GMB HR84

grifo® Mini BLOCK Housing
8 Opto Inputs, 4 Relay Outputs

TECHNICAL MANUAL

grifo®
ITALIAN TECHNOLOGY

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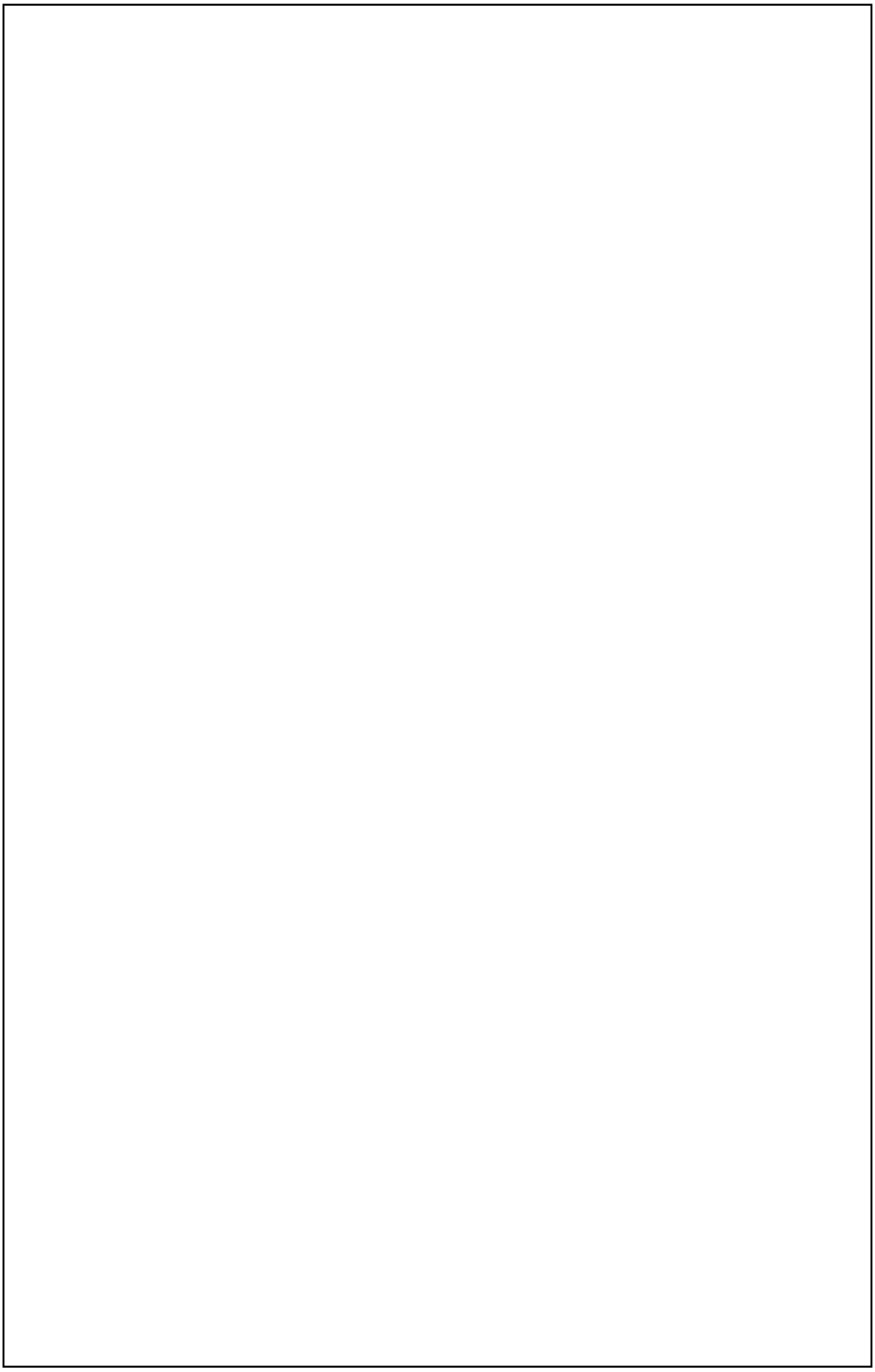
GMB HR84 Rel. 5.10 *Edition 19 January 2005*



