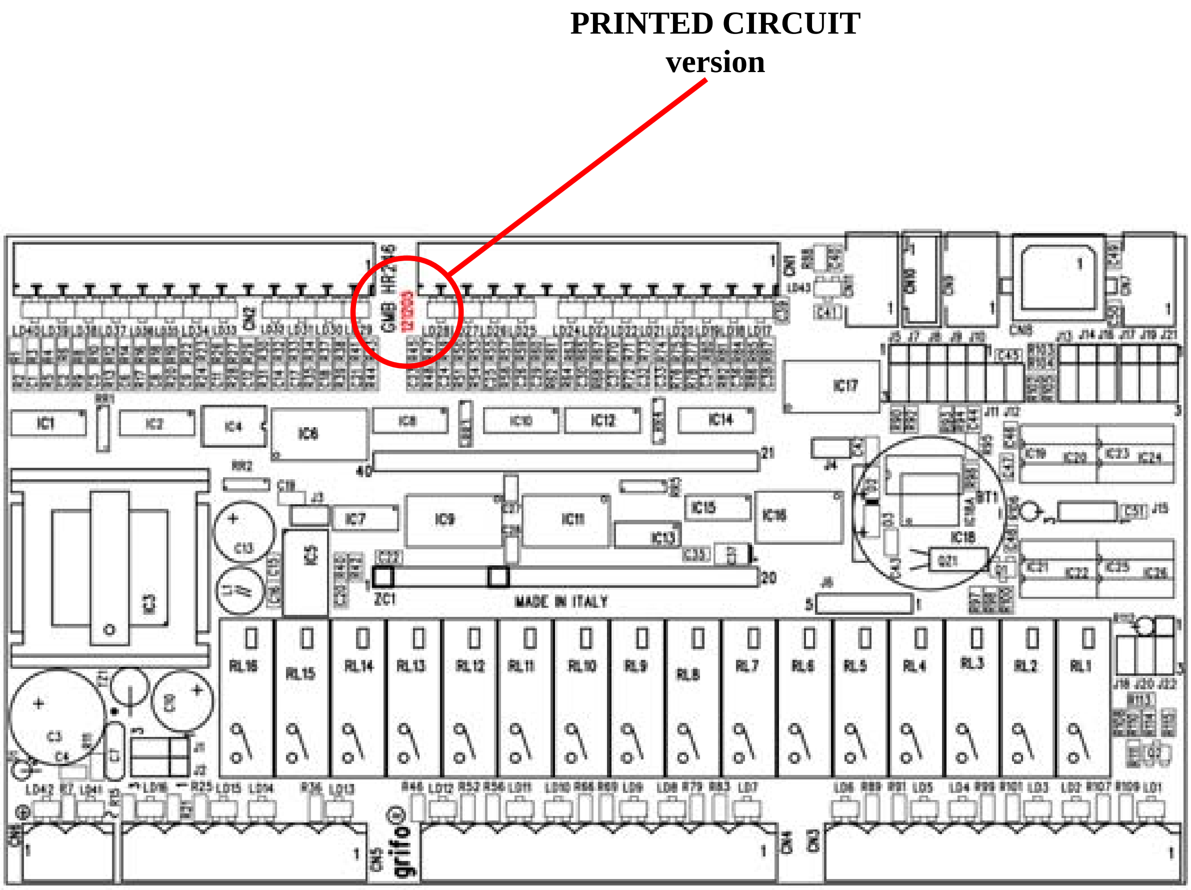


FIGURE 1: LOCATION OF PRINTED CIRCUIT VERSION

GENERAL INFORMATION

GMB HR246 is a module for DIN rail capable to accomodate a Mini Module card, type **CAN xxx** or **GMM xxx**, either with 28 or 40 pins. The board is provided of galvanically isolated inputs, relays outputs, LEDs visualizations, serial lines and several other features as one A/D line, one PWM line, power supply section, etc. Its category is the low cost controller band, and it can work as intelligent stand alone peripheral and/or remoted inside a wider telecontrol/teleacquisition network.
GMB HR246 is provided with a standard plastic container with clamps for common Omega rails that can be found in any electric panel. Thanks to low cost of this interface and CPU Mini Modules it allows to build with great profit a serie of low budget automation systems.
Thanks to the information contained in this manual the user can develop his own hardware that, once inserted in the 40 pins socket, can completely use all the features of **GMB HR246**.
For those users that have no time or no resources to obtain this product, **grifo®** sells the numerous Mini Modules plus the rich software development tools, as, for example, the cheap and powerful BASIC compilers (**BASCOM 8051**, **BASCOM AVR**, **PICBASIC**, etc.), the C compilers (**μC/51**, **SYS51CW**, **ICC AVR**, **HiTechC**, etc.), PASCAL compilers (**SYS51PW**, **MikroPASCAL**, etc.) and many other packages.
As an alternative, the card can be acquired under the form of **GMT HAC2** that includes also a preinstalled firmware capable to manage the on board resources through a simple serial communication, in accordance with ModBUS standard protocol.
The board is provided with a set of comfortable connectors that can be easily linked to the signals of the field without any additional module, so there is no additional cost. Moreover these connectors simplify the possible update and assistance phases that can become necessary during the use of the module.
Of course, board features change according with installed Mini Module, but a common overall is below listed:

- Modular plastic container **DIN 50022 Modulbox**, model **M9 HC53**.
- Size: frontal **90x158 mm**; height **58 mm**.
- Mounting on **omega** rails **DIN 46277-1** e **DIN 46277-3**.
- **40 pins** socket for the insertion of all the **grifo®** **Mini Modules** as: **GMM ACB**, **GMM AM32**, **GMM 4620**, **CAN AVR**, etc.
- **24 optocoupled** inputs that can be indifferently **NPN** or **PNP** type.
- Power supply of inputs selectable by user, according with his requirements, and displayed by **LED** with **different colours**.
- Status of 24 inputs visualized by **24 LEDs**.
- **Isolated DC/DC converter** capable to generate power supply voltage for all the optocoupled inputs; thus the last results powered on board.
- Each digital inputs must be connected to **pure contacts**, or in other words, without any additional power supply voltage.
- Some inputs can act as **counter** and **interrupts**.
- **16 relays** outputs capable to drive loads up to **5 A**, **35 Vdc**.
- Status of **16 outputs** visualized through **16 LEDs**.
- **2** serial lines in **RS 232**, **RS 422** , **RS 485**, **Current Loop** and **TTL**.
- **1 A/D** line with selectable input ranges.
- Up to **5 I/O** lines at **TTL** level.

- **I2C BUS** line available for external devices, on dedicated connector.
- **CAN** interface connected to specific connector (when available on Mini Module).
- **USB** interface connected to specific connector (when available on Mini Module).
- **Real Rime Clock** backed by **lithum battery**, capable to manage autonomously hours, minutes, seconds, day, month, year and week day.
- **1 TTL** output driven by interrupt or **alarm** signal, of the optional RTC, displayed by LED and connected to proper connector.
- **240 Bytes** of **backed SRAM**, included in the RTC and available for the user.
- Connection of all the signals through **comfortable connectors**, with standard pin outs.
- On board **switching** power supply.
- On board protection aganist voltage peaks by **TransZorb**.
- Single power supply variable in **AC** and **DC** wide ranges: **10÷38Vdc** or **8÷24Vac**.

Here follows a description of the board's sections and the operations they perform. To easily locate such sections and to verify their connections, please refer to figure 2.

ANALOG INPUT

One analog input is available on a connector of **GMB HR 246** for the field signals. This input accepts a voltage that can be connected to a proper adapter circuit, that allows to define also the admitted range, and then it is connected to one of the inputs of A/D section on the Mini Module. This feature depends on used Mini Module, so please refer to its documentation.

SERIAL COMMUNICATION

GMB HR246 features two asynchronous serial lines whose physical protocol (baud rate, stop bit, bits per character, etc.) is completely settable by software programming the Mini Module installed on the card, so for further information please refer to its technical manual.
By hardware it is possible to select the electric protocol, through a comfortable set of jumpers and drivers to install. In detail the card lines can be not buffered (**TTL** or **RS 232**) or buffered in **Current Loop**, **RS 422**, **RS 485**; in these last two cases it can be defined also abilitation and direction of communication lines. Please remark that in default configuration the board is provided with both serial lines not buffered, by otaining two RS 232 lines when it is joined with a Mini Module. So any different configuration must be specified in the order.
For further information about serial communication please refer to paragraphs: CONNECTIONS SERIAL COMMUNICATION SELECTION, SERIAL LINE 1 (PRIMARY) and SERIAL LINE 2 (AUXILIARY).

OPTOCOUPLED DIGITAL INPUTS

The card features 24 **NPN** and/or **PNP** inputs connected to two quick release screw terminal connectors that are connected, through a galvanically isolated interface, to I/O lines of 40 pins socket and to a specific I/O expander. All these lines are visualized by proper LEDs and have been selected to be able to take full advantage of possible **grifo®** Mini Module internal peripherals; in such case the inputs can generate interrupts, be counted by hardware counters, acts as a trigger, etc.
The power supply voltage for optocoupled inputs, named Vopto, is generated on board by a specific circuitery completely separated from the other power supply for on board logic.

I2C BUS LINE

One connector of **GMB HR246** is dedicated to I2C BUS, managed by two signals of the 40 pins socket and thus by installed Mini Module. The last can have a comfortable standard connection for this synchronous communication line either when it has an integrated I2C BUS hardware controller or when it is emulated by software through two I/O signals.
This kind of interface allows to connect devices featuring the same communication standard, to easily improve the system performances. Connector has been designed to allow both external and internal connections in confront of plastic container, in order to satisfy any need of the user.
Moreover the I2C BUS line is used also for the management of some on board peripherals as the I/O expander and the possible RTC+SRAM option.
A wide list of software examples explains the management of most common and diffused I2C BUS peripherals like A/D and D/A converters, display drivers, memories, temperature sensors, etc. With reference to these peripherals it can be examined the **K51-AVR** card, provided of technical manual (complete of electric diagram) and a complete set of examples in many different languages.
Further information about I2C BUS interface, please refer to pragraphs CN10 - I2C BUS LINE CONNECTOR and I2C BUS INTERFACE.

MINI MODULE

Mini Module refers to the component installed on the 40 pins socket ZC1 and that manages all the resources of the card. This component normally is based on a microcontroller, programmable with a specific firmware, that defines the card functionality according with user requirements. By using **grifo®** Mini Modules there are many high level development tools for the user firmware, that are ready to use, and many other modalities for programming the obtained firmware inside the microcontroller (i.e. serial Boot loader), with no requirements of additional accessories.
GMB HR246 has been designed to accept all the 28 and 40 pins **grifo®** Mini Modules or any hardware that can fit in a standard 40 pins 600 mils, DIL socket.
For further information please refer to description of socket ZC1 and to chapter dedicated to PERIPHERAL DEVICES SOFTWARE DESCRIPTION.
Every combination **GMB HR246** plus **grifo®** Mini Module is a separated item on our products list; in order to simplify their use each couple of cards is described by its own manual. When a combination **GMB HR246** + **grifo®** Mini Module has been ordered, it will be delivered already installed, configured and ready for use.

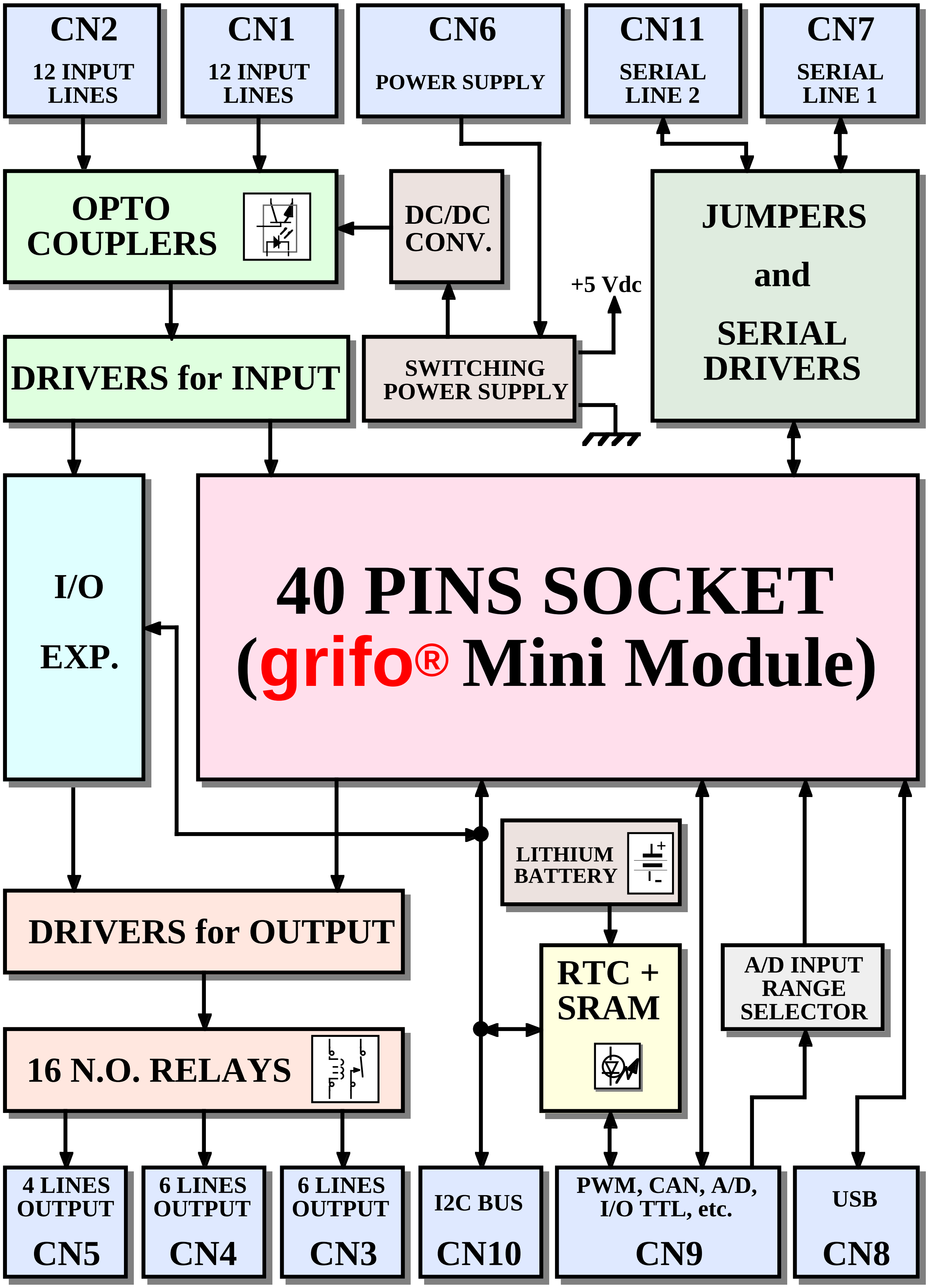


FIGURE 2: BLOCK DIAGRAM

I/O TTL SIGNALS

GMB HR246 allows to connect up to 5 digital I/O TTL lines of 40 pins socket to a specific connector for the field. The purposes of these signals is completely user defined and, when a **grifo®** Mini Module is installed, become available some interesting and automous functionalities derived by some hardware peripherals that are at the edge of the same lines.
For example it is important to remind the interrupt and alarm line of optional RTC section, PWM line to generate an analog signal, count signal associated to Timer Counter, etc.

DIGITAL RELAYS OUTPUTS

The board is provided with 16 relays outputs for 5 A loads, with normally open contacts, whose status is visualized by 16 LEDs. Each line is driven directly by the signals of the 40 pins socket or indirectly by the I/O expander, it is buffered through a specific driver and then connected to three comfortable quick release screw terminal connector to simplify interfacement to the field signals.
When **grifo®** Mini Module is installed on ZC1 socket, some relays outputs take advantage of internal hardware peripherals (as PCA, TCU, CCU, etc.) that allow to generate interesting and evolved autonomous functions.

POWER SUPPLY SECTION

GMB HR246 is provided with an efficent switching power supply section, composed by two separate sub-sections. The first is a switching section, that provides supply voltage for all the card functionalities, in any condition of input voltage and load.
The second is a complete DC/DC converter section that generates the stabilized voltage Vopto, used to supply the optocoupled inputs, by mantaining a galvanic separtation from the first.
The board has components selected and circuit designed to reduce consumptions and to increase noise immunity. Remarkable is protection circuit based on TransZorb™ that avoids damages due to incorrect voltages.
For detailed information please refer to paragraphs ELECTRIC FEATURES and POWER SUPPLY VOLTAGE.

CAN LINE

On **GMB HR246** there is an interface for the eventual CAN line available on installed Mini Module. Such interface is simply a connector for field connection and some jumpers that link the CAN signals to proper pins of ZC1 socket; all other hardware and software characterisrtics (line driver, bit rate, etc.) are exactly the ones of used Mini Module, so for further information please refer to its technical documentation.

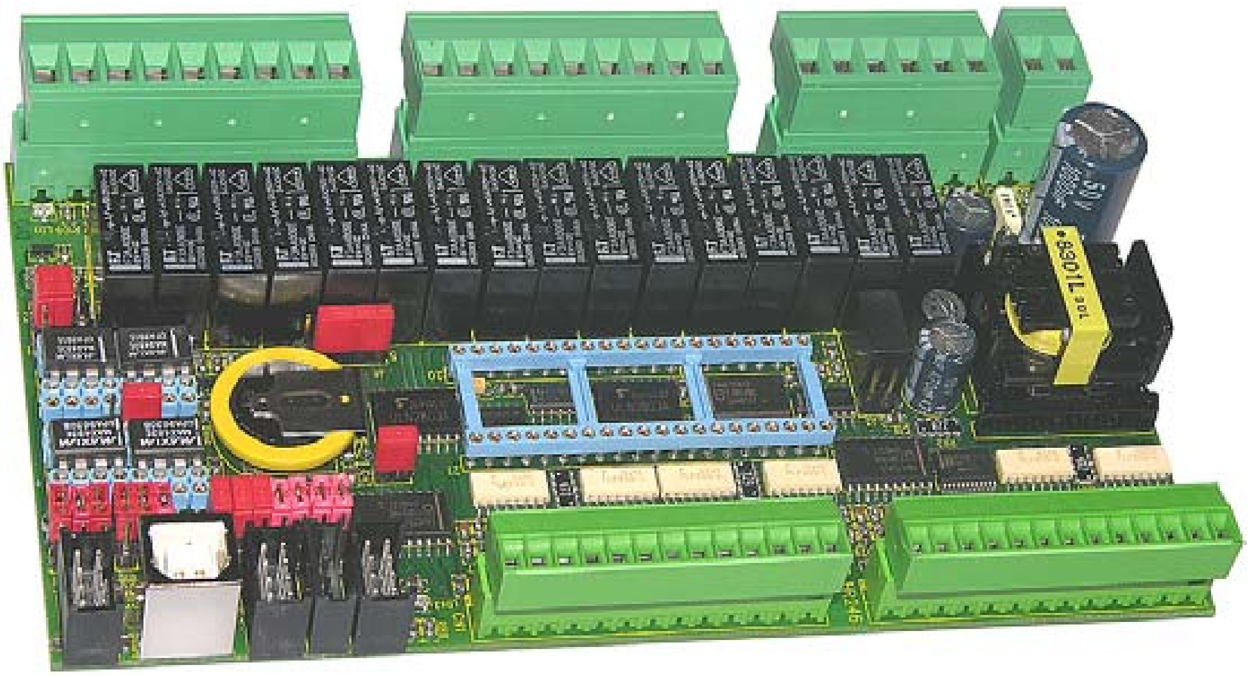


FIGURE 3: GMB HR246 COMPLETE OF OPTIONS

TELECONTROL FIRMWARES

The Mini Module installed on **GMB HR246** can be provided with one of the telecontrol firmwares; such firmwares allow to manage all the board resources through a set of commands and responses exchanged through the primary serial line.
The main advantage of these firmwares is the possibility to use well developed commands that solve fundamental problems of automation like pulses count, wave form generation, debounced input acquisition, Real Time Clock managentent, parameters saving and recall, etc.
Moreover some network communication modes are supported: these allow to remote many modules, also at great distance, and to build systems with distribuited logic driven by a single master unit (PC, PLC, card of the **GPC®** family, etc.).
By now, some standard protocols like **ALB xxx** (**ABACO®** Link BUS) and **GMT xxx** (**grifo® ModBUS** Telecontrol) are available, anyway new ones can be developed on specific request of the customer. Please contact directly **grifo®** for further information.

RTC+SRAM

The **GMB HR246** can be provided with a complete Real Time Clock section capable to manage hours, minutes, seconds, day, month, year and week day in a completely autonomous manner. The section uses high quality components and a dedicated crystal, in order to obtain a timing frequency affected by a minimum error. In addition a back up circuit based on a Lithium battery ensures the maintenance of data in SRAM and the clock update, even when card is not powered.
On the SRAM can be saved up to 240 bytes dedicated to equipment parameters, user configurations, production data, etc. while the RTC is capable to generate periodic interrupts or alarm in corrispondence of a predefined time and date.
The management of RTC+SRAM is performed through the I2C BUS line of the card, as described in the homonimous paragraph in SOFTWARE DESCRIPTION chapter.

TECHNICAL FEATURES

GENERAL FEATURES

On board resources:	24 optocoupled digital inputs NPN or PNP 16 relays digital outputs 2 serial lines (TTL, RS 232, RS 422, RS 485, Current Loop) 1 I2C BUS lines 1 analog input 5 TTL I/O lines 1 connector for CAN interface 1 connector for USB interface 1 RTC section backed by Lithium battery (option) 240 bytes of SRAM backed by Lithium battery (option) 1 switching power supply section 1 DC/DC converter section 43 status LEDs
Mini Module:	28 or 40 pins on 600 mils DIL socket
Opto inputs cut-off frequency:	13 KHz

PHYSICAL FEATURES

Size:	90 x 158 x 58 mm	(H x W x D with container)
	85 x 155 x 32 mm	(H x W x D without container)
Container:	DIN 50022 modulbox, model M9 HC53	
Weight:	350 g	(ZC1 socket empty)
Connectors:	CN1: 13 pins quick release screw terminal, vertical, 3.5 mm CN2: 13 pins quick release screw terminal, vertical, 3.5 mm CN3: 9 pins quick release screw terminal, vertical, 5 mm CN4: 9 pins quick release screw terminal, vertical, 5 mm CN5: 6 pins quick release screw terminal, vertical, 5 mm CN6: 2 pins quick release screw terminal, vertical, 5 mm CN7: 4+4 pins AMP Modu II, male, vertical CN8: USB connector, type B, vertical CN9: 4+4 pins AMP Modu II, male, vertical CN10: 4 pins AMP Modu II, male, vertical CN11: 4+4 pins AMP Modu II, male, vertical	
Temperature range:	from 0 to 50 centigrad degreeses	
Relative humidty:	20% up to 90%	(without condense)

ELECTRIC FEATURES

Power supply:	10÷38 Vdc or 8÷24 Vac	(*)
Max power required:	7.9 W	(*)
Output power supply:	+5 Vdc	
Current consumption on +5 Vdc:	970 mA max	(*)
Relays max voltage:	35 Vdc	
Relays max current:	5 A	(resistive load)
Back up battery:	3 V Lithium; 180 mAh; CR2032 model	
Back up current:	3.6 μA	
Analog input range:	depends on hardware on ZC1 (for **grifo®** Mini Modules: 0÷2.5; 0÷10 V)	
Analog input impedance:	4.7 kΩ	
Analog adapter reduction factor:	1/4	
Pull up resistors on I2C BUS:	4.7 KΩ	
RS 422-485 line impedance:	60 Ω	
RS 422-485 line termination:	Line termination resistor Positive pull up resistor Negative pull down resistor	=120 Ω =3.3 KΩ =3.3 KΩ
CAN line impedance:	60 Ω	
CAN line termination:	120 Ω resistor, external	

(*) The reported values are referred to 20 C° environment temperature (for further information please refer to chapter POWER SUPPLY VOLTAGES).

INSTALLATION

In this chapter there are the information for a right installation and correct use of the product **GMB HR246**. In detail there are the locations and functions of each connector, of jumpers, of the battery, LEDs and any other information concerning hardware configuration.

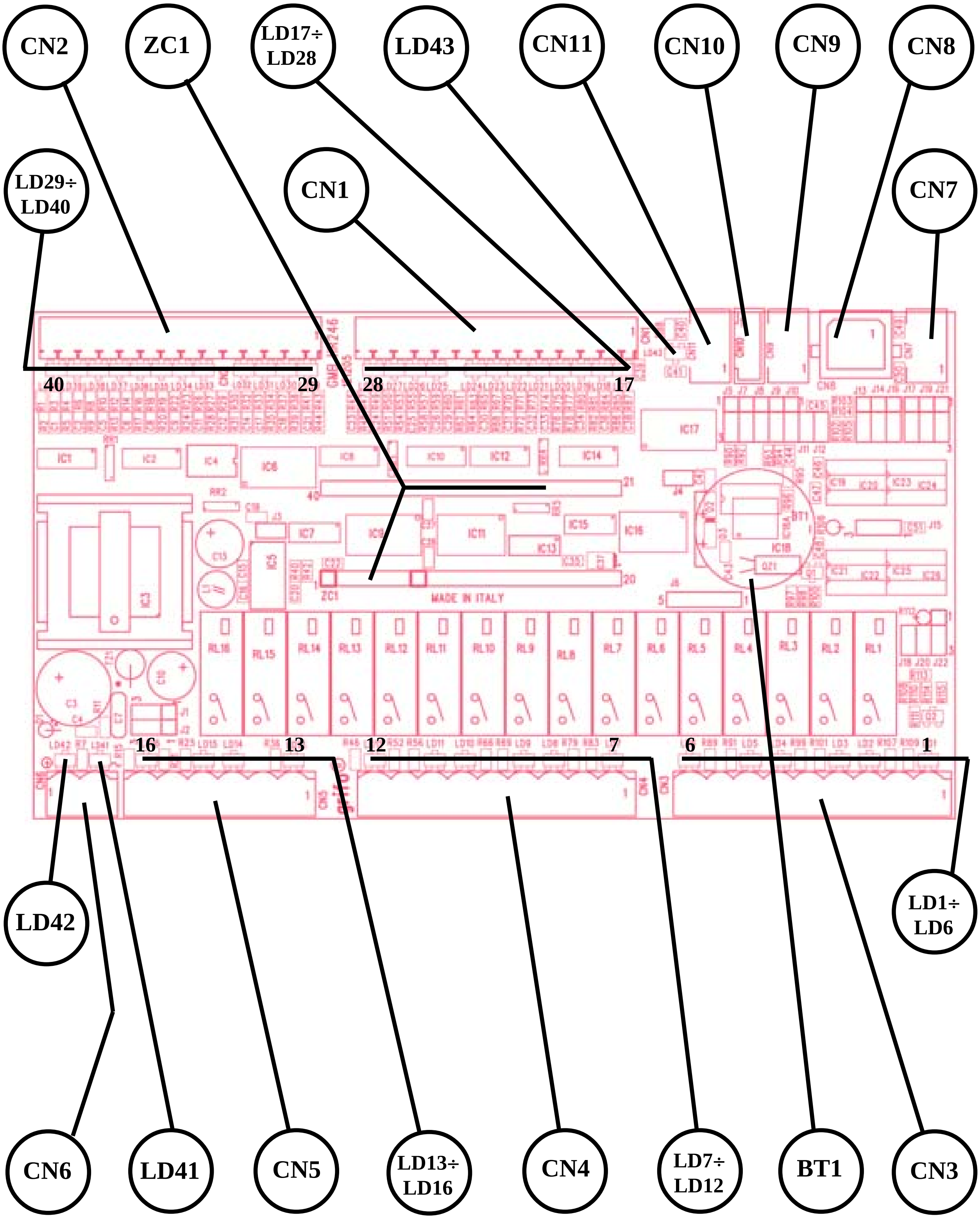


FIGURE 4: CONNECTORS, BATTERY, LEDS, ETC. LOCATION

CONNECTIONS

GMB HR246 has 11 connectors that can be linkeded to other devices or directly to the field, according to system requirements. Below are reported the pin outs, the meaning of the connected signals (including their directions); figure 4 shows the connectors position on the board and it simplify their recognitions. Finally the following figures show the on board connection for each connector, plus some examples, that simplify and speed the wiring phase.
All the connectors are accessible from the side breakings of the plastic container that allows comfortable insertion and deinsertion.