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Modular plastic Container **DIN 50022 Modulbox**, model **M4 HC53**; size: front **90** x **71** mm, height **58** mm; mounting on **Omega** rail DIN 46277-1 and DIN 46277-3; **8** Optocoupled Inputs that can be both **NPN** or **PNP**; status of **8** inputs shown by **8 LEDs**; some inputs can pefrom **Interrupt** or Counter functions; **4** Relay Outputs **5 A**; status of **4** outputs shown by **4 LEDs**; **1 TTL output** driven by optional **RTC** of Mini Module and visualized by its own LED; Serial Line in RS 232, RS 422, RS 485, current loop or **TTL**; 1 anaolog signal for **A/D** conversion with selectable full range; 1 TTL **PWM** to generate a **D/A**-like signal by software; all signals can be connected through connectors featuring **Normalized** pin out; up to **6 I/O TTL** signals; **I²C BUS** available on connector for external devices; **Switching** power supply on board; protection of on board logic, through **TransZorb**; power supply in **DC** or in **AC**: 10 ÷ 40 Vdc or 8÷24 Vac for logic supply; **28 pin** socket for connection of Mini Modules **grifo®** like: CAN GM Zero, GMM AM08, GMM 876, etc.

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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

abaco®, **GPC®**, grifo® : are trade marks of grifo®.

Other Product and Company names listed, are trade marks of their respective companies.

GENERAL INDEX

FIGURE 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 Mini Module are not provided with any kind of ESD protection. They are connected directly to their respective pins of microcontroller. Mini Module is affected by electrostatic discharges. Personnel who handles Mini Modules is invited to take all necessary precautions to 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 etc. installation are destined - and then executable - always and in exclusive way from specialized warned and educated personnel, or directly from the TECHNICAL AUTHORIZED ASSISTANCE, in the height respect of the manufacturer recommendations and the actual safety and health norms.

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

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

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

CARD VERSION

The present handbook is reported to the **GMB HR84** card release **220503**.
The validity of the bring informations is subordinate to the number of the card release.

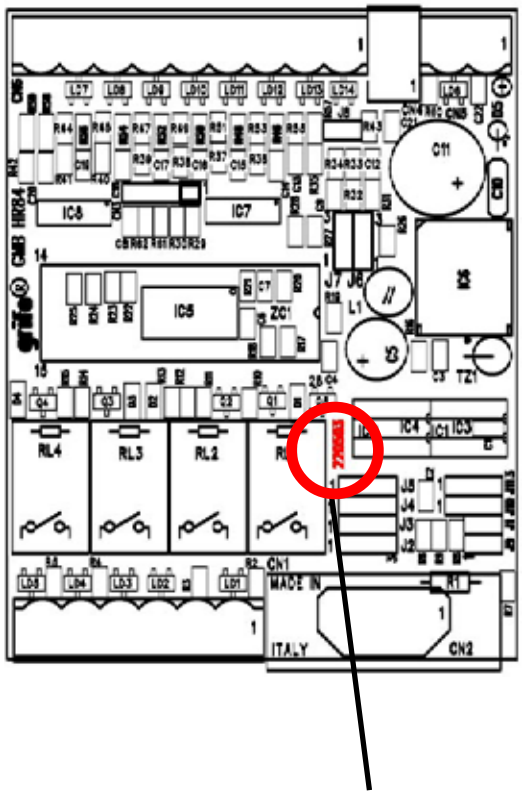


FIGURE 1: POSITION OF CARD RELEASE OF GMB HR84

GENERAL INFORMATION

GMB HR84 is a module for DIN rail with a **grifo®** where a 28 pins Mini Module CPU type **GMM** or **CAN** can be installed.
The board features 8 galvanically isolated inputs and 4 relays outputs with LEDs visualizations; an asynchronous serial line; an I²C BUS serial line; an anlog input for A/D converter; a PWM output; up to 4 I/O TTL. Its rank is low cost controller, that can work as intelligent peripheral in autonomy and/or remoted inside a wider telecontrol/teleacquisition network.
GMB HR84 is provided with a standard plastic container with clamps for common Omega rails that can be found in any electric panel.
Low cost of this interface and CPU Mini Modules allow to build with great profit a serie of low budget automation systems.
It is possible to create complete applications in astonishing short times and minumum costs by taking advantage of wide variety of software development tools, like BASIC, C and Pascal compilers, unexpensive and portable, all available from **grifo®**.
The union 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.
Such connectors easy also update and assistance phases, that can be needed in time.
Overall features of **GMB HR84** are:

- Modular plastic Container **DIN 50022 Modulbox**, model **M4 HC53**
- Size: front **90** x **71** mm, height **58** mm
- Mounting on **Omega** rail DIN 46277-1 and DIN 46277-3
- **8** Optocoupled Inputs that can be both **NPN** or **PNP**
- Status of **8** inputs shown by **8 LEDs**
- Some inputs can pefrom **Interrupt** or Counter functions
- **4** Relay Outputs **5 A**
- Status of **4** outputs shown by **4 LEDs**
- **1 TTL output** driven by optional **RTC** of Mini Module and visualized by its own LED
- Serial Line in RS 232, RS 422, RS 485, current loop or **TTL**
- 1 anaolog signal for **A/D** conversion with selectable full range
- 1 TTL **PWM** to generate a **D/A**-like signal by software
- All signals can be connected through connectors featuring **Normalized** pin out
- Up to **6 I/O TTL** signals
- **I²C BUS** available on connector for external devices
- **Switching** power supply on board; protection of on board logic, through **TransZorb**
- Power supply in **DC** or in **AC**: 10 ÷ 40 Vdc or 8÷24 Vac for logic supply
- **28 pin** socket for connection of Mini Modules **grifo®** like: CAN GM Zero, GMM AM08, GMM 876, etc.