CN6 - POWER SUPPLY CONNECTOR

CN6 is a vertical, 2 pins, male, quick release screw terminal connector, with 5 mm pitch.
On CN6 must be connected the single power supply voltage for the module that can be one out of two different types, as described by following figure.

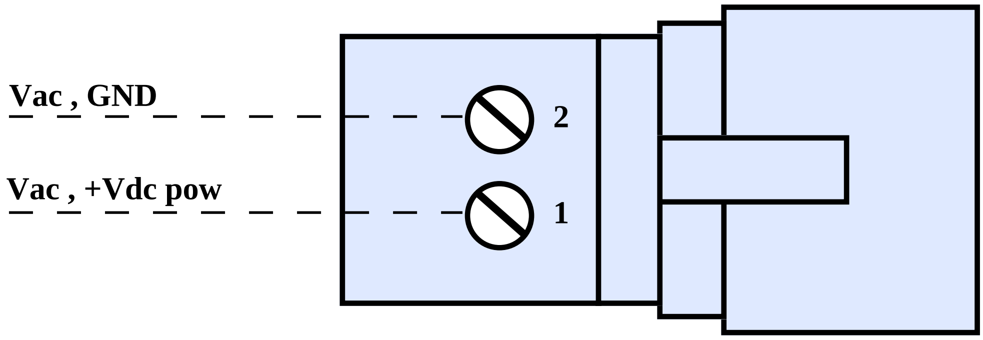


FIGURE 5: CN6 - POWER SUPPLY CONNECTOR

Signals description:

Vac	= I	- AC power supply lines connected to on board switching section; these signals must be in the range **8÷24 Vac**.
+Vdc pow	= I	- DC power supply lines connected to on board switching section (**10÷38 Vdc**).
GND	=	- Ground signal for DC power supply.

NOTE For further information about power supply features, please refer to paragraph POWER SUPPLY VOLTAGE.

CN8 - USB INTERFACE CONNECTOR

CN8 is an USB connector, female, vertical, type B.
On CN8 is connected the USB interface that can be available on Mini Module installed on ZC1; the signals follows the international normative about this communication standard.

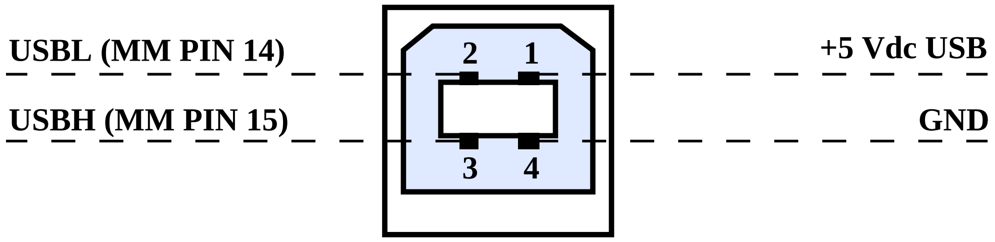


FIGURE 6: CN8 - USB INTERFACE CONNECTOR

Signals description:

USBL	= I/O - Differential line low for USB communication.
USBH	= I/O - Differential line high for USB communication.
MM PIN xx	= I/O - Signal connected to pin xx of the ZC1 socket.
+5 Vdc USB	= O - +5 Vdc power supply signal for USB.
GND	= - Ground signal

Detailed information about the features of USB interface are contained in technical manual of the Mini Module provided of the same interface. It is important remind that **GMB HR246** connects only the signals described in figure 6 to relative pins of socket, without any additional circuit.

NOTE On CN8 are available the two power supply signals +5 Vdc USB and GND but they can't be used to supply power to external systems, nor to supply the card.
The presence of USB communication signals on CN8 is subordinated to some jumpers configuration, as described in JUMPERS paragraph and in figure 47.

CN10 - I2C BUS LINE CONNECTOR

CN10 is a vertical, 4 pins, male, AMP MODU II connector, with 2.54 mm pitch.
Through CN10 can be connected the synchronous communication line in I2C BUS. The signals connected respect the international normatives defined by this standard of communication and include also the power supply voltage generated on board, that can be used to supply power at external devices and/or systems. On the other hand the signals placement has been designed to reduce interferences and it is the same one available on great part of **grifo®** cards, to speed up the connection of different units.
The female connector for CN10 is directly available between **grifo®** accessories, and it can be ordered by using the codes **CKS.AMP4** or **AMP4.Cable**, as described in APPENDIX B of the manual.

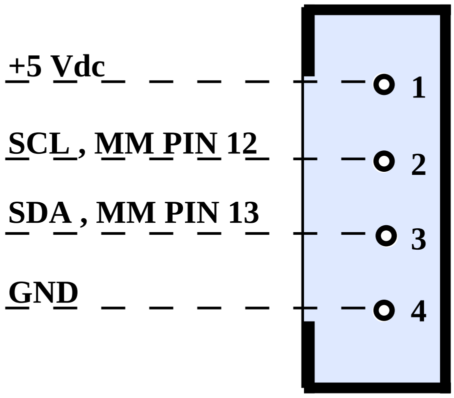


FIGURE 7: CN10 - I2C BUS LINE CONNECTOR

Signals description:

SDA	= I/O - Data signal for I2C BUS communication.
SCL	= I/O - Clock signal for I2C BUS communication.
MM PIN xx	= I/O - Signal connected to pin xx of the ZC1 socket.
+5 Vdc	= O - +5 Vdc power supply signal.
GND	= - Ground signal.

A complete description of I2C BUS communication is reported in technical manual of the installed Mini Module, while the following figures show a connection example diagram with a generic I2C BUS master unit, both in point to point and network mode.

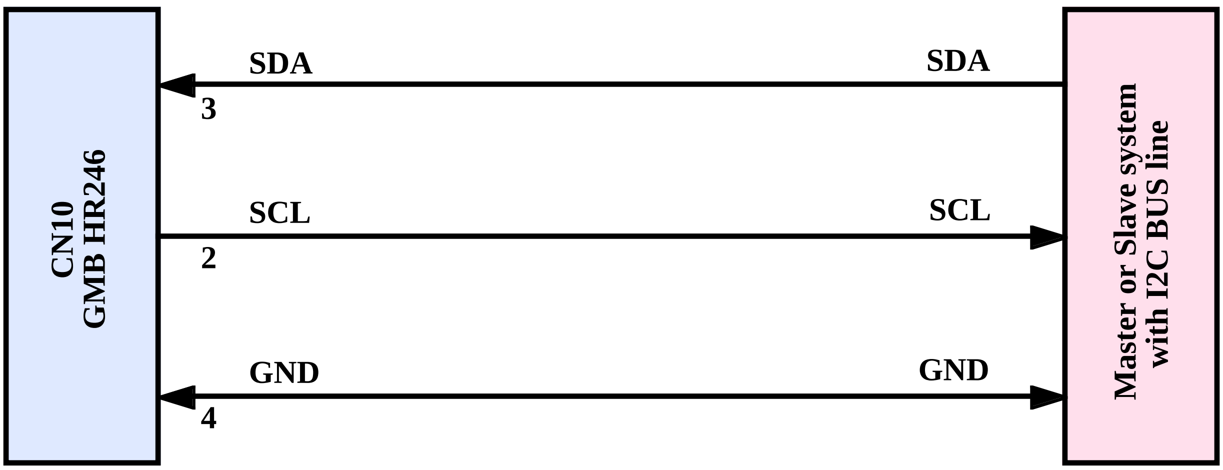


FIGURE 8: CONNECTION EXAMPLE FOR I2C BUS POINT TO POINT COMMUNICATION

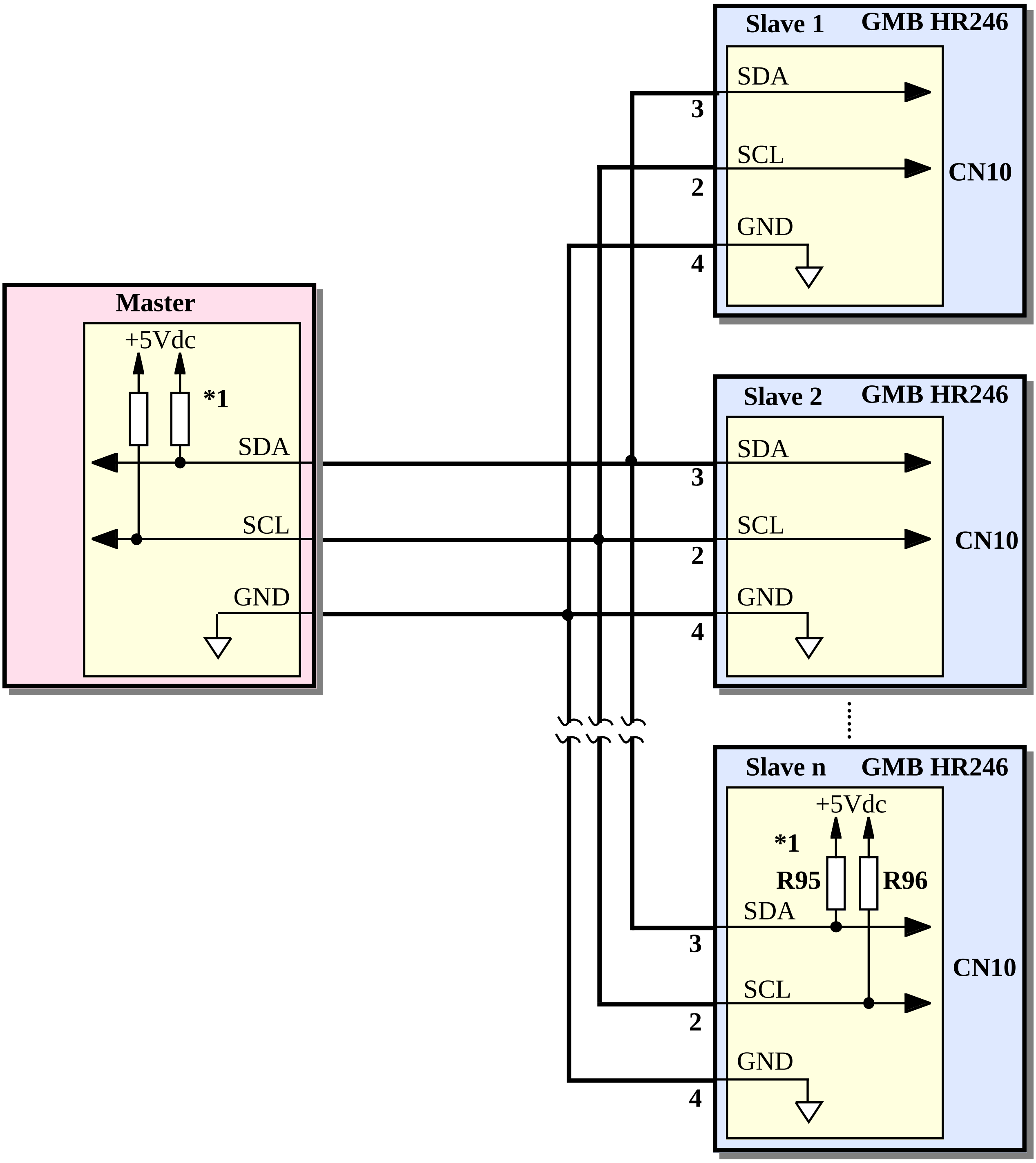


FIGURE 9: CONNECTION EXAMPLE FOR I2C BUS NETWORK COMMUNICATION

Please remind that in a I2C BUS network must be connected two pull up resistors at the net extrems, respectevely near the master unit and the slave unit at the greatest distance from the master.
On **GMB HR246** these resistors (*1) are always present in default configuration and they have the value described in ELECTRIC FEATURES paragraph. The user must select or configure the I2C BUS devices to connect, by taking care of this feature. In detail on **GMB HR246** the described resistors must be removed on the units that are not at the line extremities, as shown in previous figure, on slaves 1 and 2.
For further information please refer to document "*THE I2C-BUS SPECIFICATIONS*", from PHILIPS semiconductors.

CN7 - SERIAL LINE 1 (PRIMARY) CONNECTOR

CN7 is a 8 pins, male, vertical, AMP MODU II 4+4 connector with 2.54 mm pitch.
On this connector there are the signals for communication in RS 232, RS 422, RS 485, Current Loop and TTL, performed through hardware serial line 1 (primary) of Mini Module. Signals placement has been designed to reduce interferences and electrical noises and to simplify the connections with other system; the electric protocols follow the CCITT directives of the used standard.
Female connector for CN7 is directly available between **grifo®** accessories, and it can be ordered by using the codes **CKS.AMP8** or **AMP8.Cable**, as described in APPENDIX B of the manual.
For further information on serial communication please refer to figure 21 and to SERIAL COMMUNICATION SELECTION paragraph.

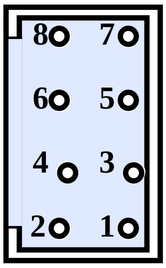


FIGURE 10: CN7 - SERIAL LINE 1 (PRIMARY) CONNECTOR

Pin	*Signal*	*Direction*	*Description*
TTL serial line1:			
5	**RX TTL**	= I	- Receive data for TTL.
3	**TX TTL**	= O	- Transmit data for TTL.
7	**GND**	=	- Ground signal.
RS 232 serial line1:			
5	**RX RS232**	= I	- Receive data for RS 232.
3	**TX RS232**	= O	- Transmit data for RS 232.
7	**GND**	=	- Ground signal.
RS 422 serial line 1:			
6	**RX- RS422**	= I	- Negative receive data for RS 422.
5	**RX+ RS422**	= I	- Positive receive data for RS 422.
3	**TX- RS422**	= O	- Negative transmit data for RS 422.
4	**TX+ RS422**	= O	- Positive transmit data for RS 422.
7	**GND**	=	- Ground signal.
RS 485 serial line 1:			
6	**RXTX+ RS485**	= I/O	- Positive receive and trasmit data for RS 485.
5	**RXTX- RS485**	= I/O	- Negative receive and trasmit data for RS 485.
7	**GND**	=	- Ground signal.

Current Loop serial line 1:

6	**RX- C.L.**	= I	- Negative receive data for Current Loop.
5	**RX+ C.L.**	= I	- Positive receive data for Current Loop.
3	**TX- C.L.**	= O	- Negative transmit data for Current Loop.
4	**TX+ C.L.**	= O	- Positive transmit data for Current Loop.

Power supply voltages:

1	**+5 Vdc**	= O	- +5 Vdc power supply signal.
7	**GND**	=	- Ground signal.
2	**Vopto A**	= O	- Power supply voltage for optocoupled digital inputs.
8	**Vopto B**	= O	- Power supply voltage for optocoupled digital inputs.

FIGURE 11: TTL POINT TO POINT CONNECTION EXAMPLE

FIGURE 12: RS 232 POINT TO POINT CONNECTION EXAMPLE

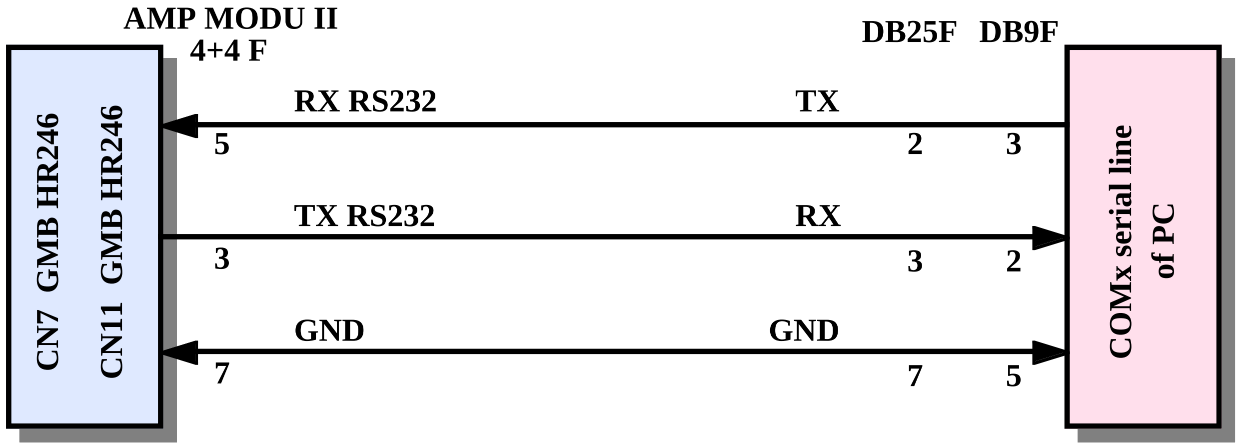


FIGURE 13: RS 232 CONNECTION EXAMPLE WITH PC

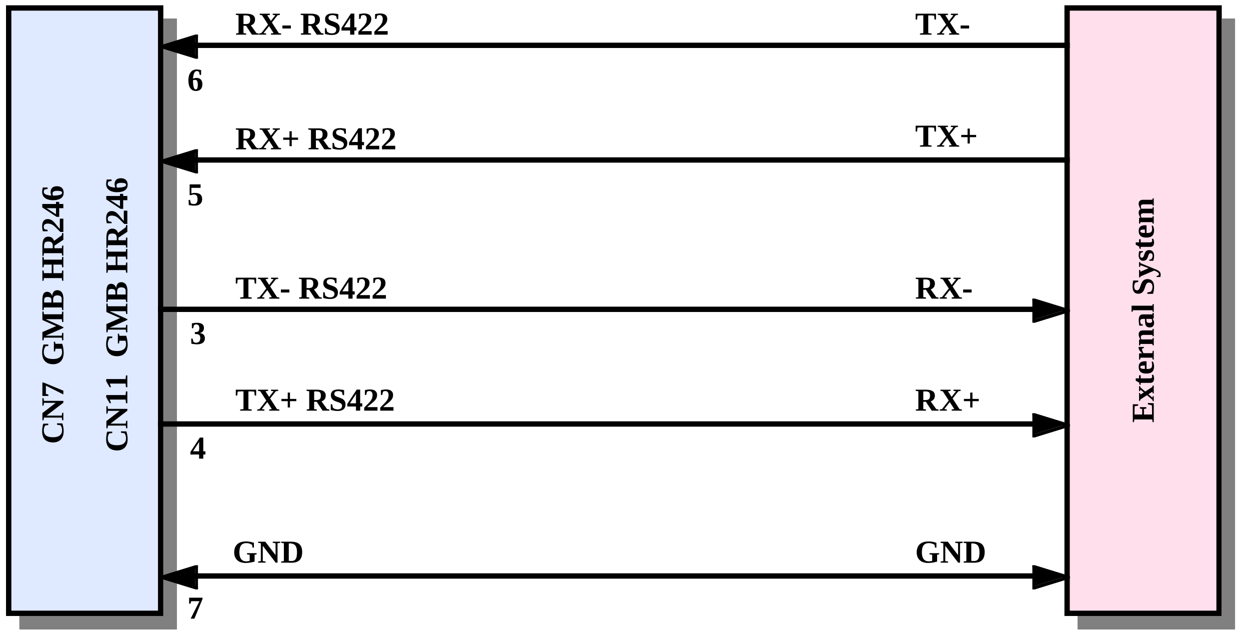


FIGURE 14: RS 422 POINT TO POINT CONNECTION EXAMPLE

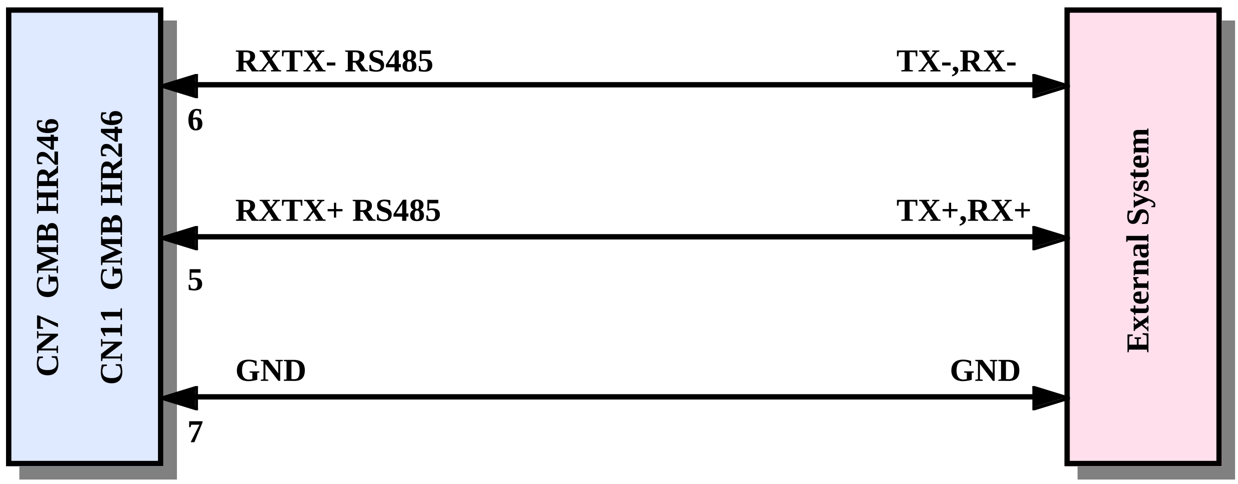


FIGURE 15: RS 485 POINT TO POINT CONNECTION EXAMPLE

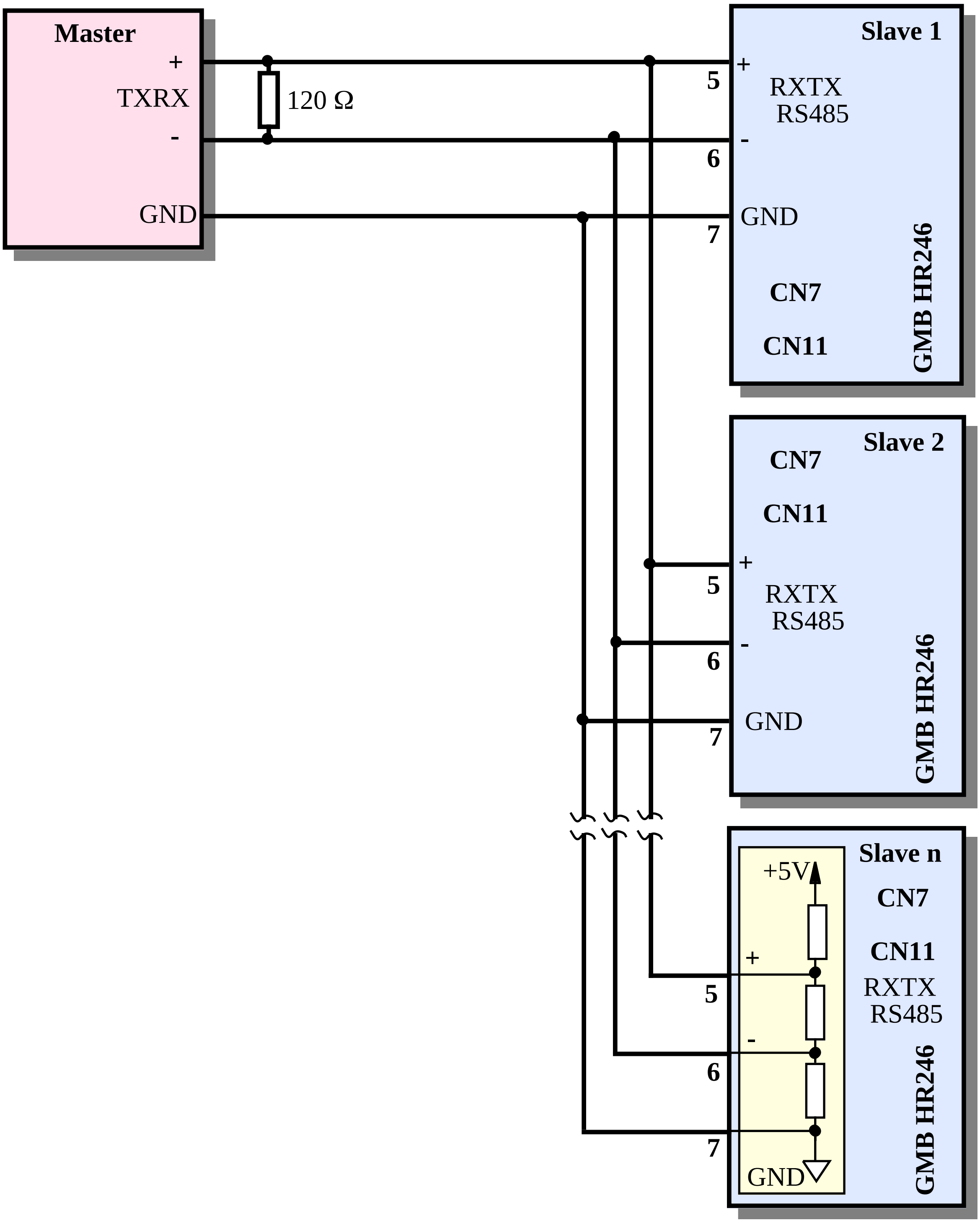


FIGURE 16: RS 485 NETWORK CONNECTION EXAMPLE

Please remark that in a RS 485 network two forcing resistors must be connected across the net and two termination resistors (120 Ω)must be placed at its extrems, respectevely near the Master unit and the Slave unit at the greatest distance from the Master.
Forcing and terminating circuitry is installed on **GMB HR246** board. It can be enabled or disabled through specific jumers, as explained later.
About termination resistor of Master unit,connect it only if not already present (for example many RS 232-RS 485 converters already have it inside).
For further information please refr to TEXAS INSTRUMENTS Data-Book , "*RS 422 and RS 485 Interface Cicuits*", the introduction about RS 422-485.