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

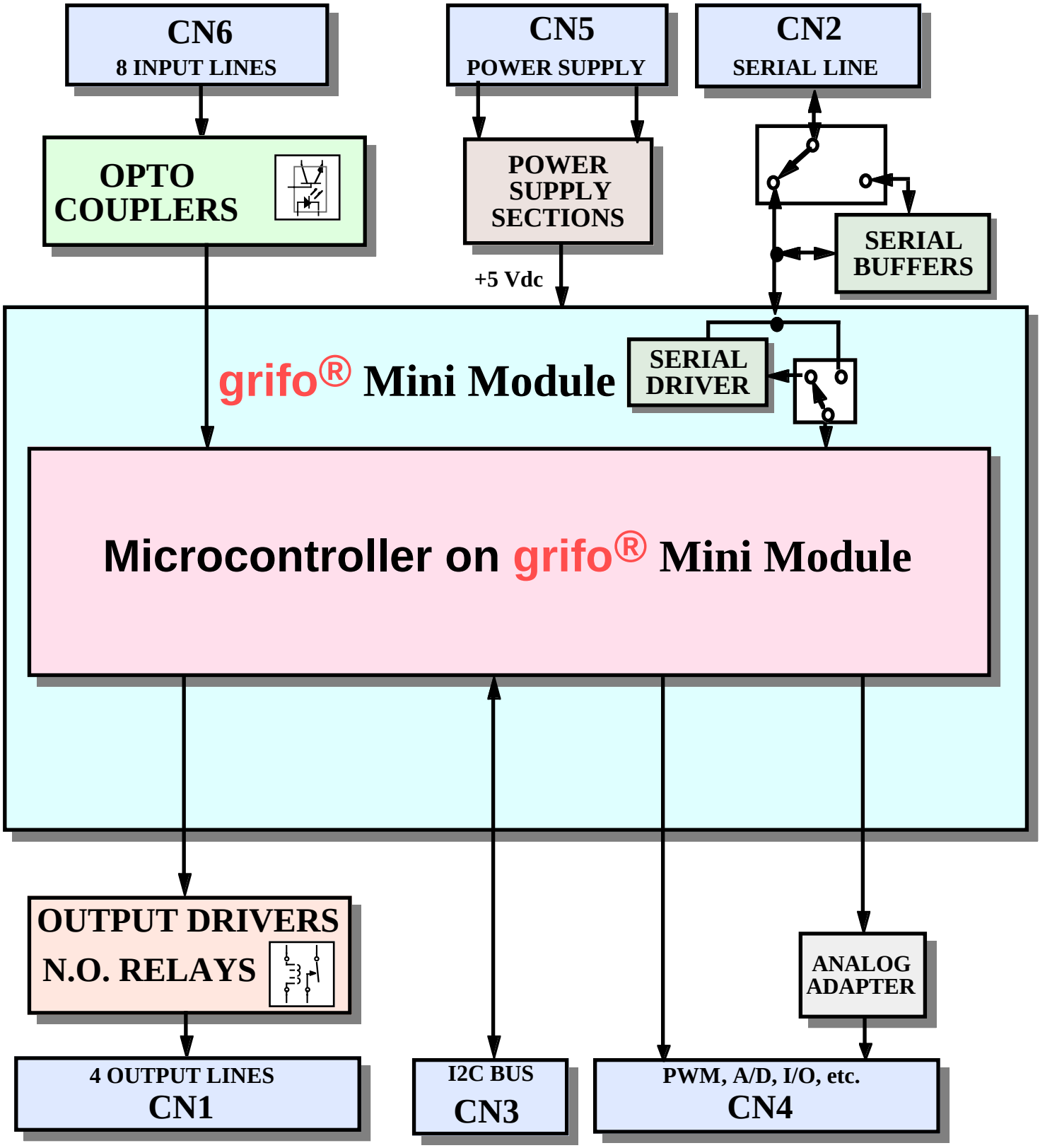


FIGURE 2: BLOCKS DIAGRAM

ANALOG INPUT

One analog input is available connected through a field connector to a specific circuitery that allows to acquire signals in variable ranges with the resolution typical of Mini Module installed.
This feature depends on Mini Module used, so please refer to documentation of specific **GMB HR84** + Mini Module union.

OPTOCOUPLED DIGITAL INPUTS

GMB HR84 features 8 NPN and/or PNP inputs connected to a quick release screw terminal connector that are directly acquired by 8 I/O lines of Mini Module through a galvanically isolated interface.
These lines are visualized by specific LEDs and have been selected to be able to take advantege completely of Mini Module's CPU internal peripherals, so the inputs can generate interrupts, be counted by hardware counters, etc.
Optocoupled inputs are supplied by a specific voltage called +Vopto that must be provided from an external source.

DIGITAL RELAYS OUTPUTS

The board is provided with 4 relays outputs 5 A, normally open, whose status is visualized by 4 LEDs. Each line is driven directly by a I/O line of Mini Module, buffered through a specific driver and connected to a comfortable quick release screw terminal connector to easy interface to the field signals.

SERIAL COMMUNICATION

GMB HR84 features one interface for an asynchronous serial line whose physical protocol (baud rate, stop bit, bit 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 line can be not buffered (**TTL**) or buffered in **current loop, RS 232, RS 422 or RS 485**; in these last two cases also abilitation and direction of line can be defined.
Please remark that by default the board is provided with both serial lines in RS 232, so any different configuration must be specified in the order.
For further information about serial communication please refer to paragraph: “CONNECTIONS” and “SERIAL COMMUNICATION SELECTION”.

MINI MODULE

GMB HR84 has been designed to accept all 28 pins grifo® Mini Modules; such CPU modules are the core of the system, in fact they provide and define the use for all peripherals according to the application to make.
Mini Module is also software programmable, to allow the user to satisfy needs that can also change in time.

CAN INTERFACE

GMB HR84 featurea an interface for an eventual CAN line available on Mini Module installed. Such interface is simply a connector for field connection and CAN line termination circuitery, while all other hardware and software characterisrtics (line driver, bit rate, etc.) are the ones of Mini Module installed, so for further information please refer to its technical documentation.