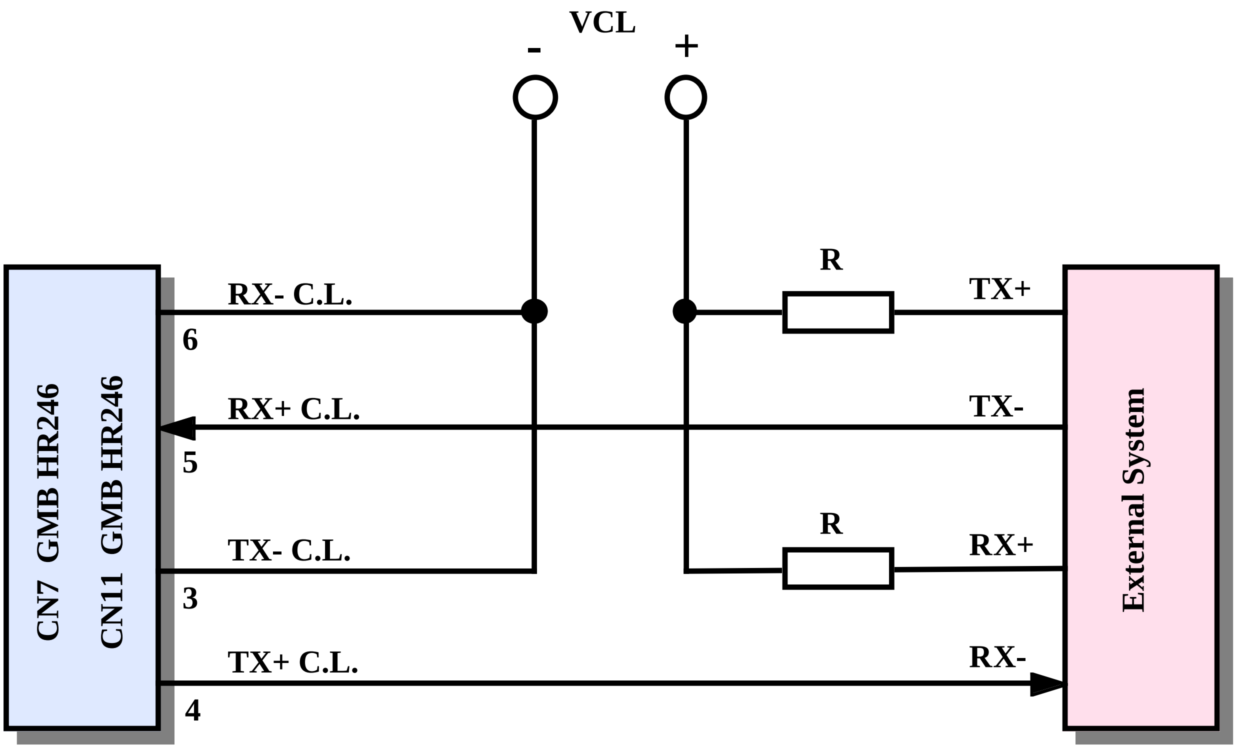


FIGURE 17: CURRENT LOOP 4 WIRES POINT TO POINT CONNECTION EXAMPLE

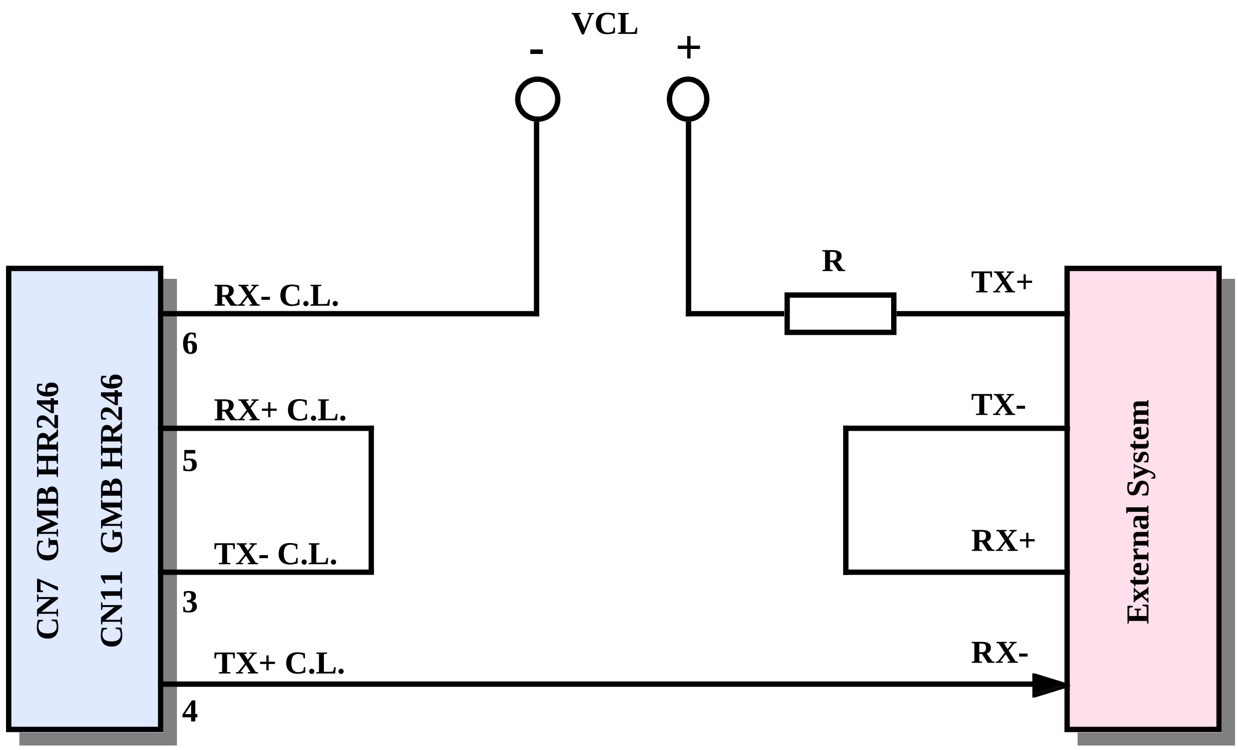


FIGURE 18: CURRENT LOOP 2 WIRES POINT TO POINT CONNECTION EXAMPLE

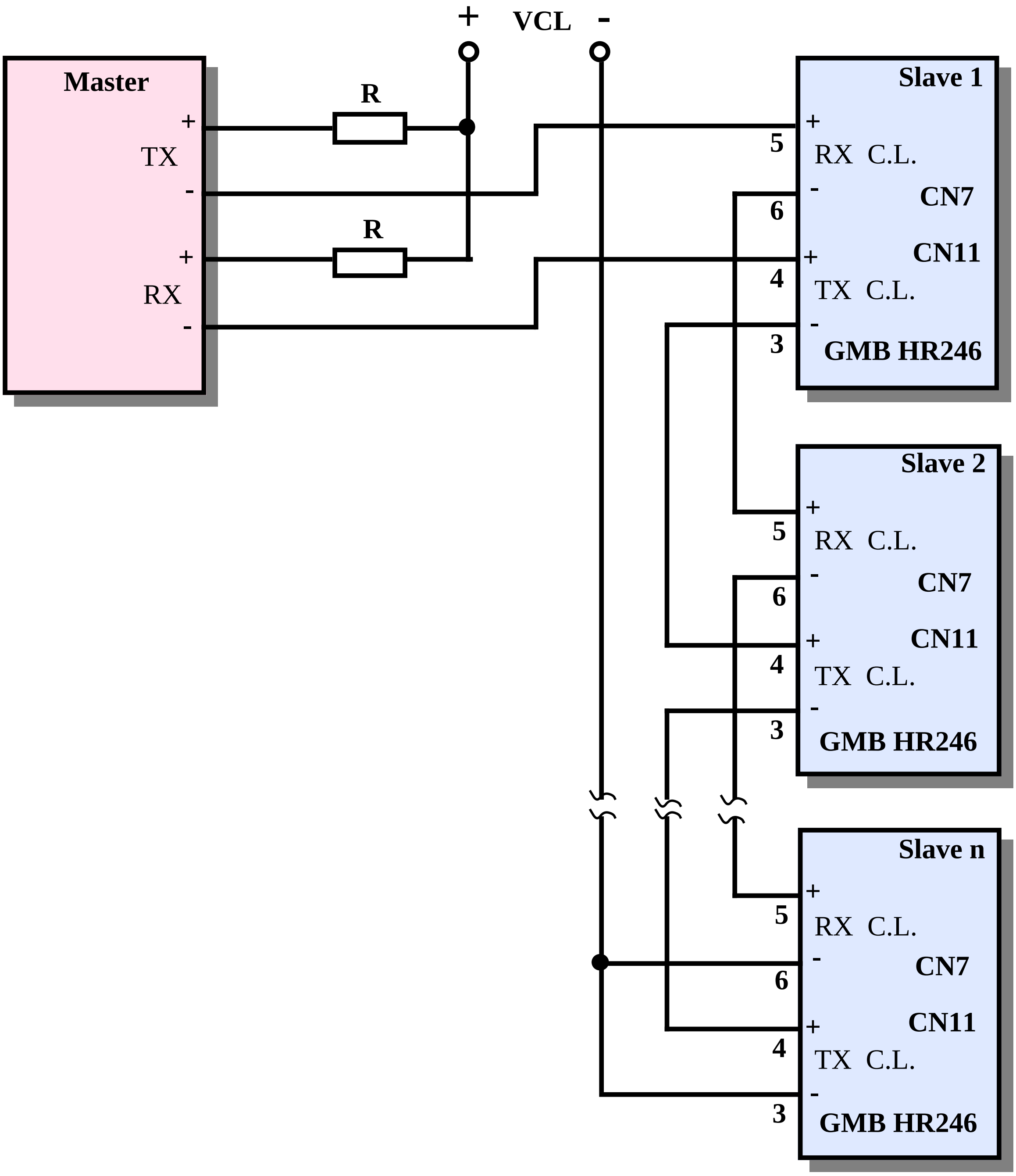


FIGURE 19: CURRENT LOOP NETWORK CONNECTION EXAMPLE

Possible Current Loop connections are two: 2 wires and 4 wires. These connections are shown in figures 17÷19 where it is possible to see the voltage for **VCL** and the resistances for current limitation (**R**). The supply voltage varies in compliance with the number of connected devices and voltage drop on the connection cable.
The choice of the values for these components must be done cosidering that:
- circulation of a **20 mA** current must be guaranteed;
- potential drop on each transmitter is about **2.35 V** with a 20 mA current;
- potential drop on each receiver is about **2.52 V** cwith a 20 mA current;
- in case of shortciruit each transmitter must dissipate at most **125 mW**;
- in case of shortciruit each receiver must dissipate at most **90 mW**.

For further info please refer to HEWLETT-PACKARD Data Book, (**HCPL 4100** and **4200** devices).

CN11 - SERIAL LINE 2 (AUXILIARY) CONNECTOR

CN11 is a 8 pins, male, vertical, AMP MODU II 4+4 connector with 2.54 mm pitch.
On this connector there are the signals for communication in RS 232, RS 422, RS 485, Current Loop and TTL, performed through serial line 2 (auxiliary) of Mini Module. For additional info on CN11 please read the documentation of similar connector CN7 and figures 10÷19.

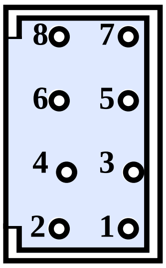


FIGURE 20: CN11 - SERIAL LINE 2 (AUXILIARY) CONNECTOR

Pin	*Signal*	*Direction*	*Description*
<u>TTL serial line2:</u>			
5	**RX TTL**	= I	- Receive data for TTL.
3	**TX TTL**	= O	- Transmit data for TTL.
7	**GND**	=	- Ground signal.
<u>RS 232 serial line2:</u>			
5	**RX RS232**	= I	- Receive data for RS 232.
3	**TX RS232**	= O	- Transmit data for RS 232.
7	**GND**	=	- Ground signal.
<u>RS 422 serial line 2:</u>			
6	**RX- RS422**	= I	- Negative receive data for RS 422.
5	**RX+ RS422**	= I	- Positive receive data for RS 422.
3	**TX- RS422**	= O	- Negative transmit data for RS 422.
4	**TX+ RS422**	= O	- Positive transmit data for RS 422.
7	**GND**	=	- Ground signal.
<u>RS 485 serial line 2:</u>			
6	**RXTX+ RS485**	= I/O	- Positive receive and trasmit data for RS 485.
5	**RXTX- RS485**	= I/O	- Negative receive and trasmit data for RS 485.
7	**GND**	=	- Ground signal.
<u>Current Loop serial line 2:</u>			
6	**RX- C.L.**	= I	- Negative receive data for Current Loop.
5	**RX+ C.L.**	= I	- Positive receive data for Current Loop.
3	**TX- C.L.**	= O	- Negative transmit data for Current Loop.
4	**TX+ C.L.**	= O	- Positive transmit data for Current Loop.
<u>Power supply voltages:</u>			
1	**+5 Vdc**	= O	- +5 Vdc power supply signal.
7	**GND**	=	- Ground signal.
2	**Vopto A**	= O	- Power supply voltage for optocoupled digital inputs.
8	**Vopto B**	= O	- Power supply voltage for optocoupled digital inputs.

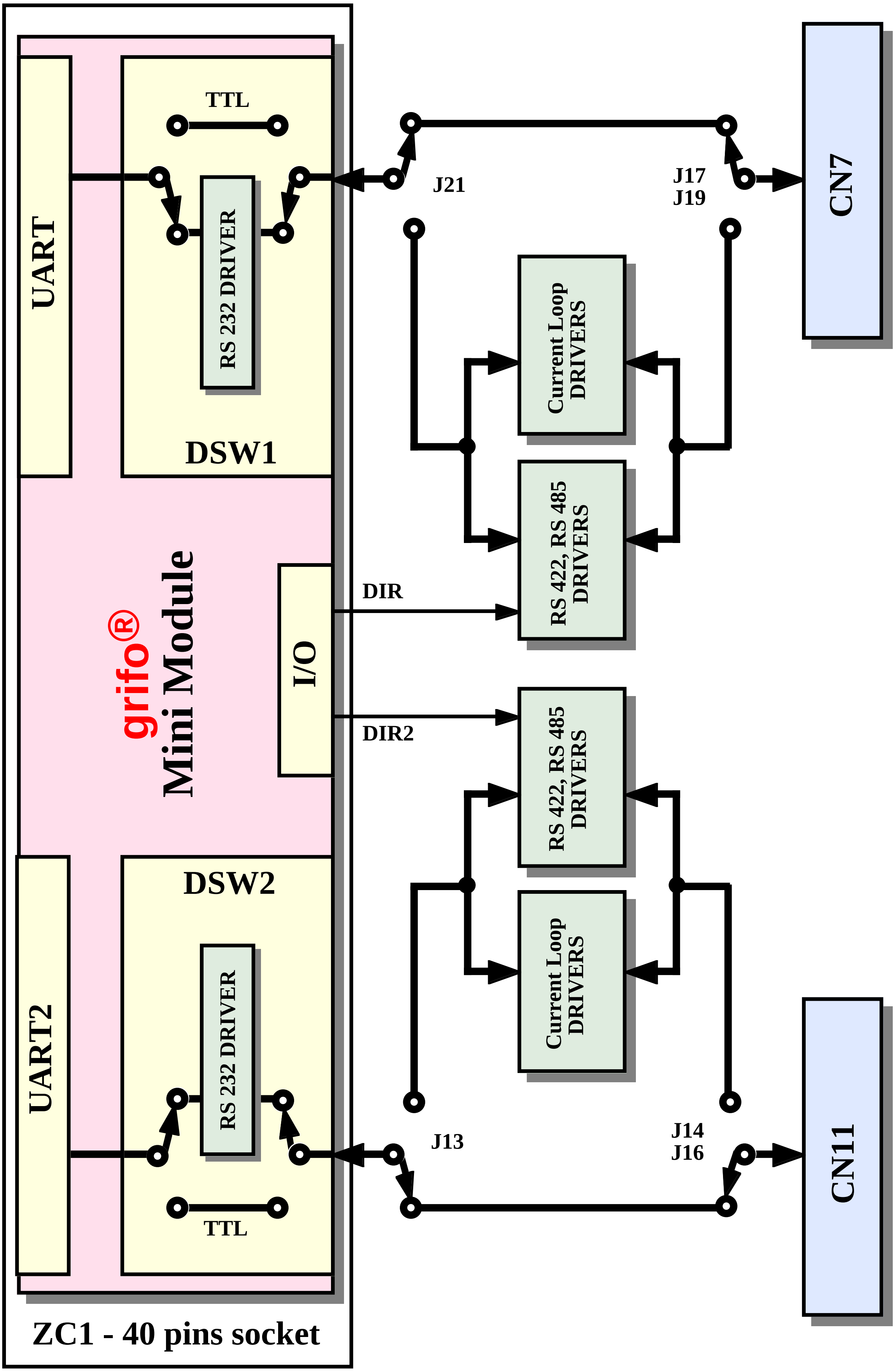


FIGURE 21: SERIAL COMMUNICATION BLOCK DIAGRAM

CN1 - OPTOCOUPLED INPUTS CONNECTOR GROUP A, B

CN1 is a 13 pins, vertical, quick release screw terminal connector with 3.5 mm pitch.
CN1 is used to connect 12 of the 24 optocoupled NPN or PNP input signals available on the card **GMB HR246**, that are visualized by as many LEDs, green and yellow. In addition to input lines, on the connector there is also the common pin where it must be connected the inputs to enable, with a pure contact. The lines of the 40 pins socket connected to CN1 inputs signals have been carefully selected to take advantage of grifo® Mini Modules internal peripherals.

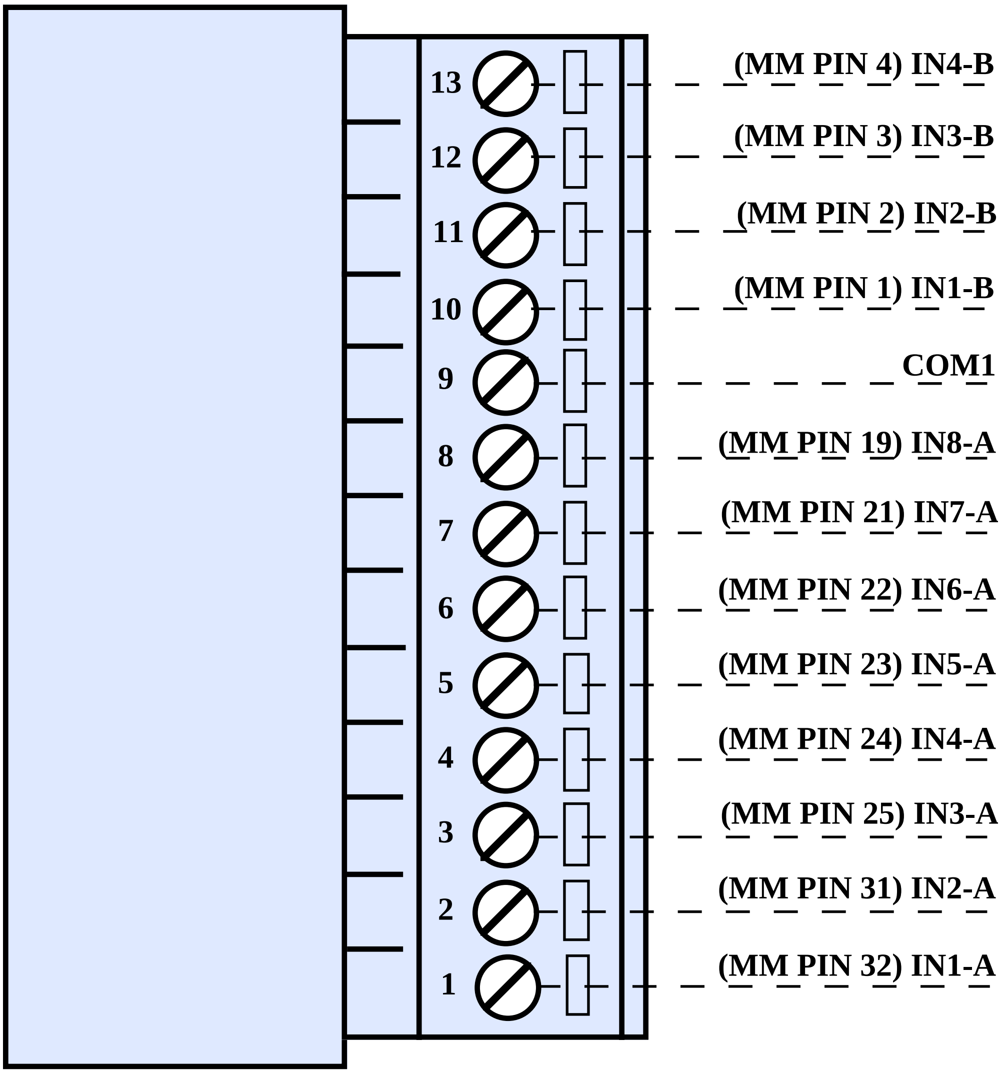


FIGURE 22: CN1 - OPTOCOUPLED INPUTS CONNECTOR GROUP A, B

Signals description:

IN n-A	=	I	- Optocoupled input n, NPN or PNP type, of group A.
IN n-B	=	I	- Optocoupled input n, NPN or PNP type, of group B.
COM1	=		- Common pin where an input must be connected to enable it.
MM PIN xx	=	I	- Signal connected to pin xx of the ZC1 socket.

Input lines are optocoupled and provided with lowpass filter; this warrants a grade of protection for internal electronics against external noise. Each line has a LED for visual signalation that turns on whenever input pin and common pin are connected, regardless from current direction. By this way the input lines are suitable both for **PNP** and **NPN** drivers.

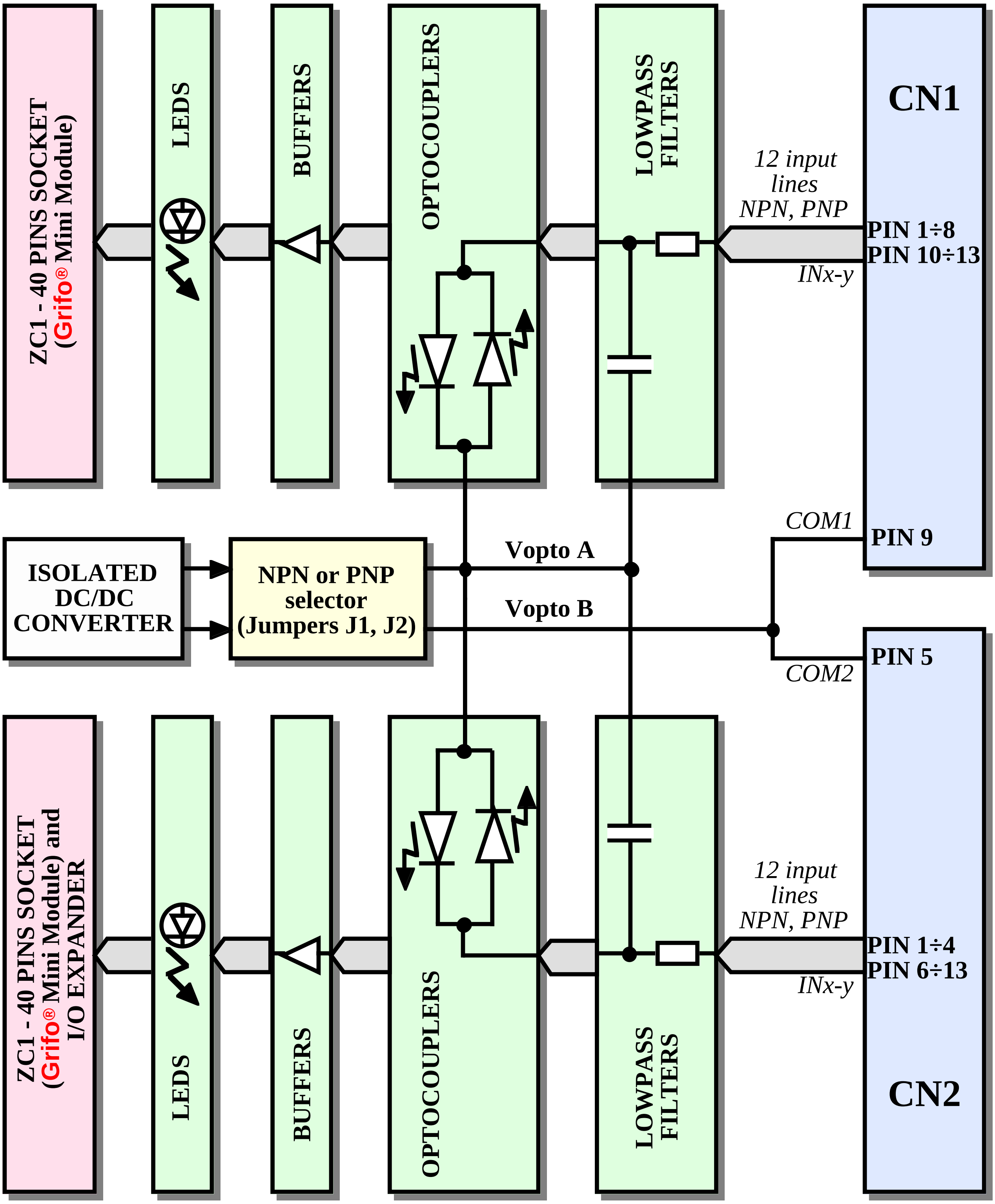


FIGURE 23: OPTOCOUPLED INPUTS BLOCK DIAGRAM

Supply voltage for optocouplers (named Vopto A and Vopto B) is generated on board starting from the single external supply voltage provided on CN6 connector, by a proper isolated DC/DC converter; thus to enable an input it is sufficient connect it to common signal COM1 or COM2. The Vopto signals are available also on CN7 and CN11 connectors and the user can link them when required.