I²C BUS LINES

GMB HR84 is provided with one connector (CN3) dedicated to I²C BUS, which can be a hardware peripheral of the microcontroller or sofware emulated, connected to two signals of Mini Module, each provided with a 4.7 kΩ pull-up installed on **GMB HR84**.
This kind of interface allows to connect devices featuring the same communication standard, to easily improve the system performances.
A wide set of software examples explains the management of most common I²C BUS peripherals like A/D and D/A converters, display drivers, memories, temperature sensors, etc.
For this purpose it can be intresting to condifer **K51-AVR**, for which both technical manual and electric diagram are available, also a wide set of examples in several languager are avalable.

TELECONTROL FIRMWARE

The Mini Module installed on **GMB HR84** can be provided with a telecontrol firmware; such firmwares allow to manage all the board resources through a set of commands to send to the serial line.
Taking advantage of these firmwares make possible to use well developed commands that solve fundamental problems of automation like impulse count, wave from generation, debounced input acquisition, Real Time Clock managentent, etc.
In addition, Master Slave communication mode is supported; this allows to remote single modules also at great distance, to build a telecontrol network driven by a unique master unit (PC, PLC, **GPC**®, etc.).
By now, some standard protocols like **ALB x84** (**ABACO**® Link BUS) and **MODBUS** are available, anyway new protocols can be developed on specific request of the customer.
Please contact grifo® for further information.

DIGITAL I/O TTL SIGNALS

According to which Mini Module is installed, **GMB HR84** features from 2 to 6 digital I/O TTL signals.
Use of these lines is completely user defineable and, in some cases, are available also automatic features controlled by Mini Modue peripherals multiplexed with I/O on the same pin.
Remarkablre are: optional Real Time Clock, PWM line from CPU internal PCA to generate an analog signal, count signal from CPU internal 16 bit Timer Counter, etc.

POWER SUPPLY SECTION

GMB HR84 is provided with an efficent switching power supply section, that provides supply +5 Vdc voltage needed by logic and output circuits, in any condition of input load and voltage.
If this section is not present, supply voltages must be provided from an external source.
The board features components and circuits designed to reduce consumptions (including the possibility of power-down and idle working modes of Mini Modules) and to reduce noise sensibility.
Remarkable is protection circuit based on TransZorb™ that avoids damages due to incorrect voltages.
To supply optocouplers of galvanically isolated sections an extezrnal voltage is needed.
For further information please refer to chapter “ELECTRIC FEATURES” and paragraph “SUPPLY VOLTAGES”.

FIGURE 3: PHOTO OF GMB HR84 WITH ITS CONTAINER

TECHNICAL FEATURES

GENERAL FEATURES

On board resources:	8 optocoupled digital inputs NPN and PNP 4 relays digital buffered outputs 5 A 1 serial line (RS 232, TTL, RS422, RS485, Current Loop, etc.) 1 connector for I^2C BUS lines 1 analog input 1 PWM output (for D/A) Up to 6 digital I/O TTL 1 switching power supply section 14 status LEDs
Mini Module:	28 pins, like **CAN GM Zero**, **GMM AM08**, **GMM 876**, etc.
Opto input cut-off frequency:	13 KHz

PHYSICAL FEATURES

Size:	90 x 71 x 58 mm (container DIN 50022) 85 x 66 x 32 mm (without container)
Container:	DIN 50022 modulbox, model M4 HC53
Montaggio:	On Ω rails type DIN 46277-1 and DIN 46277-3
Weight:	160 g
Connectors:	CN1: 6 pins quick release screw terminal connector CN2: 9 pins D type female, vertical, connector CN3: 4 pins strip, male, vertical CN4: 2x4 vie AMP MODU II, male, vertical CN5: 2 pins quick release screw terminal connector CN6: 9 pins quick release screw terminal connector
Temperature range:	from 0 to 50 centigrad degreeses
Relative humidty:	20% up to 90% (without condense)