CN2 - OPTOCOUPLED INPUTS CONNECTOR GROUP B, C

CN2 is a 13 pins, vertical, quick release screw terminal connector with 3.5 mm pitch.
CN2 is used to connect 12 of the 24 optocoupled NPN or PNP input signals available on the card **GMB HR246**, that are visualized by as many LEDs,yellow and green. In addition to input lines, on the connector there is also the common pin where it must be connected the inputs to enable, with a pure contact. The lines of the 40 pins socket connected to CN2 inputs signals have been carefully selected to take advantage of grifo® Mini Modules internal peripherals; the remaining inputs are connected to on board I/O expander.

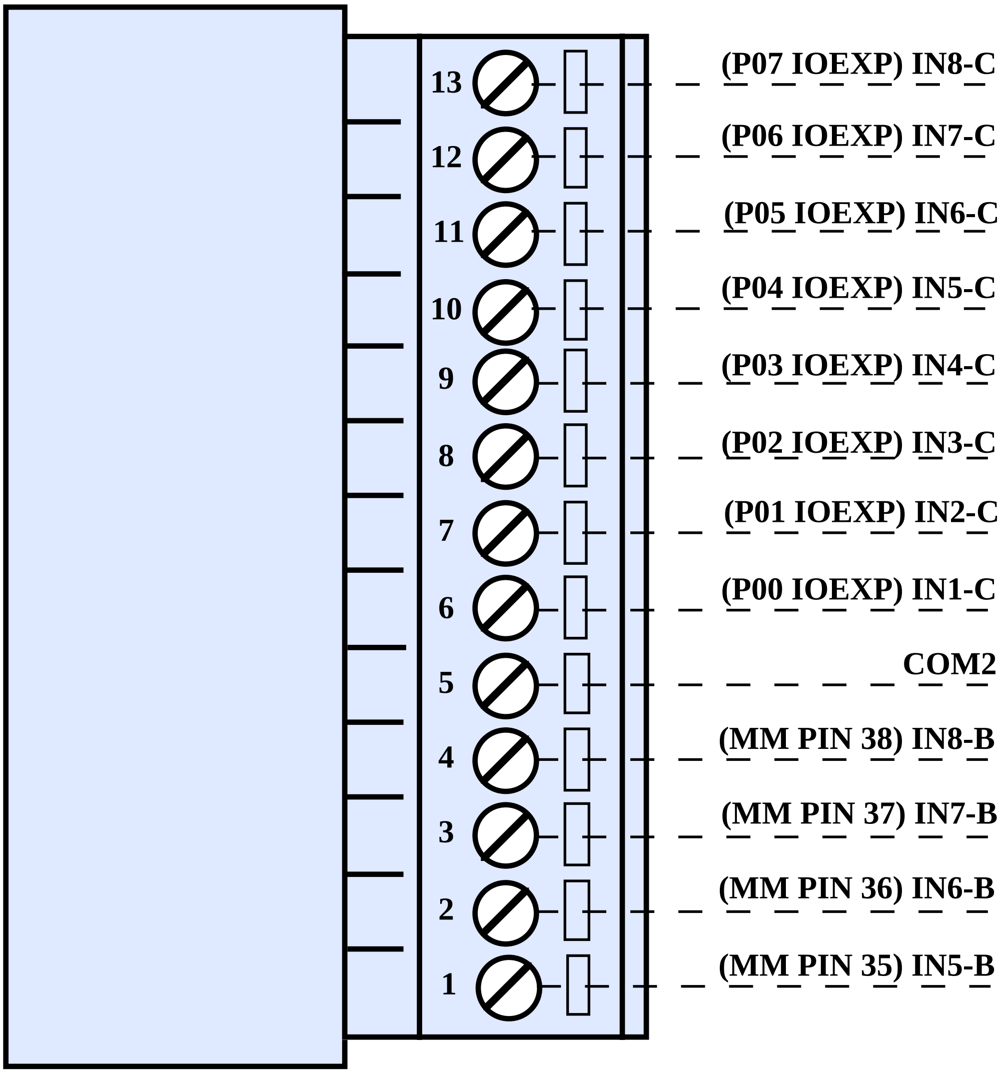


FIGURE 24: CN2 - OPTOCOUPLED INPUTS CONNECTOR GROUP B, C

Signals description:

IN n-B	=	I	- Optocoupled input n, NPN or PNP type, of group B.
IN n-C	=	I	- Optocoupled input n, NPN or PNP type, of group C.
COM2	=		- Common pin where an input must be connected to enable it.
MM PIN xx	=	I	- Signal connected to pin xx of the ZC1 socket.
P0x IOEXP	=	I	- Input connected to signal P0x of the I/O expander.

The following figure shows the connection modality for all the 24 optocoupled inputs, available on CN1 and CN2.

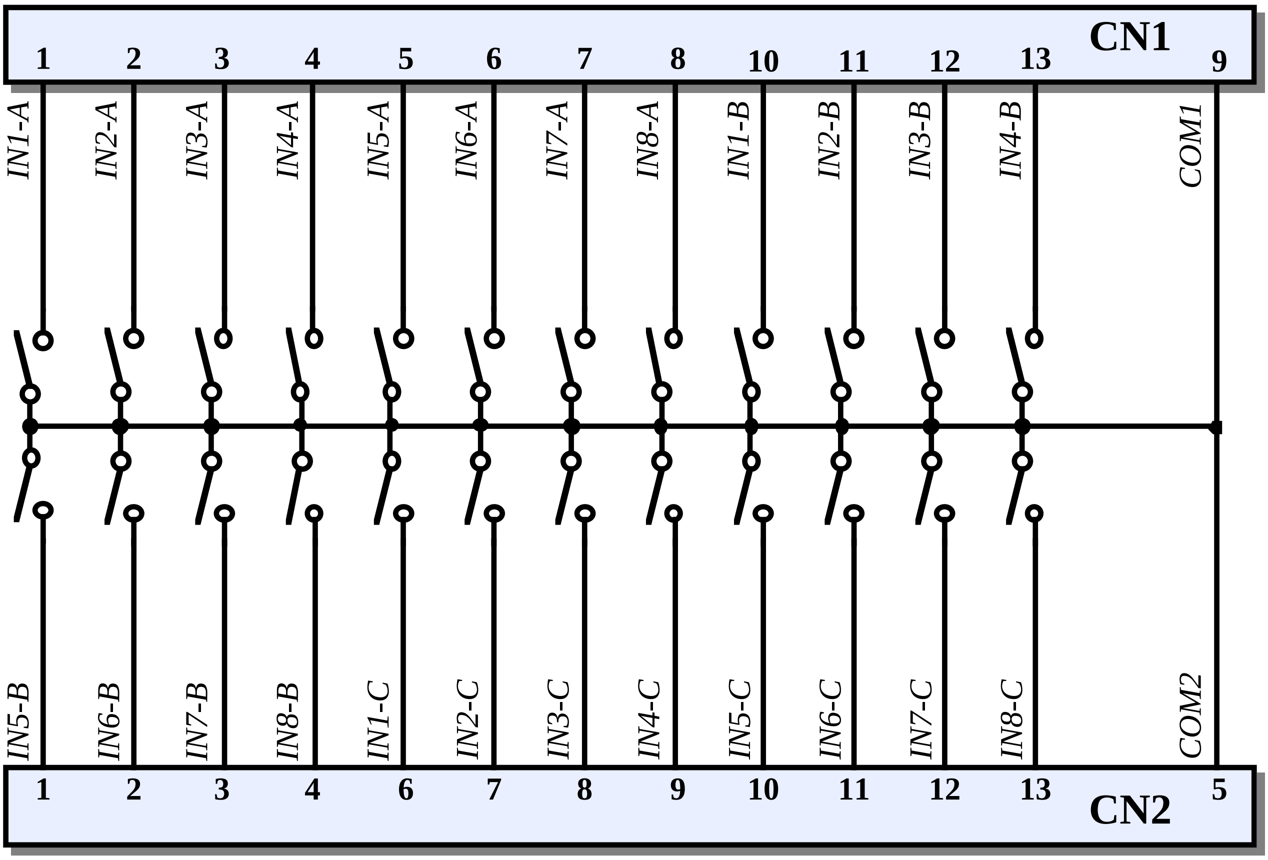


FIGURE 25: OPTOCOUPLED INPUTS CONNECTION DIAGRAM

Additional information about the connection of optocoupled inputs are placed also in the paragraphs I/O CONNECTIONS and NPN OR PNP INPUTS CONFIGURATION: here the user can find the description of the selection between **NPN** and **PNP** type.

CN3 - RELAYS OUTPUTS CONNECTOR GROUP A, B, C

CN3 is a 9 pins, vertical, quick release screw terminal connector, with 5 mm pitch.
CN3 is used to connect 6 of the 16 relays outputs, available on **GMB HR 246**. Please remind that maximum (resistive) current for each line is **5 A** and maximum voltage is **35 Vdc**.
These lines are driven by signals of the 40 pins socket, opportunely buffered, and carefully selected in order to simplify software management and in order to take advantage of **grifo®** Mini Modules internal peripherals.

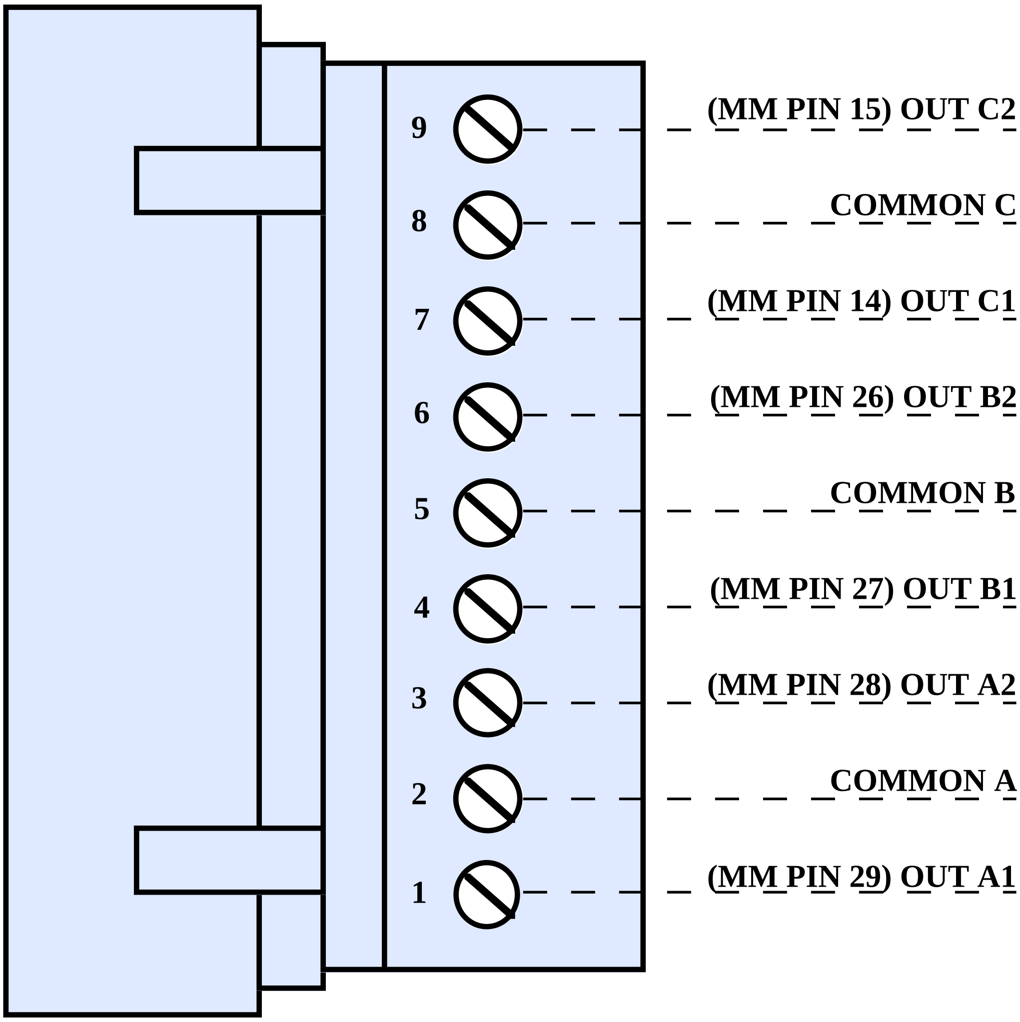


FIGURE 26: CN3 - RELAYS OUTPUTS CONNECTOR GROUPS A, B, C

Signals description:

OUT An	=	O	- Normally open contact for relay n, of group A.
COMMON A	=		- Common contact for relays of group A.
OUT Bn	=	O	- Normally open contact for relay n of group B.
COMMON B	=		- Common contact for relays of group B.
OUT Cn	=	O	- Normally open contact for relay n of group C.
COMMON C	=		- Common contact for relays of group C.
MM PIN xx	=	O	- Signal connected to pin xx of the ZC1 socket.

Each relay output is provided with a LED that visualize the line status (LED will be on when relay contact is closed), placed near the output terminal screw.

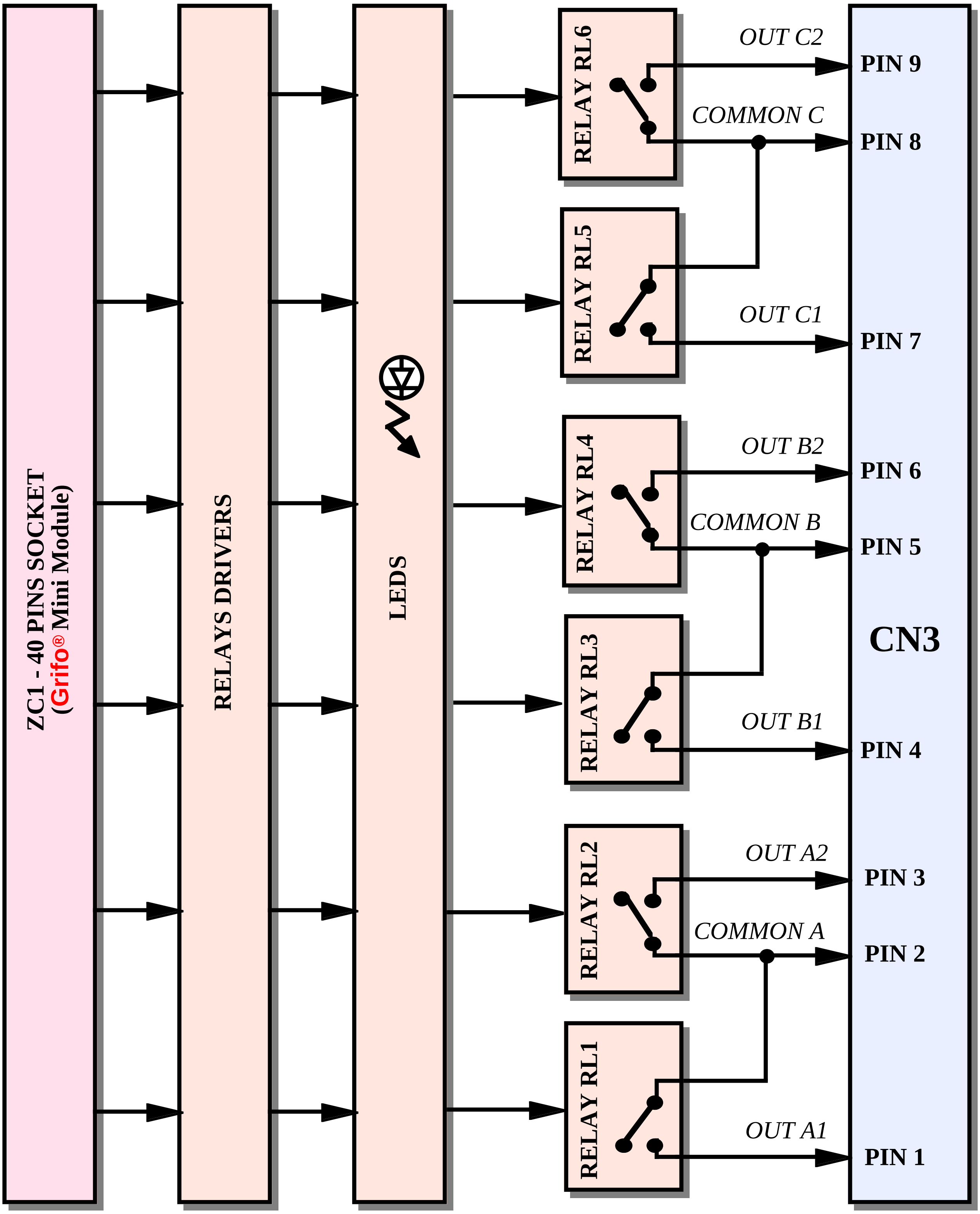


FIGURE 27: RELAYS OUTPUTS GROUPS A, B, C BLOCK DIAGRAM

As described in previous figures, there are three groups of two relays, called A1 and A2, B1 and B2, C1 and C2; moreover each group has its own common terminal (COMMON A, B and C). This allows to connect external loads supplied by three different sources, making the wiring of the whole system very easier, as illustrated on figure 32.

CN4 - RELAYS OUTPUTS CONNECTOR GROUP D, E, F

CN4 is a 9 pins, vertical, quick release screw terminal connector, with 5 mm pitch.
CN4 is used to connect 6 of the 16 relays outputs, available on **GMB HR 246**. Please remind that maximum (resistive) current for each line is **5 A** and maximum voltage is **35 Vdc**.
These lines are driven by signals of the 40 pins socket, opportunely buffered, and carefully selected in order to simplify software management and in order to take advantage of **grifo®** Mini Modules internal peripherals; the remaining outputs are connected to on board I/O expander.

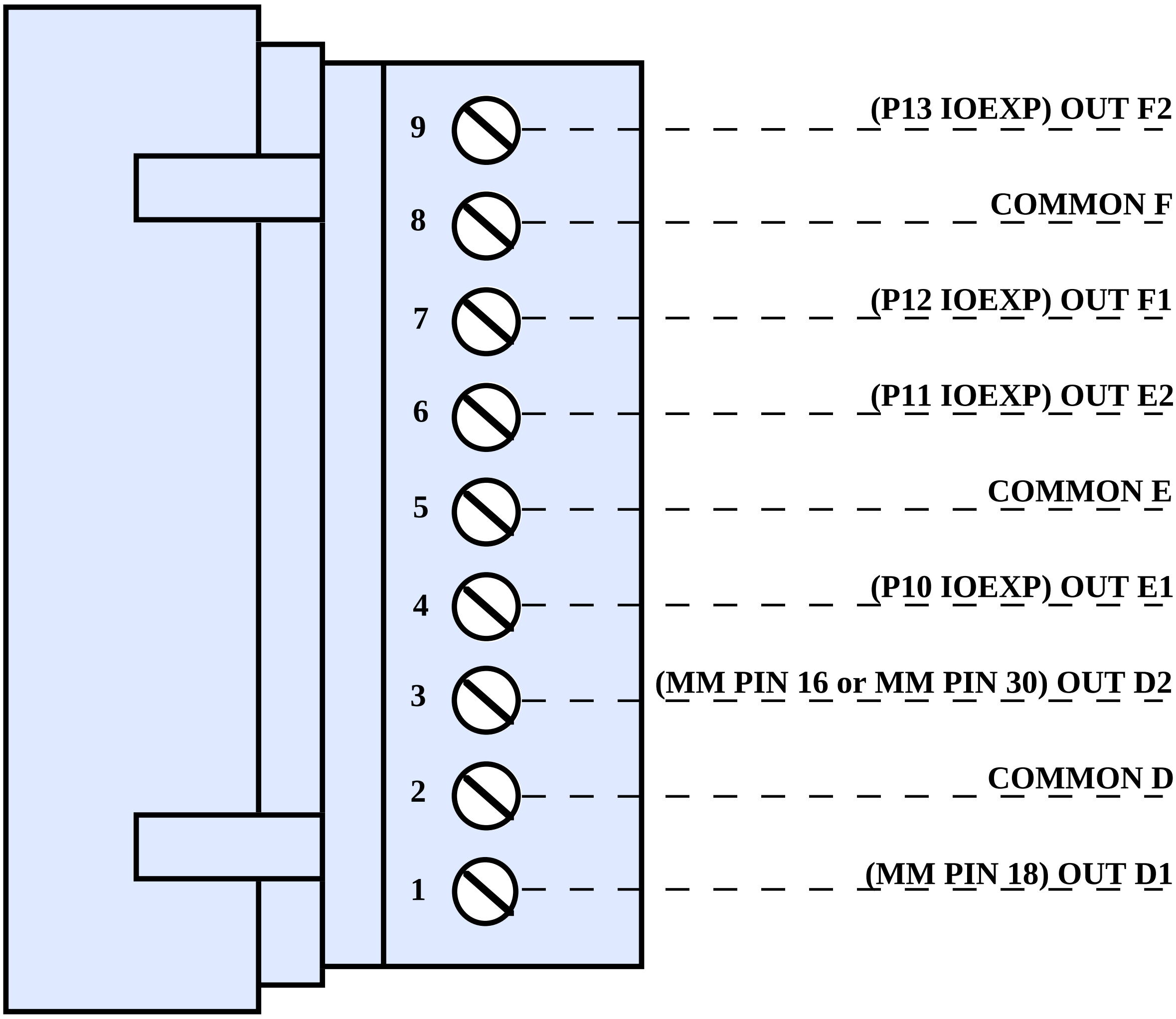


FIGURE 28: CN4 - RELAYS OUTPUTS CONNECTOR GROUPS D, E, F

Signals description:

OUT Dn	=	O	- Normally open contact for relay n, of group D.
COMMON D	=		- Common contact for relays of group D.
OUT En	=	O	- Normally open contact for relay n of group E.
COMMON E	=		- Common contact for relays of group E.
OUT Fn	=	O	- Normally open contact for relay n of group F.
COMMON F	=		- Common contact for relays of group F.
MM PIN xx	=	O	- Signal connected to pin xx of the ZC1 socket.
P1x IOEXP	=	O	- Output connected to signal P1x of the I/O expander.

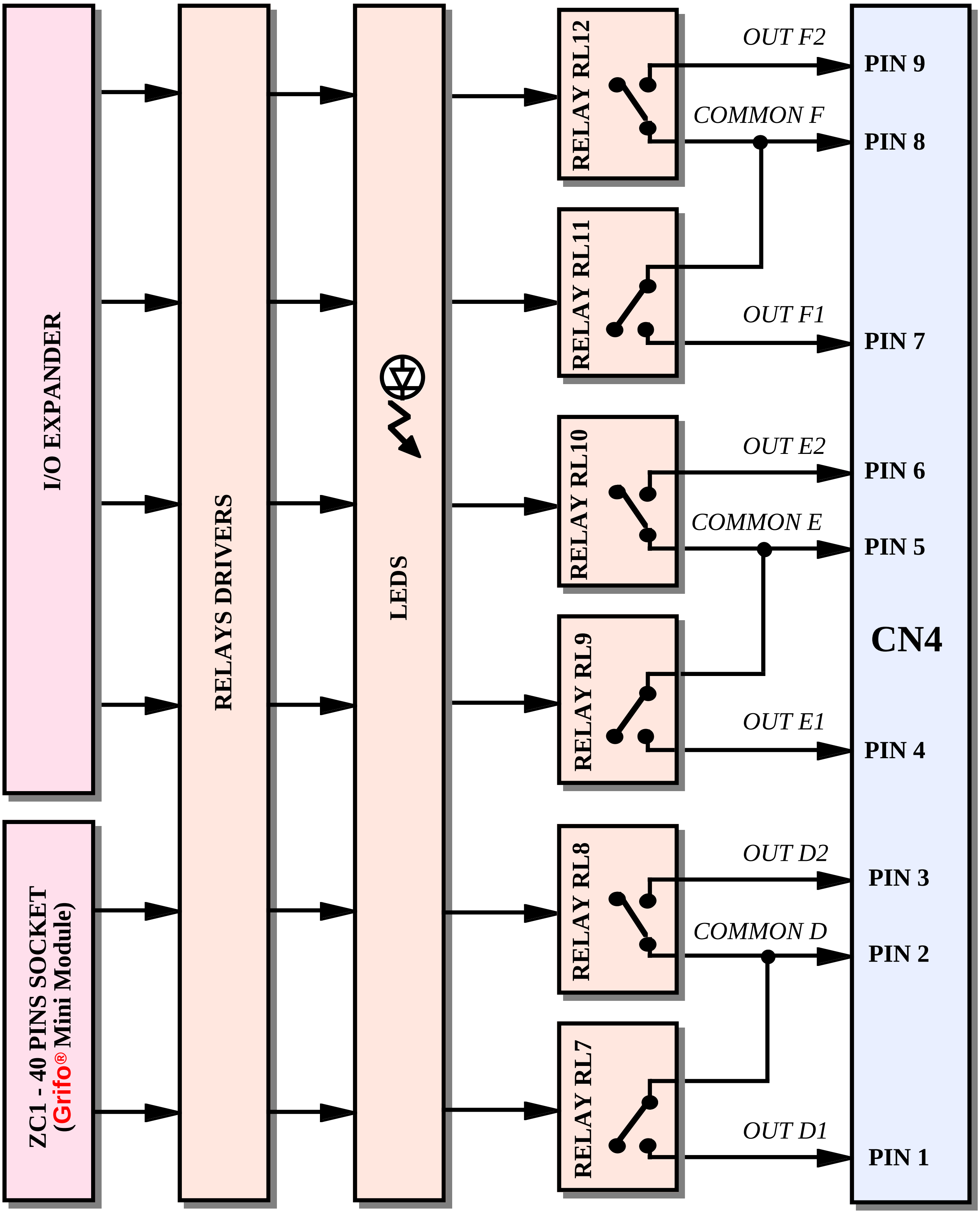


FIGURE 29: RELAYS OUTPUTS GROUPS D, E, F BLOCK DIAGRAM

As described in previous figures, there are three groups of two relays, called D1 and D2, E1 and E2, F1 and F2; moreover each group has its own common terminal (COMMON D, E and F). This allows to connect external loads supplied by three different sources, making the wiring of the whole system very easier, as illustrated on figure 32.

CN5 - RELAYS OUTPUTS CONNECTOR GROUP G, H

CN5 is a 6 pins, vertical, quick release screw terminal connector, with 5 mm pitch.
CN5 is used to connect 4 of the 16 relays outputs, available on **GMB HR 246**. Please remind that maximum (resistive) current for each line is **5 A** and maximum voltage is **35 Vdc**.
These lines are driven by signals of the on board I/O expander, opportunely buffered,through a simple software management.

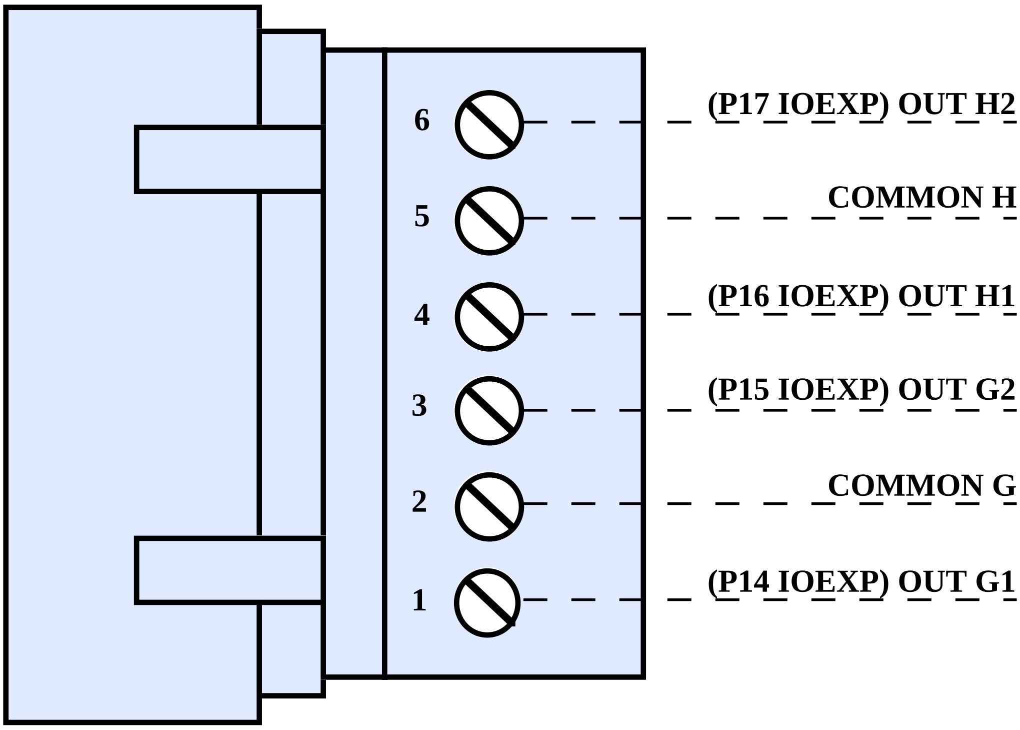


FIGURE 30: CN5 - RELAYS OUTPUTS CONNECTOR GROUPS G, H

Signals description:

OUT Gn	= O	- Normally open contact for relay n, of group G.
COMMON G	=	- Common contact for relays of group G.
OUT Hn	= O	- Normally open contact for relay n of group H.
COMMON H	=	- Common contact for relays of group H.
P1x IOEXP	= O	- Output connected to signal P1x of the I/O expander.

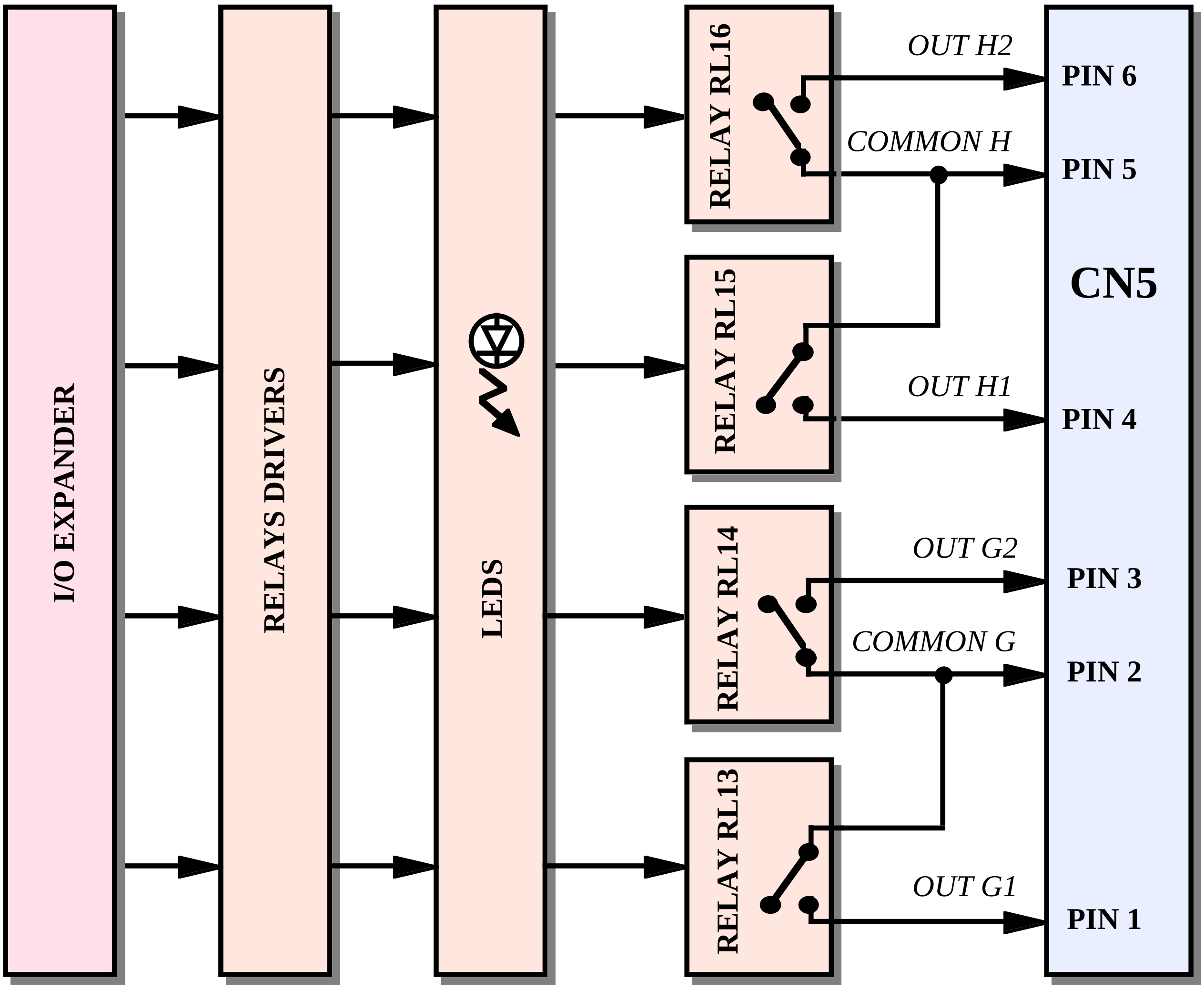


FIGURE 31: RELAYS OUTPUTS GROUPS G, H BLOCK DIAGRAM

As described in previous figures, there are two groups of two relays, called G1 and G2, H1 and H2; moreover each group has its own common terminal (COMMON G, H). This allows to connect external loads supplied by two different sources, making the wiring of the whole system very easier, as illustrated on figure 32.

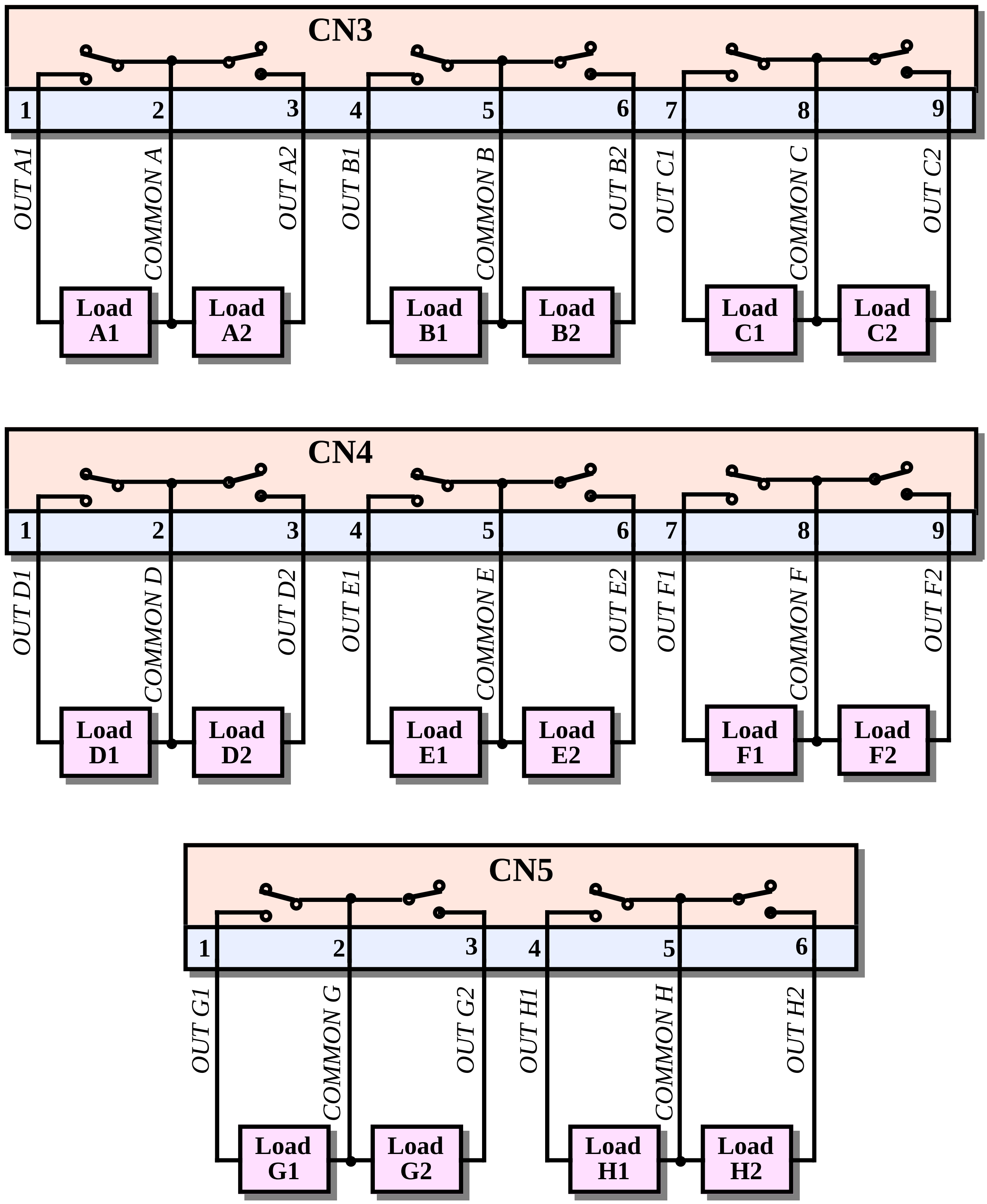


FIGURE 32: RELAYS OUTPUTS CONNECTION DIAGRAM

NOTE

The relays outoputs are divided on three different connectors in order to satisfy the physical form of the container. Anyway the signals placement is modular and repeated, or in other words, each group use always 3 pins with the same position for the contacts and the common.

So, whenever a connection must be moved from one group to another it is not necessary to recable, but it is sufficient to shift the existent wirings (for example by using 3 pins female connectors both on CN3, CN4 and CN5).

CN9 - TTL I/O, A/D, PWM, CAN, ETC. CONNECTOR

CN9 ia an 8 pins, male, vertical, AMP MODU II 4+4 connector with 2.54 mm pitch.
On this connector are always available: the +5 Vdc supply voltage generated by on board switching section, one line dedicated to analog input, up to 5 digital I/O lines at TTL level (one of these with PWM functionality), and the eventual CAN interface.
When it is ordered the optional RTC, or the installed Mini Module has a RTC on board, the pin 4 of CN9 is connected to its interrupt signal, so it can be used as generic I/O only when specifics settings has been done.
Female connector for CN9 is directly available between **grifo®** accessories, and it can be ordered by using the codes **CKS.AMP8** or **AMP8.Cable**, as described in APPENDIX B of the manual.

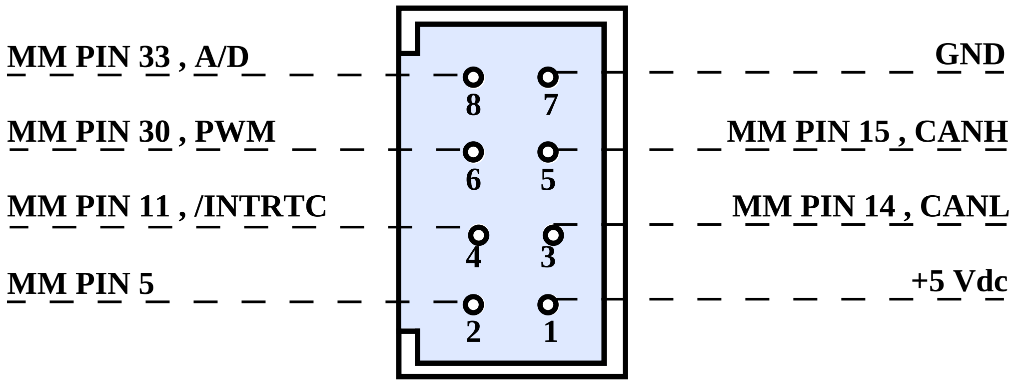


FIGURE 33: CN9 - TTL I/O, A/D, PWM, CAN, ETC. CONNECTOR

Signals description:

MM PIN xx	= I/O - TTL digital I/O signal, connected to pin xx of Mini Module.
A/D	= I - Analog input signal (see figure 49).
PWM	= O - Pulse width modulation signal.
/INTRTC	= I/O - Real Time Clock interrupt signal of Mini Module or **.RTC** option.
CAN H	= I/O - Differential line high of CAN interface.
CAN L	= I/O - Differential line low of CAN interface.
+5 Vdc	= O - +5 Vdc power supply signal.
GND	= - Ground signal.

NOTE The connection of some signals on CN9 depends on configurations of some jumpers of the card: it is suggested to examine the hpmonimous paragraph JUMPERS and figure 43.

Next pages report some figures concerning CN9 and the relative connection modalities for field signals.

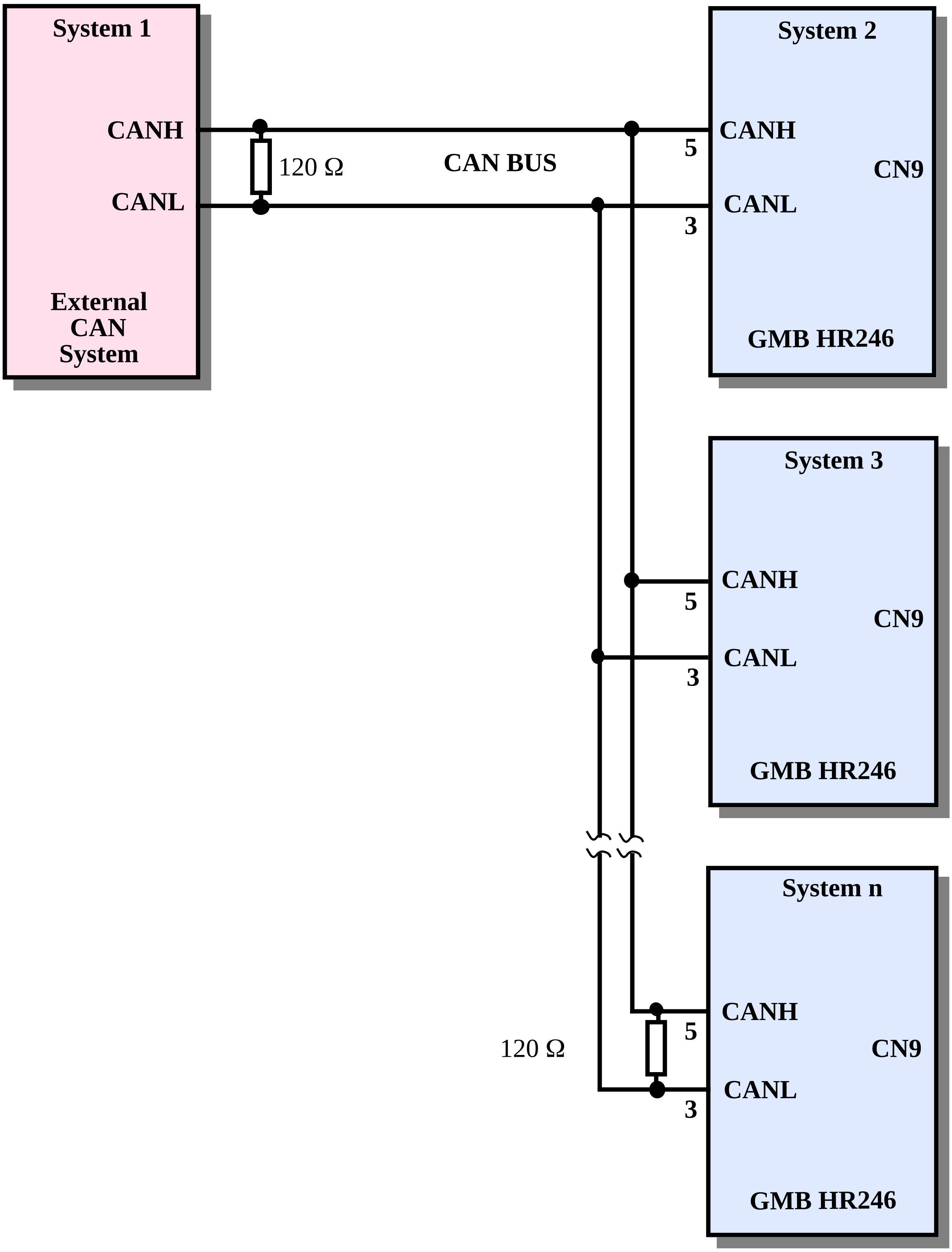


FIGURE 34: CAN INTERFACE CONNECTION EXAMPLE

Please remind that a CAN network line must have impendace of 60 Ω; in order to obtain this, two termination resistors (120 Ω) placed at its extrems, respectevely near the two units that are at the greatest distance.
If the system to connect are at very different potentials, it is possible to connect also the grounds of the systems, that is pin 7 of CN9, in order to solve eventual problems of communication and/or damages.

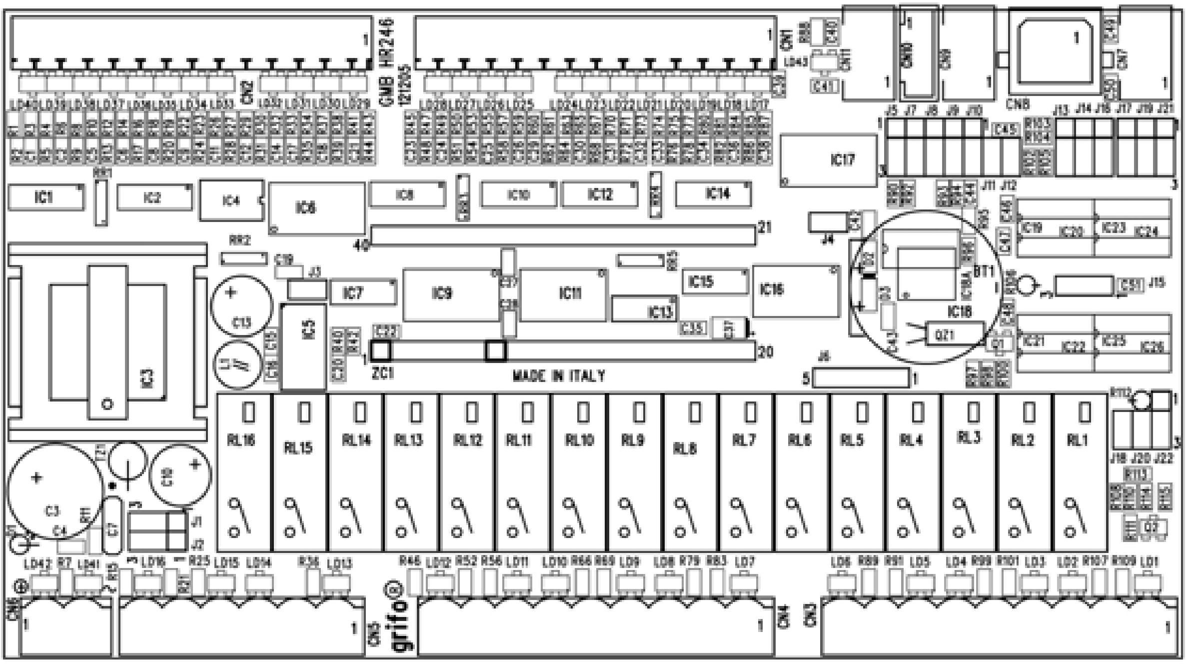


Figure 35: Components map components side

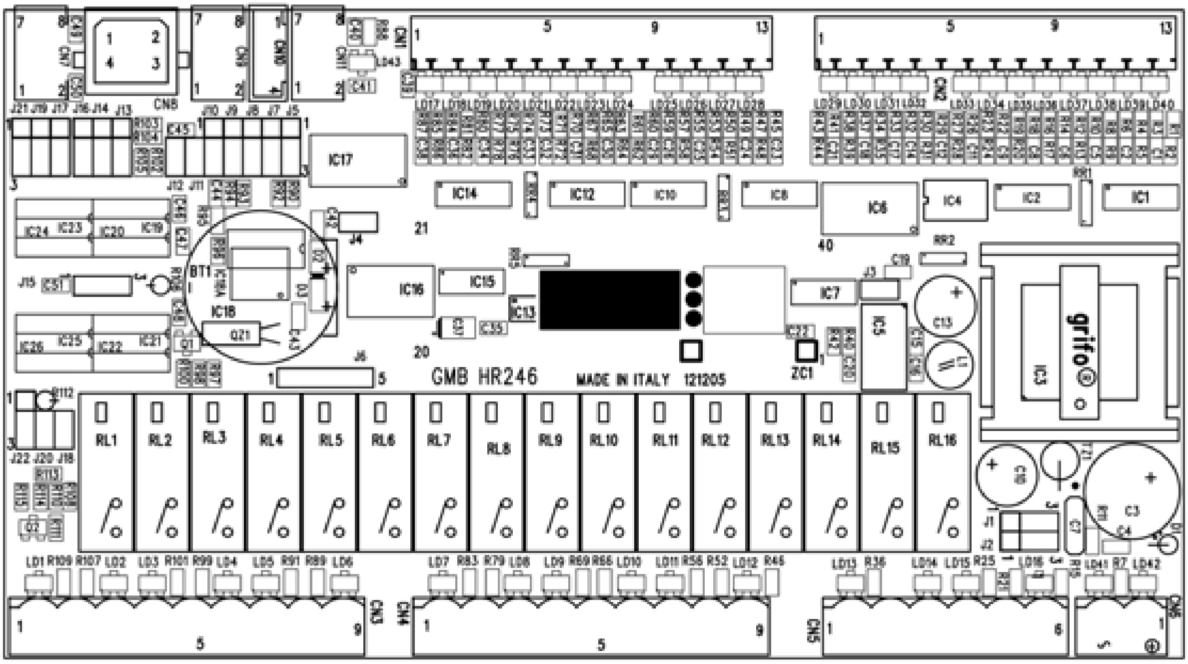


Figure 36: Components map solder side

ZC1 - SOCKET FOR CONTROL DEVICE

ZC1 is a DIL socket provided of 40 pin, 600 mils width and 2.54 mm pitch.
Its purpose is to install the intelligent hardware card that manages all the **GMB HR 246** signals or in other words, the unit that acquires the optocoupled inputs, drives the relays outputs, communicates with other systems through the numerous interfaces, etc.
Signals placement on ZC1 has been designed for a direct use of **grifo®** Mini Modules. If you are using a combination **GMB HR 246** + **grifo®** Mini Module please refer to its specific manual, that describes the total features of both the cards.
If you want to develop a new hardware or you have to check hardware compatibility of an existing board, please refer to the following figure, that shows the connection of the on board resources. Once the resource is found you can get further information by reading the previous paragraphs, where many figures illustrate the hardware connections of socket ZC1. In these figures and in all other pages of the manual, the pins of the socket are always identified by **MM PIN xx** name.
On figure 37 some pins of socket are provided of many signals description: this correspond to possible connections, selectable by proper configuration jumpers as described in homonimous paragraph, or to different features of Mini Module.

IN1-B	1	40	RX2 RS232 , RX2 TTL
IN2-B	2	39	TX2 RS 232 , TX2 TTL
IN3-B	3	38	IN8-B
IN4-B	4	37	IN7-B
CN9.2	5	36	IN6-B
DIR2	6	35	IN5-B
N.C. , Vref	7	34	+5 Vdc
N.C.	8	33	A/D , CN9.8
RX TTL , RX RS232	9	32	IN1-A
TX TTL , TX RS232	10	31	IN2-A
CN9.4 , /INTRTC	11	30	DIR , PWM, CN9.6 , OUT D2
CN10.2 , SCL	12	29	OUT A1
CN10.3, SDA	13	28	OUT A2
OUT C1 , CN9.3 , USBL , CANL	14	27	OUT B1
OUT C2 , CN9.5 , USBH , CANH	15	26	OUT B2
N.C. , OUT D2	16	25	IN3-A
N.C. , DIR	17	24	IN4-A
OUT D1	18	23	IN5-A
IN8-A	19	22	IN6-A
GND	20	21	IN7-A

FIGURE 37: ZC1 - CONTROL DEVICE SOCKET

Signals description:

IN n-A	= I	- Line connected to optocoupled input n of group A.
IN n-B	= I	- Line connected to optocoupled input n of group B.
IN n-C	= I	- Line connected to optocoupled input n of group C.
OUT An	= O	- Line connected to relay output n of group A.
OUT B n	= O	- Line connected to relay output n of group B.
OUT Cn	= O	- Line connected to relay output n of group C.
OUT Dn	= O	- Line connected to relay output n of group D.
CNx.y	= I/O	- Line connected to pin y of connector CNx.
Vref	= I	- Reference voltage for A/D converter section.

A/D	=	I	- Analog input signal.
PWM	=	O	- Pulse width modulation signal.
/INTRTC	=	I/O	- Real Time Clock interrupt signal of Mini Module or **.RTC** option.
CAN L	=	I/O	- Differential line low of CAN interface.
CAN H	=	I/O	- Differential line high of CAN interface.
USBL	=	I/O	- Differential line low for USB interface.
USBH	=	I/O	- Differential line high for USB interface.
SDA	=	I/O	- Data signal for I2C BUS interface.
SCL	=	I/O	- Clock signal for I2C BUS interface.
RX2 RS232	=	I	- Receive data for RS 232 serial line 2 (auxiliary).
TX2 RS232	=	O	- Transmit data for RS 232 serial line 2 (auxiliary).
RX2 TTL	=	I	- Receive data for TTL serial line 2 (auxiliary).
TX2 TTL	=	O	- Transmit data for TTL serial line 2 (auxiliary).
DIR2	=	O	- Line for RS 422, RS 485 driver management of serial line 2 (auxiliary).
RX RS232	=	I	- Receive data for RS 232 serial line 1 (primary).
TX RS232	=	O	- Transmit data for RS 232 serial line 1 (primary).
RX TTL	=	I	- Receive data for TTL serial line 1 (primary).
TX TTL	=	O	- Transmit data for TTL serial line 1 (primary).
DIR	=	O	- Line for RS 422, RS 485 driver management of serial line 1 (primary).
+5 Vdc	=	O	- +5 Vdc power supply signal.
GND	=		- Ground signal.
N.C.	=		- Not connected.

Inside the manuals of the pairs **GMB HR 246 + grifo®** Mini Module are already available the configurations of both the card and Mini Module, that allow the user to take the maximum advantages from all the lines on ZC1. Moreover are described also the CPU signals names connected to the same lines, in order to simplify the software management of the resource (see table CORRESPONDENCES BETWEEN SIGNALS AND RESOURCES of these manuals).

INTERRUPTS

Interrupts management on **GMB HR246** depends completely on hardware installed on ZC1, in fact it's this latter to determine which signals are interrupts.
When a **grifo®** Mini Module is installed, several interrupt sources are available, depending on which model is used.
Please refer to specific manual of Mini Module for further information.

I/O CONNECTIONS

In order to prevent possible connecting problems between **GMB HR246** and the external systems, the user has to read carefully the previous paragraphs information and the joined figures, that show the internal connection diagram. In this paragraph are briefly summarized these instructions:

- For all TTL signals the user must follow the rules of this electric standard. The connected digital signals must be always referred to card digital ground GND. For TTL signals, the 0V level corresponds to logic state 0, while 5V level corrisponds to logic state 1.

- Optocoupled input signals can be configured as described in paragraph NPN OR PNP INPUTS CONFIGURATION. When inputs are configured as NPN, positive voltage is present on input pins (INn-A, INn-B and INn-C) and ground is present on the common pins (COM1 and COM2), while when the inputs are configured as PNP the situation is reversed, this means ground on input pins and positive signal on common pins.
  In both the configurations, on the input connectors must be connected only pure, or clean, contacts (limit switches, relays contacts, push buttons, proximities, etc.) that simply short circuit or not the common (COM1 or COM2) to input INn-A,B,C, as illustrated on figure 25.
  Please remind that it is not possible to use a connection with mixed NPN and PNP inputs, but 24 inputs all NPN type or 24 inputs all PNP type.

- Relays outputs must be connected directly to the load to drive (electric valves, power relays, actuators, motors, etc.). The on board relays contacts are normally open and they can accept **5 A** current, up to **35 Vdc** voltage. In order to drive different loads, with different supplies, the card provides 8 couples of relays with as many commons pins, completely separated.
  When the loads don't respect the described features the user must interpose proper adaption circui, as for example specific external power relays.

- For the signals of the RS 232, RS 422, RS 485, Current Loop, CAN and USB interfaces, the user must follow the standard rules of each one of these protocols.

- For the I2C BUS interface, the user must follow the standard rules of this protocol and he must remind that both signals on CN10 are connected to a 4.7 KΩ pull up resistor.

- The analog input on CN9 is acquired through A/D converter section of Mini Module. It is provided with filtering capacitor that warrants more stability on the acquired signal but at the same time it decrease the cut-off frequency. In addition the analog input can be connected to a proper analog adapter that reduces its amplitude with a factor=4. Thus in order to correctly select the signals accepted by analog input it must be considered the Mini Module features (admitted range, resolution, precision, etc.) and the described features of **GMB HR246**.

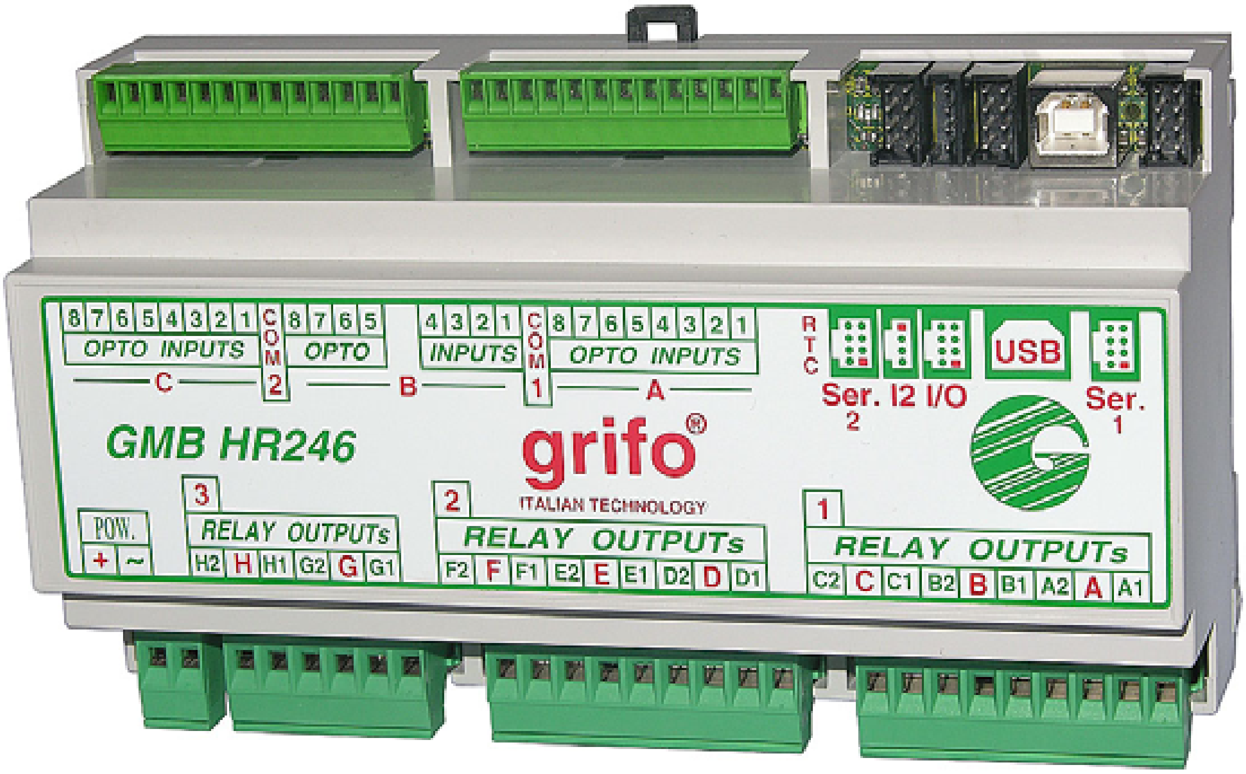


FIGURE 38: COMPLETE VIEW

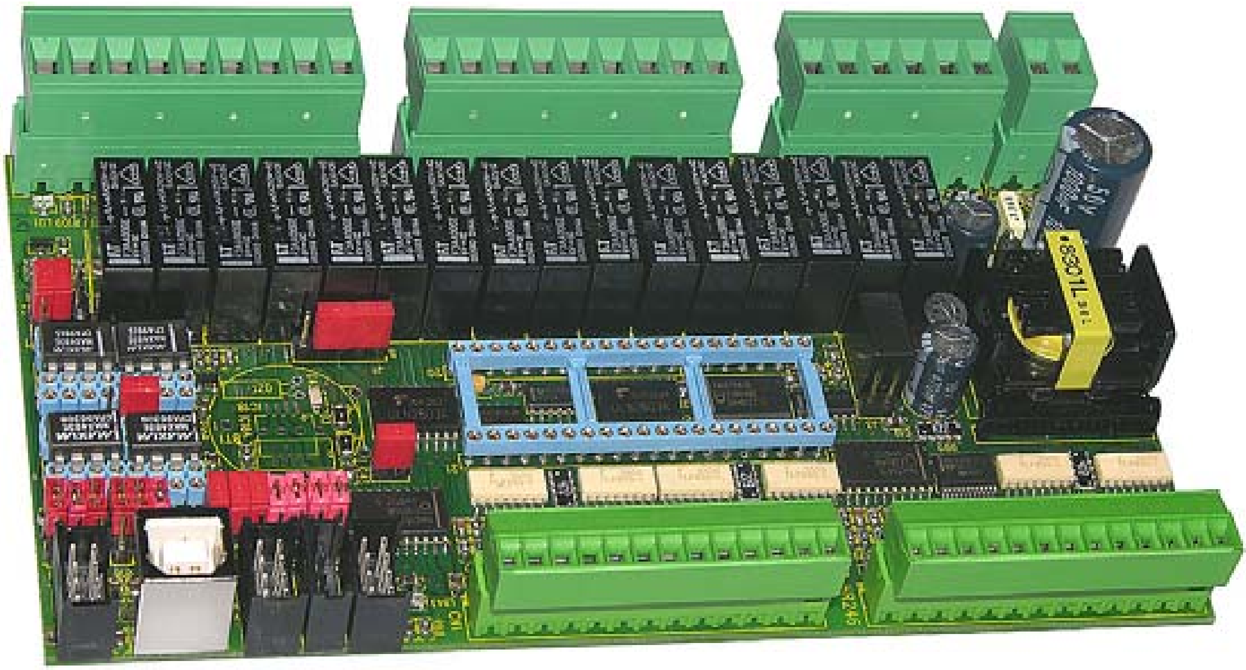


FIGURE 39: VIEW WITHOUT CONTAINER

POWER SUPPLY VOLTAGE

GMB HR246 is provided with a power supply section that solves in a efficent and comfortable way the problem to supply the board, in any situation. It generates energy for all sections of the board: control logic, Mini Module, optocoupled inputs, relays outputs, serial interfaces, I2C BUS line, Real Time Clock, etc.
On board there is a switching power supply that requires a 10÷38 Vdc or 8÷24 Vac voltage, provided through CN6 (polarity must be respected in case of DC supply). This allows to supply the module by using standard industrial and commercial power sources like transformers, batteries, solar cells, etc. A comfortable and inexpensive solution for power supply can be the **EXPS-1** product that can be directly connected to the terminal starting from mains.
Please remind that on board switching section is provided with single diode rectifier, so in case of DC supply, all ground signals of the module (GND) are at the same potential.
When a single AC source is used to supply different units (both some **GMB HR246** or other cards provided of supply section with single diode rectifier), please ensure that the two phases of AC voltage must be connected at the same input pins of power supply connector. Whenever this rule is not satisfied dangerous malfunctions or damages can rise up on all the connected devices. For example, if we call Phase1 and Phase2 the two signals of the AC voltage, then Phase1 must be always connected to positive inputs (Vac, +Vdc pow) and Phase2 must be connected to negative input (Vac, GND) of all the cards. Complete information and details can be found on paragraph CN6 - POWER SUPPLY CONNCECTOR.

A second part of power supply section includes a galvanically isolated DC/DC converter that generates the **V opto** voltage, used to supply the optocoupled inputs. This voltage can be connected in two different modes, as described in NPN OR PNP INPUTS CONFIGURATION paragraph.

The **GMB HR246** is always provided with a **TransZorb™** protection circuit in order to avoid damages from incorrect voltages and/or break down of power supply section. It is also provided with a distribuited filtering circuitry that saves the terminal from disturbs or noises from the field, improving the overall system performances. As described in following pages, the presence of power supply voltages generated on board is also displayed by two dedicated LEDs.
The card has an additional features that allows the user to fetch both the general power supply (+5 Vdc) and opto inputs power supply (Vopto A and Vopto B) generated on board, through the connectors CN7, CN9, CN10 and CN11. To warrant highest immunity against noise and so a correct working of the cards, it is essential that these two voltages remains galvanically isolated.

When the user requires to supply external systems by using the signals +5 Vdc, GND or Vopto A, Vopto B of the card, it is suggested to contact directly **grifo®** technicians.

For further information please refer to paragraph ELECTRIC FEATURES, too.

FIGURE 40: POWER SUPPLY EXPS-1

ISP PROGRAMMING

Every Mini Module that can be instaleld on **GMB HR246** can be programmed in circuit (In System Programming) and allows to read and write internal memories of Mini Module with simple and comfortable operations. Through ISP the user can, for example, change the application program, write and read configurations data and/or data gathered by the program, etc.
ISP activation mode changes according to which Mini Module is used, but it often require a manual intervent on a jumper or dip switch. When **GMB HR246** is closed in its container, it is not possible to acces the Mini Module; so it has been provided the possibility to active ISP externally, by acting on connector CN9. In detail it is sufficient to short circuit pins 7 and 8 of this latter (see figure below) with a jumper or a little switch, and ensure that the same pins aren't already used:

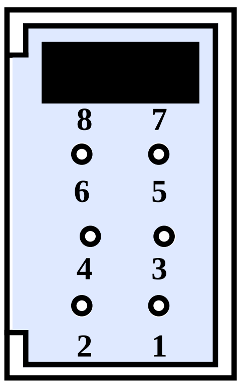


FIGURE 41: ISP ACTIVATION THROUGH CN9

NOTE The ISP activation through CN9 can be done only on Mini Modules that have ISP abilitation signal on pin 33 of their socket (e.g. **CAN GM2**, **GMM 5115**) and when jumper J5 is in position 1-2. Further information can be found in technical manuals of the used Mini Module and/or of the pairs **GMB HR 246** + **grifo®** Mini Module.

VISUAL SIGNALATIONS

The **GMB HR246** card is provided of 43 coloured LEDs that inform the user about card status and make easier the debug and test operations of the complete system. In order to recognize the LEDs locations on the card, please refer to figure 4, while for detailed information on LEDs activation, please refer to paragraphs that describes the section where the LEDs are included.
All the LEDs reported in following figure are visible from the lateral breaks of the plastic container dedicated to connectors: this allows their inspection also when the board is closed and installed in the electric panel. In addition, LEDs that display buffered I/Os status are physically located near the corresponding connector's pins, in order to simplify the cabling verifications and to let the user perform all the other possible working tests.

LED	COLOUR	FUNCTION
LD1÷LD16	Red	Visualize status of relays output with the corrispondence OUT A1, OUT A2, OUT B1, ÷ OUTH1, OUT H2 on CN3, CN4 and CN5. The LED active signals that the output contact of relay is connected to common terminal COMMON x.
LD17÷LD24	Green	Visualize status of optocoupled inputs 1÷8 of group A on CN1. The LED active signals a current flowing between input INn-A and common terminal COMx.
LD25÷LD32	Yellow	Visualize status of optocoupled inputs 1÷8 of group B on CN1 and CN2. The LED active signals a current flowing between input INn-B and common terminal COMx.
LD33÷LD40	Green	Visualize status of optocoupled inputs 1÷8 of group C on CN2. The LED active signals a current flowing between input INn-C and common terminal COMx.
LD41	Green	When active the position 1-2 is selected on jumpers J1 and J2 to configure the optocoupled inputs connected to CN1 and CN2 in **NPN** mode.
	Red	When active the position 2-3 is selected on jumpers J1 and J2 to configure the optocoupled inputs connected to CN1 and CN2 in **PNP** mode.
LD42	Yellow	When active, it indicates that switching power supply is generating the +5 Vdc power supply.
LD43	Yellow	Visualizes status of signal MM PIN 11 connected to pin 4 of CN9, which is also the Real Time Clock interrupt signal. Thus the LED shows the status of /INTRTC signal of either the possible RTC of Mini Module or the optional RTC on **GMB HR246**.

FIGURE 42: LEDS TABLE

JUMPERS

On **GMB HR246** there are 22 jumpers for card configuration and by connecting them, the user can perform some selections that regard the working conditions of the module. Here below there is the jumpers list and relative functions in the possible connection modalities:

JUMPER	N° PINS	PURPOSE
J1, J2	3	Select optocoupled inputs type between NPN or PNP.
J3	2	Connects a voltage of 2.5 Vdc to signal MM PIN7, that is the Vref reference voltage for Mini Module A/D converter.
J4	2	Connects Lithium battery for backup of optional RTC+SRAM.
J5	3	Selects connection for signal MM PIN 33, that is the range for analog input signal.
J6	5	Selects DIR signal used for RS 422, RS 485 serial communication and selects which signal drives relay output OUT D2.
J7	3	Selects connection for signal MM PIN 15 between relay output OUT C2 and the CAN or USB interfaces.
J8	3	Selects connection for signal MM PIN 14 between relay output OUT C1 and the CAN or USB interfaces.
J9	3	Selects connection for signal MM PIN 15 between CAN interface and USB interface.
J10	3	Selects connection for signal MM PIN 14 between CAN interface and USB interface.
J11, J12	2	Connect termination and forcing circuitery to serial line 2 (auxiliary) in RS 422, RS 485.
J13, J14, J16	3	Select signals connection for serial line 2 (auxiliary) of Mini Module.
J15	3	Configures the serial line 2 (auxiliary) for RS 422 or RS 485.
J17, J19, J21	3	Select signals connection for serial line 1 (primary) of Mini Module.
J18, J20	2	Connect termination and forcing circuitery to serial line 1 (primary) in RS 422, RS 485.
J22	3	Configures the serial line 1 (primary) for RS 422 or RS 485.

FIGURE 43: JUMPERS TABLE

To recognize the valid connections and locations of these jumpers, please refer to the board printed diagram (serigraph) or to figure 46 of this manual, where the pins numeration is listed.
In next tables the "*****" denotes the default connection, or on the other hand the connection set up at the end of testing phase, that is the configuration the user receives. The user can check the default configuration of all the modificable features, also in the APPENDIX B at the end of the manual.
Further information about purpose of the jumpers are reported in the following paragraphs, that describe all the valid configurations supported by relative functions.

2 PINS JUMPERS

JUMPER	CONNECTION	PURPOSE	DEF.
J3	not connected	Does not connect any signal to MM PIN 7 of socket ZC1.	*
	connected	Connects a 2.5 Vdc voltage to signal MM PIN 7 of socket ZC1. This signal is the reference voltage (Vref) for A/D converter section, required by some grifo® Mini Modules.	
J4	not connected	Does not connect on board Lithium battery to optional Real Time Clock + SRAM circuitery.	*
	connected	Connects on board Lithium battery to optional Real Time Clock + SRAM circuitery, allowing to keep date, time and SRAM content even when power supply is not present.	
J11, J12	not connected	Do not not connect termination and forcing circuitery to RS 485 receiver/transmitter or to RS 422 receiver of serial line 2 (auxiliary).	*
	connected	Connect termination and forcing circuitery to RS 485 receiver/transmitter or to RS 422 receiver of serial line 2 (auxiliary).	
J18, J20	not connected	Do not not connect termination and forcing circuitery to RS 485 receiver/transmitter or to RS 422 receiver of serial line 1 (primary).	*
	connected	Connect termination and forcing circuitery to RS 485 receiver/transmitter or to RS 422 receiver of serial line 1 (primary).	

FIGURE 44: 2 PINS JUMPERS TABLE

5 PINS JUMPERS

JUMPER	CONNECTION	PURPOSE	DEF.
J6	position 1-2	Connects signal MM PIN 17 to DIR signal, used to enable the transmitter in RS 422 and RS 485 of the serial line 1 (primary).	*
	position 2-3	Connects signal MM PIN 30 to DIR signal, used to enable the transmitter in RS 422 and RS 485 of the serial line 1 (primary).	
	position 3-4	Connects signal MM PIN 30 to signal that drive relay output OUT D2.	
	position 4-5	Connects signal MM PIN 16 to signal that drive relay output OUT D2.	*

FIGURE 45: 5 PINS JUMPERS TABLE

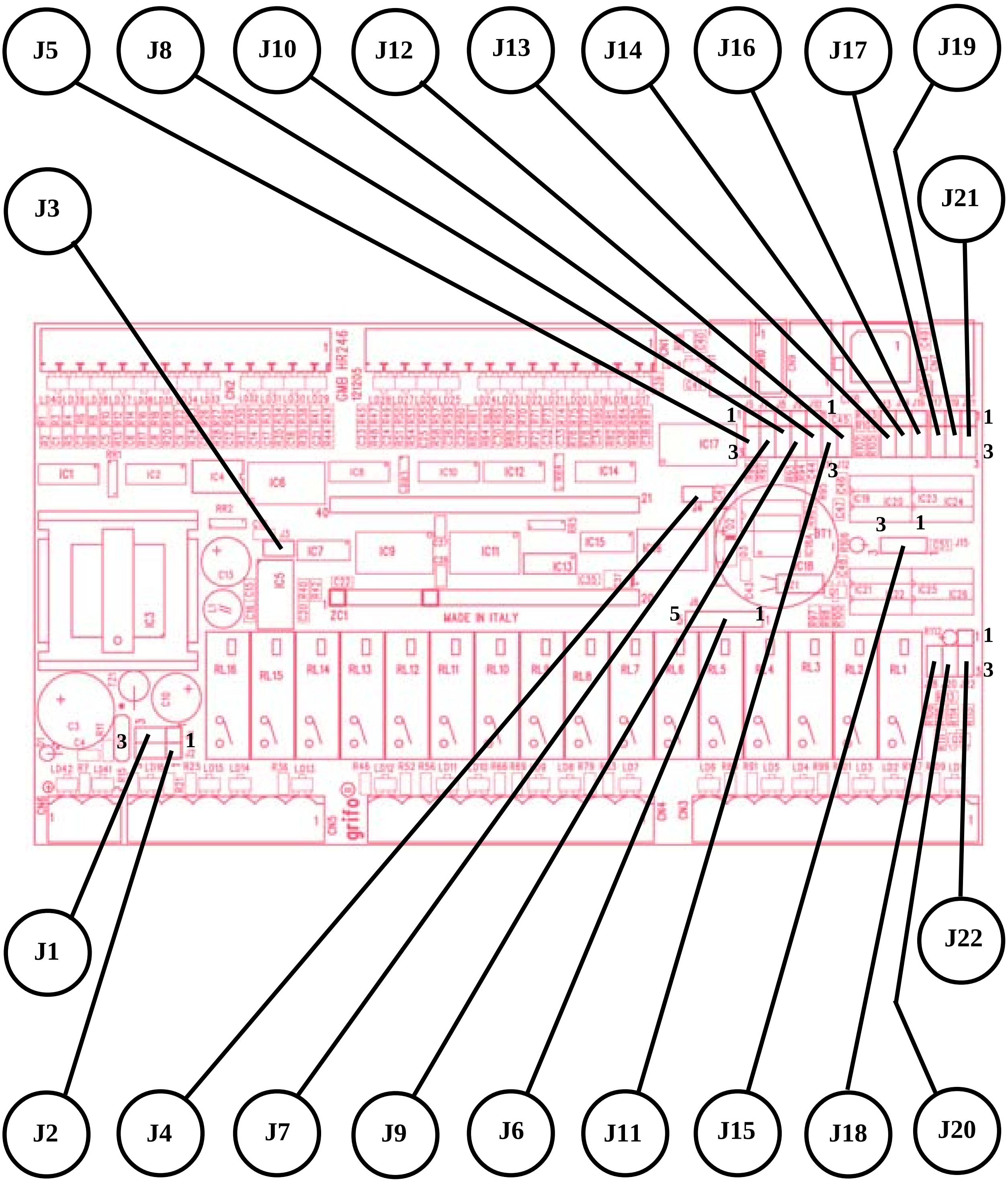


FIGURE 46: JUMPERS LOCATION AND NUMERATION

3 PINS JUMPERS

JUMPER	CONNECTION	PURPOSE	DEF.
J1, J2	position 1-2	Selects NPN type for optocoupled inputs of CN1 and CN2 (see NPN OR PNP CONFIGURATION paragraph).	*
	position 2-3	Selects PNP type for optocoupled inputs of CN1 and CN2 (see NPN OR PNP CONFIGURATION paragraph).	
J5	position 1-2	Connects signal MM PIN 33 directly to pin 8 of CN9: in this condition the range 0÷A/D max voltage is slected for the analog input signal.	*
	position 2-3	Connects signal MM PIN 33 to pin 8 of CN9 through an analog adapter: in this condition the range 0÷(A/D max voltage*4) is slected for the analog input signal.	
J7	position 1-2	Connects signal MM PIN 15 to CAN and USB interfaces.	
	position 2-3	Connects signal MM PIN 15 to relay output OUT C2 on CN3.	*
J8	position 1-2	Connects signal MM PIN 14 to CAN and USB interfaces.	
	position 2-3	Connects signal MM PIN 14 to relay output OUT C1 on CN3.	*
J9	position 1-2	Connects signal MM PIN 15 to USB interface on CN8.	
	position 2-3	Connects signal MM PIN 15 to CAN interface on CN9.	*
J10	position 1-2	Connects signal MM PIN 14 to USB interface on CN8.	
	position 2-3	Connects signal MM PIN 14 to CAN interface on CN9.	*
J13, J14, J16	position 1-2	Connect signals of serial line 2 (auxiliary) on CN11 to drivers for RS 422, RS 485, Current Loop electric standards.	
	position 2-3	Connect signals of serial line 2 (auxiliary) on CN11 directly to Mini Module on ZC1, by obtaining the RS 232 and TTL electric standards.	*
J15	position 1-2	Configures the drivers of serial line 2 (auxiliary) for the RS 485 electric standard (2 wires half duplex).	
	position 2-3	Configures the drivers of serial line 2 (auxiliary) for the RS 422 electric standard (4 wires full duplex).	*

FIGURE 47: 3 PINS JUMPERS TABLE (1 OF 2)

JUMPER	CONNECTION	PURPOSE	DEF.
J17, J19, J21	position 1-2	Connect signals of serial line 1 (primary) on CN7 to drivers for RS 422, RS 485, Current Loop electric standards.	
	position 2-3	Connect signals of serial line 1 (primary) on CN7 directly to Mini Module on ZC1, by obtaining the RS 232 and TTL electric standards.	*
J22	position 1-2	Configures the drivers of serial line 1 (primary) for the RS 485 electric standard (2 wires half duplex).	
	position 2-3	Configures the drivers of serial line 1 (primary) for the RS 422 electric standard (4 wires full duplex).	*

FIGURE 48: 3 PINS JUMPERS TABLE (2 OF 2)

BACK UP

GMB HR246 can be ordered with an optional Real Time Clock already installed (option **.RTC**). This component provides hours, minutes, seconds, day, month, year and week day; it includes a SRAM memory with 240 bytes and finally it adds a back up circuit based on Lithium battery, that updates time plus date and mantains memory content, even when power supply is off.
The back up circuit is connected by J4 jumper and in default configuration this jumper is not connected in order to save its charge when it is not necessary (delivery, stockage, etc.).
For further information on back up circuit, please refer to paragraph ELECTRIC FEATURES, while figure 4 reports Lithium battery BT1 location on the board.

NPN OR PNP INPUTS CONFIGURATION

The 24 optocoupled inputs of **GMB HR246** can be collectively configured as NPN or PNP, according to connection of jumpers J1 and J2.
Power supply of optocoupling sections is generated on board, starting from the single voltage applied to CN6 connector (please read ELECTRIC FEATURES and POWER SUPPLY VOLTAGE paragraphs), by a proper isolated DC/DC converter that generate the two signals **Vopto A** and **Vopto B**, as described on figure 23.
Configuration of jumpers J1 and J2 selects one of the following conditions:

J1, J2	*Inputs type*	*Vopto A*	*Vopto B*	*Current flow*
position 1-2	NPN	Positive	Negative	from INn-A,B,C to COMx
position 2-3	PNP	Negative	Positive	from COMx to INn-A,B,C

This allows to close an optocoupled input simply by connecting its terminal to common pin, for example with a pure contact.
The voltage Vopto A and Vopto B is reported on connectors CN7 and CN11 and it is isolated from card power supply: the user must keep this galvanic separation.

NOTE The jumpers J1 and J2 **must be always moved together at the same time**; thus to change their configuartion, first both jumpers must be removed and then they can be placed in the new position. In other words it must be absolutely avoided the partial configurations with one jumper in position 1-2 and the other in 2-3 or the card could be damaged and broken. Alternatively the jumpers can be moved when power supply is off.

ANALOG INPUT

GMB HR246 has an interface for one analog input that can accept a voltage signal in a variable range, according with jumper J5: in position 1-2 the analog input signal is only filtered, in order to increase its stability, while in position 2-3, also an additional voltage adapter acts on the signal, dividing its amplitude by 4.
As shown in figure 49, such analog interface is based on high precision passive components, that are selected during mounting phase, to optimize signal acquisition.
Anyway, to compensate eventual tollerances and thermal drifts, it is suggested to make a software calibration of the acquired signal, that is to calculate a correction coeffincent using a valid reference signal, and then to use such coefficent for successive analog signal acquisitions. The examples developed for **grifo®** Mini Modules show some calibration techniques that the user can modify according to application's requirements or he can directly use them as they are.
The user can discover the acquisition modality of the analog input (range, resolution, conversion time, etc.) and its possible absence, by consulting relative techical manual of **grifo®** Mini Modules or the pairs manual.

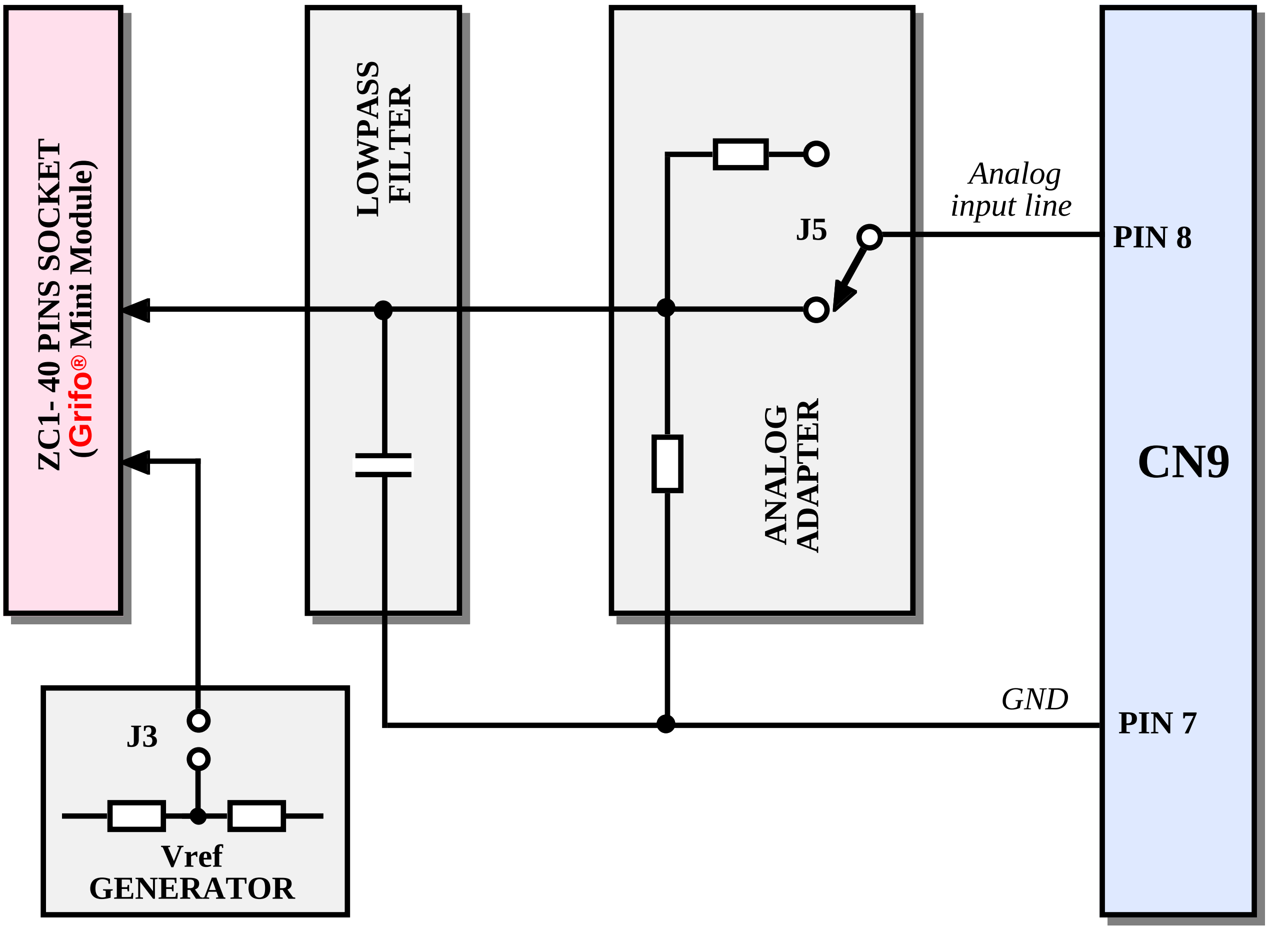


FIGURE 49: A/D ANALOG INPUT CONNECTION DIAGRAM

The jumper J3 connects or not the reference voltage of about 2.5 V, generated on **GMB HR246** board, to ZC1 socket. By using Mini Modules that requires an external Vref, J3 must be connected; viceversa for those modules with internal Vref, or without reference voltage, J3 jumper must be not connected.

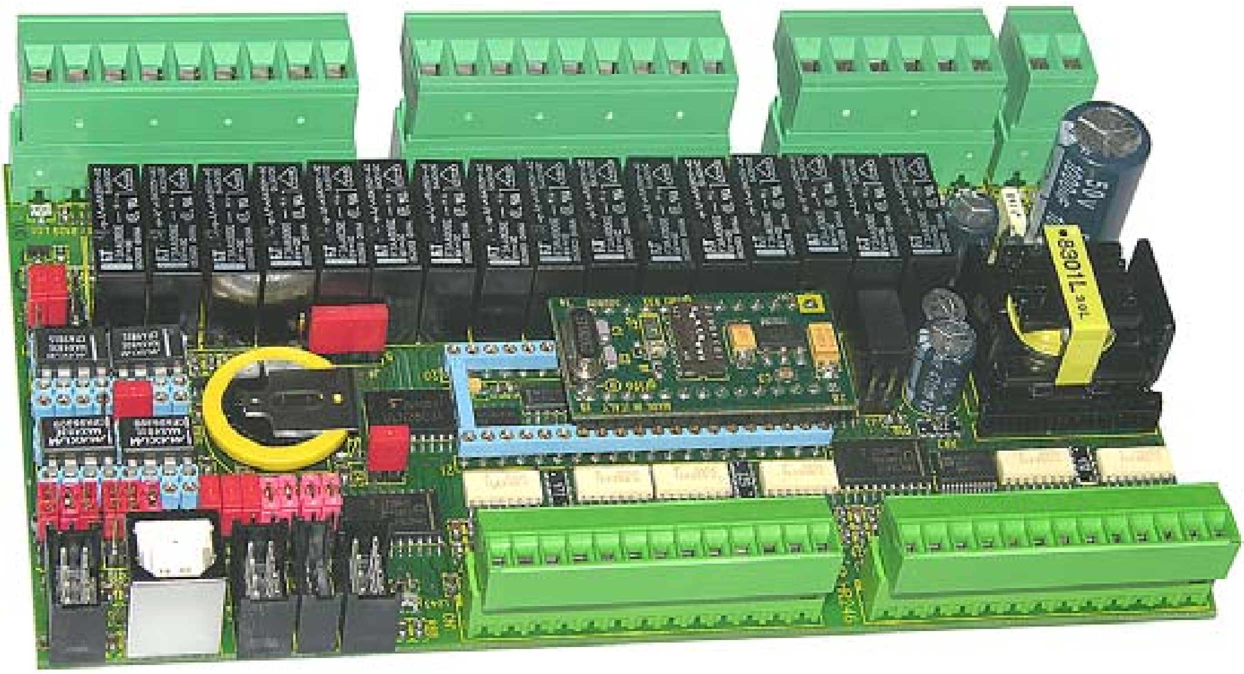


FIGURE 50: GMB HR246 PLUS 28 PINS MINI MODULE

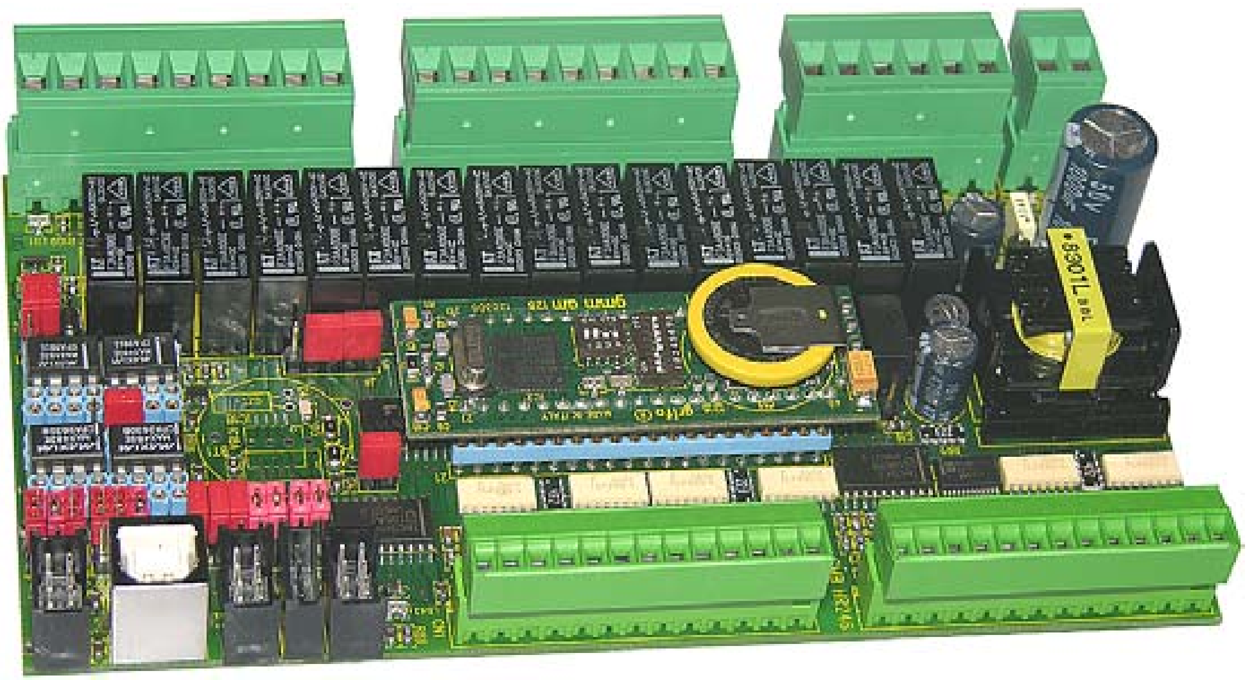


FIGURE 51: GMB HR246 PLUS 40 PINS MINI MODULE

SERIAL COMMUNICATION SELECTION

Both serial lines of **GMB HR246** can be buffered in RS 232, RS 422, RS 485, Current Loop or TTL. By software the serial lines can be programmed to operate with all the standard physical protocols, through the settings of some internal registers of the used Mini Module. In addition any logic protocols can be supported, in fact it depends completely on software management.
By hardware can be selected which one of the electric standards is used, through jumpers connections (as described in previous tables), proper drivers installation and finally the configuration of Mini Module installed on ZC1 socket. Some components needed for RS 422, RS 485 and Current Loop communications are not mounted on the board in default configuration; this is why each first non standard (non RS 232) serial configuration must be always performed by **grifo®** technicians. Then the user can change in autonomy the configuration following the informations below:

- SERIAL LINE 1 (PRIMARY) IN RS 232 (default configuration)

J18,J20	=	not connected	Module on ZC1	= serial line in RS 232 (#)
J22	=	indifferent	IC21	= no device
J17	=	position 2-3	IC25	= no device
J19	=	position 2-3	IC22	= no device
J21	=	position 2-3	IC26	= no device

- SERIAL LINE 1 (PRIMARY) IN CURRENT LOOP (option .CLOOP)

J18,J20	=	not connected	Module on ZC1	= serial line in TTL (#)
J22	=	indifferent	IC21	= no device
J17	=	position 1-2	IC25	= no device
J19	=	position 1-2	IC22	= driver HP 4200
J21	=	position 1-2	IC26	= driver HP 4100

Please remark that Current Loop serial interface is passive, so it must be connected an active Current Loop serial line, that is a line provided with its own power supply, like described in figures 17÷19. Current Loop interface can be employed to make both point to point and multi point connections through a 2 wires (half duplex) or 4 wires (full duplex) connection.

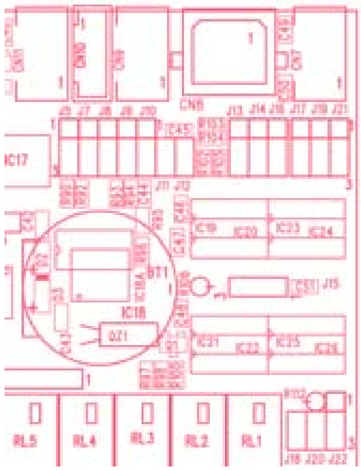
- SERIAL LINE 1 (PRIMARY) IN RS 422 (option .RS422)

J18,J20	=	(*)	Module on ZC1	= serial line in TTL (#)
J22	=	position 2-3 (**)	IC21	= driver SN 75176 or MAX 483
J17	=	position 1-2	IC25	= driver SN 75176 or MAX 483
J19	=	position 1-2	IC22	= no device
J21	=	position 1-2	IC26	= no device

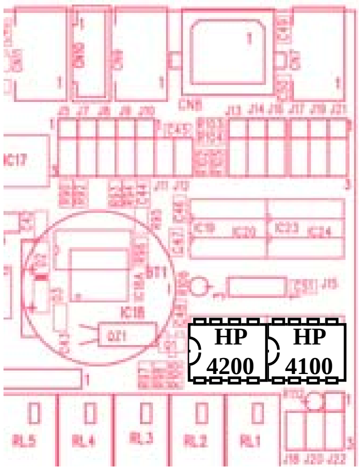
Status of DIR signal (managed by software with Mini Module line selected with J6), allows to enable or disable the transmitter:

DIR	= low level	= logic state 0	->	transmitter enabled
DIR	=high level	= logic state 1	->	transmitter disabled

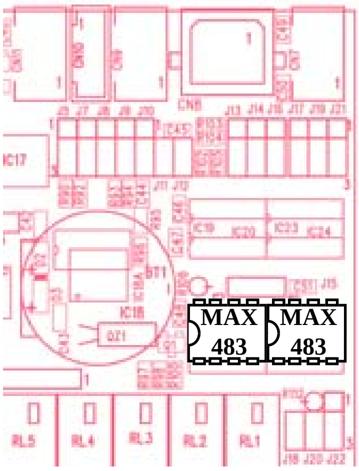
In point to point connections, DIR signal can be always kept low (trasnmitter always enabled), while in multi point connections transmitter must be enabled only when a transmission is requested. The RS 422 communication is full duplex type.



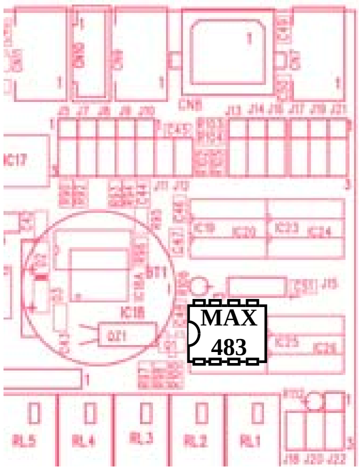
Serial line 1 (primary) in RS 232, TTL



Serial line 1 (primary) in Current Loop



Serial line 1 (primary) in RS 422



Serial line 1 (primary) in RS 485

FIGURE 52: SERIAL LINE 1 (PRIMARY) COMMUNICATION DRIVERS

- SERIAL LINE 1 (PRIMARY) IN RS 485 (option .RS485)

J18,J20	=	(*)	Module on ZC1	= serial line in TTL (#)
J22	=	position 1-2 (**)	IC21	= driver SN 75176 or MAX 483
J17	=	position 1-2	IC25	= no device
J19	=	position 1-2	IC22	= no device
J21	=	position 1-2	IC26	= no device

In this modality the signals to use are pins 5 and 6 of connector CN7, that become transmission or reception lines according to the status of DIR signal (managed by software through the Mini Module line selected with J6), as follows:

DIR	=low level	= logic state 0	->	line in transmission
DIR	=high level	= logic state 1	->	line in reception

This kind of serial communication can be used for point to point connections and multi points connections, in half duplex mode. All the transmitted characters are at the same time received (echo) when RS 485 communication is used. So the user is allowed to verify the succes of transmission, in fact, any conflict on the line can be recognized by testing the echo received character, after each transmission.

- SERIAL LINE 1 (PRIMARY) IN TTL

J18,J20	=	not connected	Module on ZC1	= serial line in TTL (#)
J22	=	indifferent	IC21	= no device
J17	=	position 2-3	IC25	= no device
J19	=	position 2-3	IC22	= no device
J21	=	position 2-3	IC26	= no device

(*) When the serial line 1 is used in RS 422 or RS 485, it is possible to connect the terminating and forcing circuit on the line by using jumpers J18 and J20. This circuit must be always connected in case of point to point connections, while in case of multi point connections it must be connected olny in the farest boards, that is on the edges of the commmunication line.
During a power on, DIR signal is at logic level high, so during these phases the RS 485 driver is in reception and RS 422 transmission driver is disabled, in order to avoid confilcts on communication line.

(**) In case of RS 422 or RS 485 communication the DIR signal, used to define the driver status by software, can be selected between two different signals of ZC1 socket:

J6 in position 1-2	->	DIR = MM PIN 17
J6 in position 2-3	->	DIR = MM PIN 30

This feature allows to use the resources of hardware installed on ZC1, in the best way, whithout renounce of other useful signals.

(#) Serial line 1 (primary) of hardware installed on socket ZC1 of **GMB HR246** must be designed to connect lines MM PIN 9 and MM PIN 10 respectively to RX and TX signals buffered in RS 232 where "serial line in RS 232" is required or to RX and TX signals at TTL level (generated, for example, directly by a microcontroller UART) where "serial line in TTL" is required.

For further information about serial communication, please refer to connection examples of figures 10÷21.

- SERIAL LINE 2 (AUXILIARY) IN TTL

J11,J12	=	not connected	Module on ZC1	= serial line in TTL (#)
J15	=	indifferent	IC19	= no device
J13	=	position 2-3	IC23	= no device
J14	=	position 2-3	IC20	= no device
J16	=	position 2-3	IC24	= no device

- SERIAL LINE 2 (AUXILIARY) IN RS 232 (default configuration)

J11,J12	=	not connected	Module on ZC1	= serial line in RS 232 (#)
J15	=	indifferent	IC19	= no device
J13	=	position 2-3	IC23	= no device
J14	=	position 2-3	IC20	= no device
J16	=	position 2-3	IC24	= no device

- SERIAL LINE 2 (AUXILIARY) IN CURRENT LOOP (option .CLOOP)

J11,J12	=	not connected	Module on ZC1	= serial line in TTL (#)
J15	=	indifferent	IC19	= no device
J13	=	position 1-2	IC23	= no device
J14	=	position 1-2	IC20	= driver HP 4200
J16	=	position 1-2	IC24	= driver HP 4100

Please remark that Current Loop serial interface is passive, so it must be connected an active Current Loop serial line, that is a line provided with its own power supply, like described in figures 17÷19. Current Loop interface can be employed to make both point to point and multi point connections through a 2 wires (half duplex) or 4 wires (full duplex) connection.

- SERIAL LINE 2 (AUXILIARY) IN RS 422 (option .RS422)

J11,J12	=	(*)	Module on ZC1	= serial line in TTL (#)
J15	=	position 2-3 (**)	IC19	= driver SN 75176 or MAX 483
J13	=	position 1-2	IC23	= driver SN 75176 or MAX 483
J14	=	position 1-2	IC20	= no device
J16	=	position 1-2	IC24	= no device

Status of DIR2 signal (managed by software with a Mini Module line), allows to enable or disable the transmitter:

DIR2	= low level	= logic state 0	->	transmitter enabled
DIR2	=high level	= logic state 1	->	transmitter disabled

In point to point connections, DIR2 signal can be always kept low (trasnmitter always enabled), while in multi point connections transmitter must be enabled only when a transmission is requested. The RS 422 communication is full duplex type.

- SERIAL LINE 2 (AUXILIARY) IN RS 485 (option .RS485)

J11,J12	=	(*)	Module on ZC1	= serial line in TTL (#)
J15	=	position 1-2 (**)	IC19	= driver SN 75176 or MAX 483
J13	=	position 1-2	IC23	= no device
J14	=	position 1-2	IC20	= no device
J16	=	position 1-2	IC24	= no device

In this modality the signals to use are pins 5 and 6 of connector CN11, that become transmission or reception lines according to the status of DIR2 signal (managed by software through a Mini Module line), as follows:

DIR2	=low level	= logic state 0	->	line in transmission
DIR2	=high level	= logic state 1	->	line in reception

This kind of serial communication can be used for point to point connections and multi points connections, in half duplex mode. All the transmitted characters are at the same time received (echo) when RS 485 communication is used. So the user is allowed to verify the succes of transmission, in fact, any conflict on the line can be recognized by testing the echo received character, after each transmission.

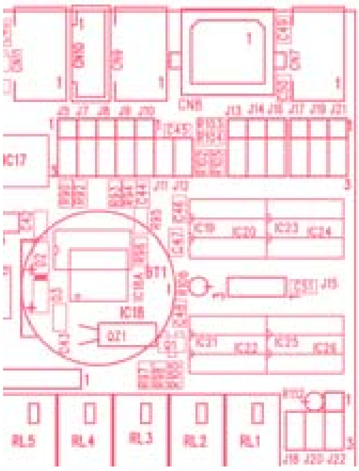
(*) When the serial line 2 is used in RS 422 or RS 485, it is possible to connect the terminating and forcing circuit on the line by using jumpers J11 and J12. This circuit must be always connected in case of point to point connections, while in case of multi point connections it must be connected olny in the farest boards, that is on the edges of the commmunication line.
During a power on, DIR2 signal is at logic level high, so during these phases the RS 485 driver is in reception and RS 422 transmission driver is disabled, in order to avoid confilcts on communication line.

(**) In case of RS 422 or RS 485 communication the DIR2 signal, used to define the driver status by software, is always connected to MM PIN 6 of ZC1 socket.

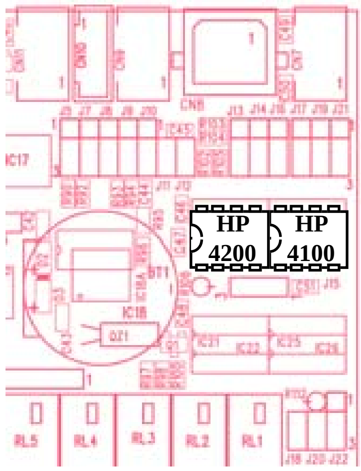
(#) Serial line 2 (auxiliary) of hardware installed on socket ZC1 of **GMB HR246** must be designed to connect lines MM PIN 40 and MM PIN 39 respectively to RX and TX signals buffered in RS 232 where "serial line in RS 232" is required or to RX and TX signals at TTL level (generated, for example, directly by a microcontroller UART) where "serial line in TTL" is required.

For further information about serial communication, please refer to connection examples of figures 10÷21.

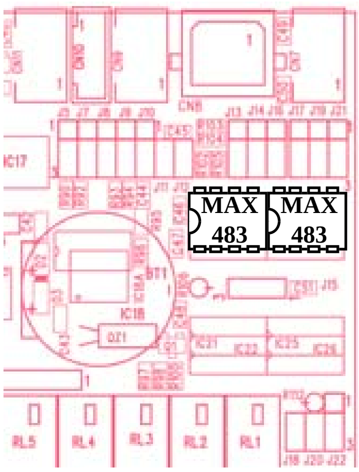
While the serial line 1 (primary) is always available on all **grifo®** Mini Modules, the serial line 2 (auxiliary) is available only on few models. In order to check its presence it can be examined the tschnical manual of Mini Module or pairs. Anyway it is important remind that the line 2 (auxiliary) can be also a software serial line, managed through two digital I/O lines of microcontroller.



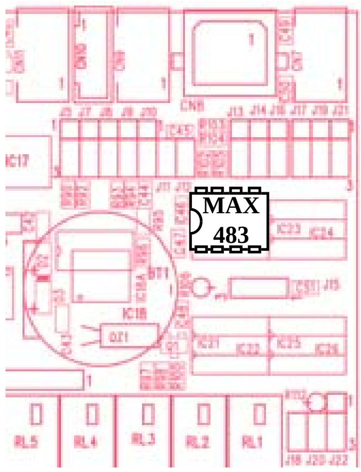
Serial line 2 (auxiliary) in RS 232, TTL



Serial line 2 (auxiliary) in Current Loop



Serial line 2 (auxiliary) in RS 422



Serial line 2 (auxiliary) in RS 485

FIGURE 53: SERIAL LINE 2 (AUXILIARY) COMMUNICATION DRIVERS

RESOURCES SOFTWARE DESCRIPTION

In the previous paragraphs are described all the connections of the on board resources towards the field and external systems, while in this one there are detailed information on connection of the same resources in confront of used Mini Module. Moreover there are the software management modalities of all the resources, that can be directly used by the customer, to develop his application program. Whenever the chapter documentation is not easy to use, please refer to techical manuals of **GMB HR246** + **grifo®** Mini Module pairs.
In the following paragraphs the **.0÷.7** indications denote the eight bits of the combination used in I/O operations.

RELAYS OUTPUTS

Staus of 16 relays outputs is defined by software management of:
- 8 output lines of the ZC1 socket;
- 8 output lines of the I/O expander PCF 8575;

with the corrispondences reported on figure 26÷31 and below summarized:

OUT A1	->	MM PIN 29
OUT A2	->	MM PIN 28
OUT B1	->	MM PIN 27
OUT B2	->	MM PIN 26
OUT C1	->	MM PIN 14 (when J8 in 2-3)
OUT C2	->	MM PIN 15 (when J7 in 2-3)
OUT D1	->	MM PIN 18
OUT D2	->	MM PIN 16 (when J6 in 4-5) or MM PIN 30 (when J6 in 3-4)
OUT E1	->	P10 IOEXP
OUT E2	->	P11 IOEXP
OUT F1	->	P12 IOEXP
OUT F2	->	P13 IOEXP
OUT G1	->	P14 IOEXP
OUT G2	->	P15 IOEXP
OUT H1	->	P16 IOEXP
OUT H2	->	P17 IOEXP

It is important remind that some of the 8 lines from **grifo®** Mini Module installed on ZC1, are not only digital outputs but they have additional functionalities defined by internal hardware peripherals (as PCA, TCU, CCU, etc.); these allow to generate timings, evolved autonomous functions, etc.
When the management signal is set to logic state low (logic 0), the corresponding output is actived (relay contact is connected to its common pin), viceversa when the signal is set to logic state high (logic 1) the corresponding output is deactived (relay contact opened).
As previously said, LEDs LD1÷16 give a visual indication of relays outputs status (LED on means output actived).
During a power on, the 16 used signals are kept at logic 1, so all outputs are disabled during and after these phases.

OPTOCOUPLED INPUTS

Status of 24 digital optocoupled inputs can be acquired through software management of:
- 16 input lines of the ZC1 socket;
- 8 input lines of the I/O expander PCF 8575;

with the corrispondences reported on figure 22÷24 and below summarized:

IN1-A -> MM PIN 32	IN1-B -> MM PIN 1	IN1-C -> P00 IOEXP
IN2-A -> MM PIN 31	IN2-B -> MM PIN 2	IN2-C -> P01 IOEXP
IN3-A -> MM PIN 25	IN3-B -> MM PIN 3	IN3-C -> P02 IOEXP
IN4-A -> MM PIN 24	IN4-B -> MM PIN 4	IN4-C -> P03 IOEXP
IN5-A -> MM PIN 23	IN5-B -> MM PIN 35	IN5-C -> P04 IOEXP
IN6-A -> MM PIN 22	IN6-B -> MM PIN 36	IN6-C -> P05 IOEXP
IN7-A -> MM PIN 21	IN7-B -> MM PIN 37	IN7-C -> P06 IOEXP
IN8-A -> MM PIN 19	IN8-B -> MM PIN 38	IN8-C -> P07 IOEXP

When NPN or PNP inputs are enabled, corresponding signals are at logic state low (logic 0), viceversa when inputs are disabled a logic level high is acquired (logic 1).
As previously said, LEDs LD17÷40 give a visual indication of digital inputs status (LED on means input actived).
All the Mini Module used lines have been selected in order to take full advantage in software management; in fact the inputs can generate interrupts, be counted by hardware counters, acts as a trigger, or simply acquired, etc.

SERIAL LINE 1 (PRIMARY)

The management of serial line 1 (primary) is completely described in the manual of used Mini Module or in data sheet of mounted microcontroller, in the sections relative to asynchronous communication (UART, USART, etc.). In these documents there are all the information about management of all physic and logic communication protocols.
The signals used on ZC1 socket are:

RX TTL or RX RS232 -> MM PIN 9
TX TTL or TX RS232 -> MM PIN 10
DIR -> MM PIN 17 (when J6 in 1-2) or MM PIN 30 (when J6 in 2-3)

that respectively corresponds to receive data, transmit data and management of activation and direction for RS 422, RS 485 drivers.

SERIAL LINE 2 (AUXILIARY)

The management of serial line 2 (auxiliary) is completely described in the manual of used Mini Module or in data sheet of mounted microcontroller, in the sections relative to asynchronous communication (UART, USART, etc.). In these documents there are all the information about management of all physic and logic communication protocols.
The signals used on ZC1 socket are:

RX2 TTL or RX2 RS232 -> MM PIN 40
TX2 TTL or TX2 RS232 -> MM PIN 39
DIR2 -> MM PIN 6

that respectively corresponds to receive data, transmit data and management of activation and direction for RS 422, RS 485 drivers.

I2C BUS INTERFACE

The management of I2C BUS line is completely described in the manual of used Mini Module or in data sheet of mounted microcontroller, in the sections relative to synchronous communication (TWI, I2C, SSP, etc.). In these documents there are all the information about management of all physic and logic communication protocols.
The signals used on ZC1 socket are:

SCL	->	MM PIN 12
SDA	->	MM PIN 13

As described in CN10 - I2C BUS LINE CONNECTOR paragraph, please remind that the SDA and SCL signals are provided of 4.7 KΩ pull up resistors and that the same interface is used also to drive other I2C peripherals available on the board. These peripherals use the slave addresses **40H** and **A2H** and when the installed **grifo®** Mini Module is provided of Real Time Clock section in I2C BUS, also the **A0H** address is used. The user that needs the I2C BUS interface of **GMB HR 246** can't use these slave addresses and he must connect a proper hardware, and develop a software, taking care of these limits.

TTL DIGITAL I/O LINES

On the **GMB HR246** there are some TTL I/O lines that can be managed by software in order to satisfy the numerous requirements of the users.
The signals used on ZC1 socket are:

Pin 2 di CN9	->	MM PIN 5
Pin 3 di CN9 (when J8 in 1-2 and J10 in 2-3)	->	MM PIN 14
Pin 4 di CN9	->	MM PIN 11
Pin 5 di CN9 (when J7 in 1-2 e J9 in 2-3)	->	MM PIN 15
Pin 6 di CN9	->	MM PIN 30
Pin 8 di CN9	->	MM PIN 33

Moreover many signals above listed can perform alternative functions, properly described on figure 37; thus it is suggested to examine with attention, the connection performed on such signals. For example the pin 8 of CN9 is also the analog input and it is connected to a 4.7 KΩ pull down resistor, the pin 4 of CN9 is connected also to LD43 yellow LED and to eventual /INTRTC interrupt signal of the optional Real Time Clock, pin 3 and 5 of CN9 could be also the CAN signals, etc.

ANALOG INPUT

Please refer to technical manual of the used Mini Module, by assuming that the used signal is:

A/D -> MM PIN 33

and that the acquired signal can be reduced as described in ANALOG INPUT paragraph.

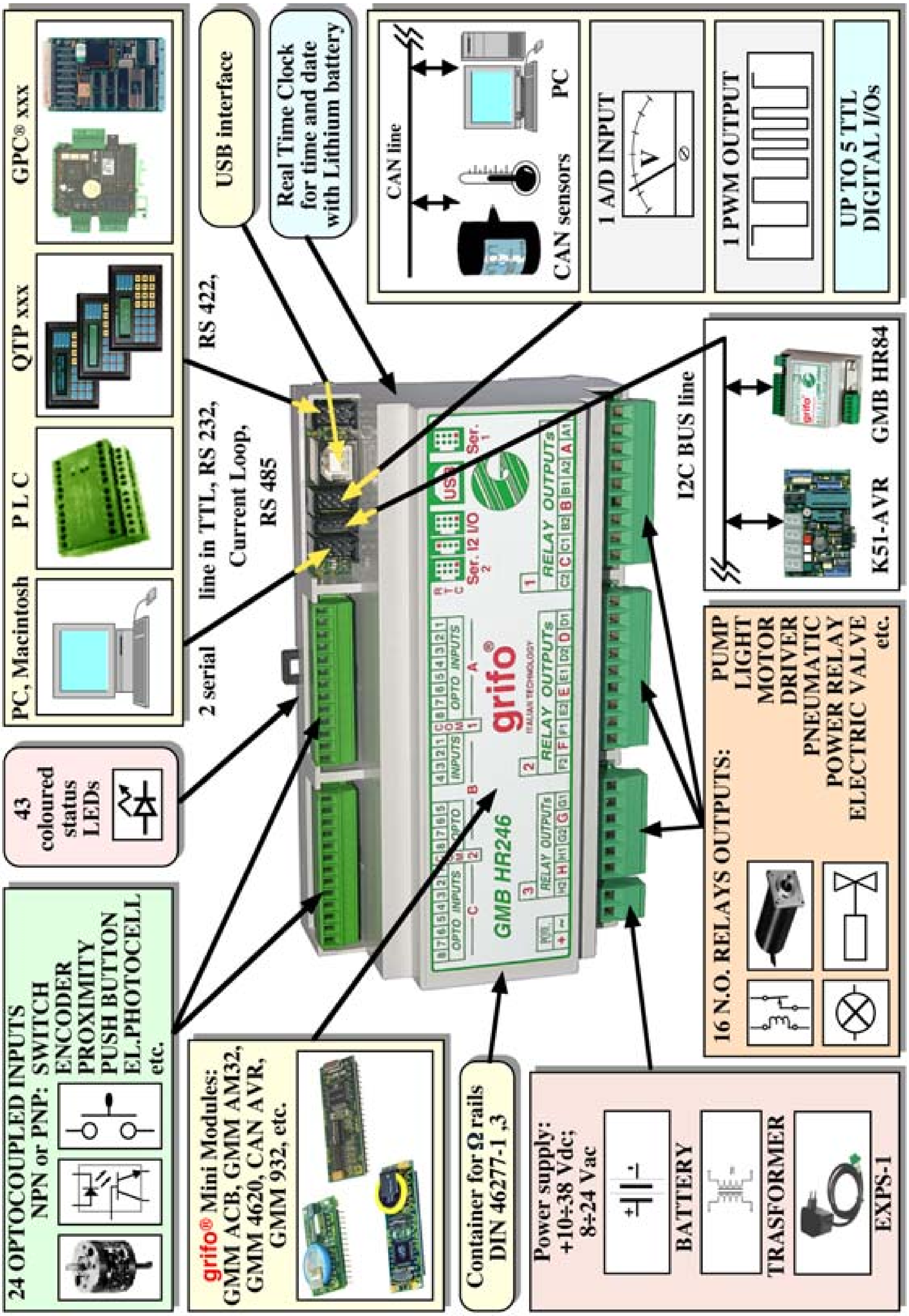


FIGURE 54: POSSIBLE CONNECTIONS DIAGRAM

PWM SIGNAL

Please refer to technical manual of the used Mini Module, in the sections relative to timers and counters (TCU, PCA, CCU, etc.), by assuming that the used signal is:

PWM -> MM PIN 30

CAN INTERFACE

Please refer to technical manual of the used Mini Module by assuming that the used signals are:

CANL (when J8 in 1-2 and J10 in 2-3) -> MM PIN 14
CANH (when J7 in 1-2 and J9 in 2-3) -> MM PIN 15

USB INTERFACE

Please refer to technical manual of the used Mini Module by assuming that the used signals are:

USBL (when J8 in 1-2 and J10 in 1-2) -> MM PIN 14
USBH (when J7 in 1-2 and J9 in 1-2) -> MM PIN 15

I/O EXPANDER

The management of 8 relays outputs and 8 optocoupled digital inputs of the **GMB HR246** is performed through a proper component defined I/O expander, that includes 16 digital I/O lines, driven by an I2C BUS interface.
About software management of the I/O expander, please refer to specific documentation of PCF 8575 component, that is briefly reported in APPENDIX A. This paragraph doesn't report software information because the management of this component is complex and it requires a deep knowledge; anyway the user can take advantage from the demo programs supplied with the card and the high level instructions specifically provided by the software development tools. Basically the software management is based on a synchronous communication with I2C BUS standard protocol, through some signals of ZC1 socket:

SCL -> MM PIN 12
SDA -> MM PIN 13

The connections of the 16 lines P00÷P07 and P10÷P17 of the I/O expander are listed in previous paragraphs RELAYS OUTPUTS and OPTOCOUPLED INPUTS.
Furthermore the circuit that defines the I/O expander management connects the A0, A1, A2 signals of the component to logic **0**, by obtaining a slave address equal to **40H**. The logic state 0 of the bit correspond to low level (=0 V) of the relative signal, while the logic state 1 corresponds to high level (=5V).
Useful information can be found also in previous paragraph I2C BUS INTERFACE.

RTC+SRAM

GMB HR246 can be ordered with a Real Time Clock + SRAM section already installed (option **.RTC**). This section manages hours, minutes, seconds, day, month, year and week day in a completely autonomous manner. The section includes also 240 bytes of SRAM, it is powered by the back up circuit in order to ensures the maintenance of saved data and the clock update in any circumstances and it is completely managed by software. Moreover the RTC is capable to generate periodic interrupts or alarms and the application software can then execute periodic processes or start a new one at predefined time and date.
About software management of the RTC+SRAM, please refer to specific documentation of PCF 8583 component, that is briefly reported in APPENDIX A. This paragraph doesn't report software information because the management of this component is complex and it requires a deep knowledge; anyway the user can take advantage from the demo programs supplied with the card and the high level instructions specifically provided by the software development tools. Basically the software management is based on a synchronous communication with I2C BUS standard protocol, through some signals of ZC1 socket:

SCL -> MM PIN 12
SDA -> MM PIN 13
/INTRTC -> MM PIN 11

Furthermore the circuit that defines the RTC+SRAM management connects the A0 signals of the component to logic **1**, by obtaining a slave address equal to **A2H**. The logic state 0 of the bit correspond to low level (=0 V) of the relative signal, while the logic state 1 corresponds to high level (=5V).
Useful information can be found also in previous paragraph I2C BUS INTERFACE.

NOTE When using a **GMB HR246** provided with optional Real Time Clock (**.RTC**), it is anyway possible to install a **grifo®** Mini Module with its own Real Time Clock on ZC1 socket, in fact they use different slave addresses. In this condition the user obtain a system provided of two indipendent clocks and a double quantity of SRAM (480 bytes).

BIBLIOGRAPHY

In this chapter there is a complete list of technical data books and sheets, where the user can find all the necessary documentations on the components mounted on **GMB HR246** board.

HEWLETT PACKARD manual:	*Optoelectronics Designer's Catalog*
NEWPORT manuale:	*DC-DC converters*
PHILIPS manual:	*I²C-bus compatible ICs*
S.E. data sheets:	*SI series - Switching power supply*
SGS-THOMSON manual:	*Small signal transistor - Data Book*
TAKAMISAWA manual:	*Relays index Book*
TEXAS INSTRUMENTS manual:	*The TTL Data Book - SN54/74 Families*
TEXAS INSTRUMENTS manual:	*RS-422 and RS-485 Interface Circuits*
TOSHIBA manual:	*Photo couplers - Data Book*

The described manuals can be requested directly to manufacturer or local dealers. Alternatively this information and/or their upgrades can be found in specific internet web pages, of the listed companies.

APPENDIX A: ON BOARD DEVICES DESCRIPTION

grifo® provides a completely free technical documentation service to make available the data sheets of on board components, through its web site. This chapter shows only the first page of the data sheets, but the user can dowload the complete documents from the "Technical documentation Service" link on the home page.

I/O EXPANDER PCF 8575

Philips Semiconductors — Product specification

Remote 16-bit I/O expander for I^2C-bus — PCF8575C

1 FEATURES

- Operating supply voltage from 4.5 to 5.5 V
- Low standby current consumption of 10 µA maximum
- I^2C-bus to parallel port expander
- 400 kbits/s FAST I^2C-bus
- Open-drain interrupt output
- 16-bit remote I/O port for the I^2C-bus
- Compatible with most microcontrollers
- Latched outputs with high current drive capability for directly driving LEDs
- Address by 3 hardware address pins for use of up to 8 devices
- SSOP24 package.

2 GENERAL DESCRIPTION

The device is a silicon CMOS circuit. It provides general purpose remote I/O expansion for most microcontroller families via the two-line bidirectional bus (I^2C-bus).

The device consists of a 16-bit quasi-bidirectional port and an I^2C-bus interface. The PCF8575C has a low current consumption and includes latched outputs with high current drive capability for directly driving LEDs. It also possesses an interrupt line ($\overline{INT}$) which can be connected to the interrupt logic of the microcontroller. By sending an interrupt signal on this line, the remote I/O can inform the microcontroller if there is incoming data on its ports without having to communicate via the I^2C-bus. This means that the device is an I^2C-bus slave transmitter/receiver.

Every data transmission from the PCF8575C must consist of an even number of bytes, the first byte will be referred to as P07 to P00 and the second byte as P17 to P10. The third will be referred to as P07 to P00 and so on.

3 ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
PCF8575CTS	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm	SOT340-1

Clock/calendar with 240 × 8-bit RAM PCF8583

1 FEATURES

- I^2C-bus interface operating supply voltage: 2.5 V to 6 V
- Clock operating supply voltage (0 to +70 °C): 1.0 V to 6.0 V
- 240 × 8-bit low-voltage RAM
- Data retention voltage: 1.0 V to 6 V
- Operating current (at f_{SCL} = 0 Hz): max. 50 μA
- Clock function with four year calendar
- Universal timer with alarm and overflow indication
- 24 or 12 hour format
- 32.768 kHz or 50 Hz time base
- Serial input/output bus (I^2C)
- Automatic word address incrementing
- Programmable alarm, timer and interrupt function
- Slave address:
  - READ: A1 or A3
  - WRITE: A0 or A2.

2 GENERAL DESCRIPTION

The PCF8583 is a clock/calendar circuit based on a 2048-bit static CMOS RAM organized as 256 words by 8 bits. Addresses and data are transferred serially via the two-line bidirectional I^2C-bus. The built-in word address register is incremented automatically after each written or read data byte. Address pin A0 is used for programming the hardware address, allowing the connection of two devices to the bus without additional hardware.

The built-in 32.768 kHz oscillator circuit and the first 8 bytes of the RAM are used for the clock/calendar and counter functions. The next 8 bytes may be programmed as alarm registers or used as free RAM space.
The remaining 240 bytes are free RAM locations.

3 QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT
V_{DD}	supply voltage operating mode	I^2C-bus active	2.5	–	6.0	V
		I^2C-bus inactive	1.0	–	6.0	V
I_{DD}	supply current operating mode	f_{SCL} = 100 kHz	–	–	200	μA
I_{DDO}	supply current clock mode	f_{SCL} = 0 Hz; V_{DD} = 5 V	–	10	50	μA
		f_{SCL} = 0 Hz; V_{DD} = 1 V	–	2	10	μA
T_{amb}	operating ambient temperature range		–40	–	+85	°C
T_{stg}	storage temperature range		–65	–	+150	°C

4 ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
PCF8583P	DIP8	plastic dual in-line package; 8 leads (300 mil)	SOT97-1
PCF8583T	SO8	plastic small outline package; 8 leads; body width 7.5 mm	SOT176-1

APPENDIX B: DEFAULT CONFIG., OPTIONS, ACCESSORIES

In corrispondence of the first purchase, or after a reparation, the **GMB HR246** is supplied in its base configuration. The features of this configuration has been described many times in the manual (by using also the name default configuration) and in this appendix they are summarized, opportunely divided in the following table.

JUMPER	DEFAULT CONNECTION	PURPOSE
J1 , J2	position 1-2	Selects NPN type for optocoupled inputs of CN1 and CN2.
J3	not connected	Does not connect any signal to MM PIN 7 of socket ZC1.
J4	not connected	Does not connect on board Lithium battery to optional Real Time Clock + SRAM circuitery.
J5	position 1-2	Connects signal MM PIN 33 directly to pin 8 of CN9.
J6	position 1-2 and 4-5	Connects signal MM PIN 17 to DIR signal and it connects signal MM PIN 16 to signal that drive OUT D2 relay output.
J7	position 2-3	Connects signal MM PIN 15 to relay output OUT C2 on CN3.
J8	position 2-3	Connects signal MM PIN 14 to relay output OUT C1 on CN3.
J9	position 2-3	Connects signal MM PIN 15 to CAN interface on CN9.
J10	position 2-3	Connects signal MM PIN 14 to CAN interface on CN9.
J11, J12	not connected	Do not not connect termination and forcing circuitery to serial line 2 (auxiliary) in RS 422, RS 485.
J13, J14, J16	position 2-3	Connect signals of serial line 2 (auxiliary) directly to Mini Module on ZC1.
J15	position 2-3	Configures the optional drivers for serial line 2 (auxiliary) for the RS 422 electric standard.
J17, J19, J21	position 2-3	Connect signals of serial line 1 (primary) directly to Mini Module on ZC1.
J18, J20	not connected	Do not not connect termination and forcing circuitery to serial line 1 (primary) in RS 422, RS 485.
J22	position 2-3	Configures the optional drivers of serial line 1 (primary) for the RS 422 electric standard.

FIGURE B1: JUMPERS DEFAULT CONFIGURATION

Please remind that the proposed default configuration of jumpers is the one relative to base version of module, that is without any options.
During the order phase the user can add to **GMB HR246**, the following features:

OPTION	*DESCRIPTION*
.RS422	RS 422 electric protocol for serial line 1 (primary)
.RS485	RS 485 electric protocol for serial line 1 (primary)
.CLOOP	Passive Current Loop electric protocol for serial line 1 (primary)
.RS422	RS 422 electric protocol for serial line 2 (auxiliary)
.RS485	RS 485 electric protocol for serial line 2 (auxiliary)
.CLOOP	Passive Current Loop electric protocol for serial line 2 (auxiliary)
.RTC	Section with RTC+SRAM backed by battery

FIGURE B2: OPTIONS TABLE

All these options are described in the pragraphs of the manual that illustrate the functionalities and the use of the same additional features. It is suggested to use the final alphabetical index, placed in following APPENDIX C, to found these paragraphs in a short time.

In addition there are a list of accessories that simplify and speed up the use of the module. Among these ones we remind:

- **AMP4.Cable** complete cable with 4 coloured wires, 1 metre length, crimped and inserted in female AMP MODU II connector, with 4 pins.

FIGURE B3: AMP4.CABLE CONNECTION ACCESSORY

- **CKS.AMP4** kit composed by female AMP MODU II 4 pins, plus 4 contacts to crimp.

FIGURE B4: CKS.AMP4 CONNECTION ACCESSORY

These components can be acquired directly from AMP dealers by using P/N 280359 and P/N 182206-2.

- **AMP8.Cable** complete cable with 8 coloured wires, 1 metre length, crimped and inserted in female AMP MODU II connector, with 8 pins.

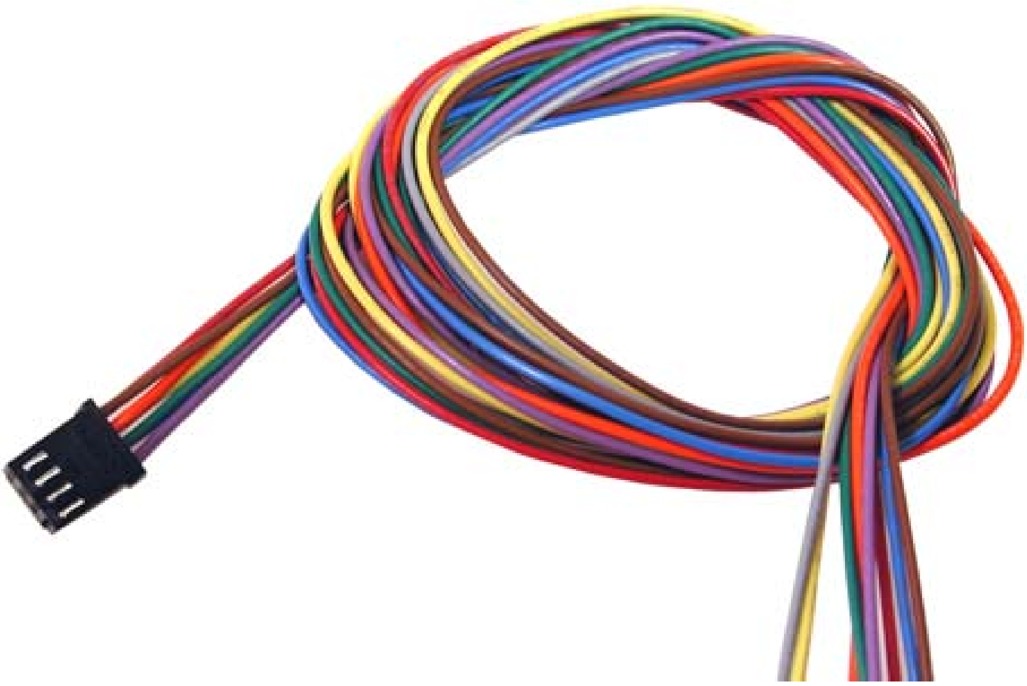


FIGURE B5: AMP8.CABLE CONNECTION ACCESSORY

- **CKS.AMP8** kit composed by female AMP MODU II 8 pins, plus 8 contacts to crimp;

FIGURE B6: CKS.AMP8 CONNECTION ACCESSORY

These components can be acquired directly from AMP dealers by using P/N 280365 and P/N 182206-2.

- **EXPS-1** power supply for direct connection to mains voltage at 230 Vac, 50 Hz, that generates an output voltage of 24 Vdc, 300 mA compatible for **GMB HR246**. The photo of this accessories is already available in previous pages of manual, on figure 40.

APPENDIX C: ALPHABETICAL INDEX

Symbols

A

B

C

J

K

L

M

N

O

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