ELECTRIC FEATURES

Power supply:	10÷40 Vdc or 8÷24 Vac	(control logic)
Power required for logic:	2.3 W	(*)
Output power supply:	+5 Vdc	
Current required by GMB HR84:	310 mA max 16÷75 mA max	(+5 Vdc) (+V opto)
Current on +5 Vdc output:	400 mA - current required - Mini Module current	
Relays max voltage:	35 Vdc	
Relays max non inductive current:	5 A	(resistive load)
Optocouplers input voltage:	+V opto = 8 ÷ 30 Vdc	(*)
Power required for optocouplers:	4.4 W	
Analog input range:	direct connection or attenuation factor 4 analog range depends on Mini Module	
Analog input impedance:	4.7 kΩ	
Pull-up on I^2C BUS dedicated lines:	4.7 kΩ	
Termination network RS 422-485:	Line termination resistor Positive pull up resistor Negative pull down resistor	=120 Ω =3.3 KΩ =3.3 KΩ
CAN termination network:	120 Ω resistor, disconnectable	

(*) The data are referred to 20 C° work temperature (for further information please refer to chapter "POWER SUPPLY VOLTAGE").

INSTALLATION

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

CONNECTIONS

GMB HR84 has 6 connectors that can be linkeded to other devices or directly to the field, according to system requirements. In this paragraph there are connectors pin out, a short signals description (including the signals direction) and connectors location (see figure 29).

CN5 - POWER SUPPLY CONNECTOR

CN5 is a 2 ways, quick release screw terminal connector, vertical, 5.00 mm pitch.
CN5 allows to provide power needed by the switching power supply to generate logic control and optocouplers supply voltage.

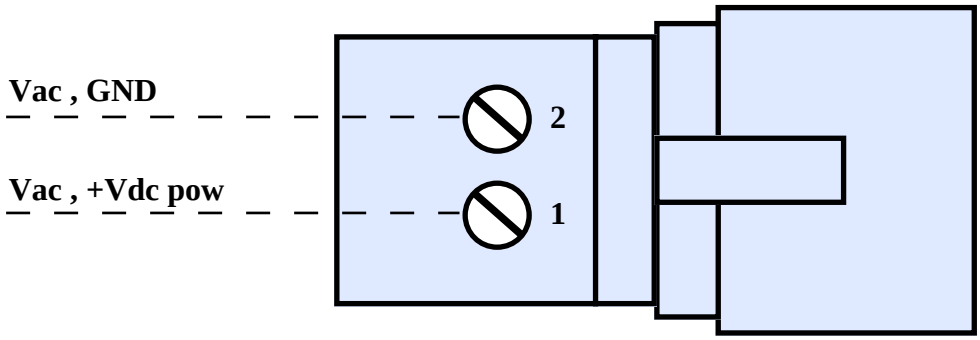


FIGURE 4: CN5 - POWER SUPPLY CONNECTOR

Signals description:

Vac , +Vdc pow = I - Positive terminal of direct supply voltage.
Vac , GND = I - Negative terminal of direct supply voltage.

For further information please refer to paragraphs "POWER SUPPLY" and "ELECTRIC FEATURES".

CN3 - I²C BUS LINE CONNECTOR

CN3 is a 4 ways, male, vertical, strip connector with 2.54mm pitch.
On CN3 is available a standard interface for any I²C BUS peripheral device.
The connector features +5 Vdc supply voltage generated by on board switching power supply that can be connected to external devices or systems.
Signals are TTL compliant, according to I²C BUS standard, their disposition has been designed to reduce interferences and so easy the connection.

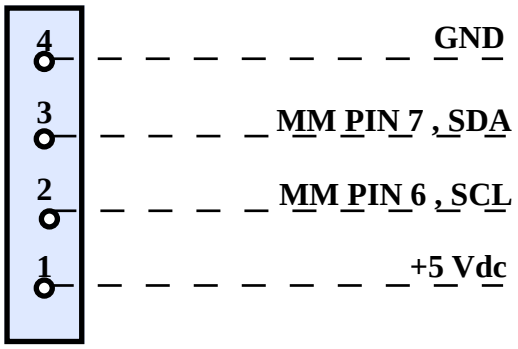


FIGURE 5: CN3 - I²C BUS LINE CONNECTOR

Signals description:

MM PIN7 , SDA= I/O - Data signal of I²C BUS serial line connected to Mini Module pin 7.
MM PIN6 , SCL= O - Clock signal of I²C BUS serial line connected to Mini Module pin 6.
+5 Vdc = O - Unique +5 Vdc power supply.
GND = - Ground.

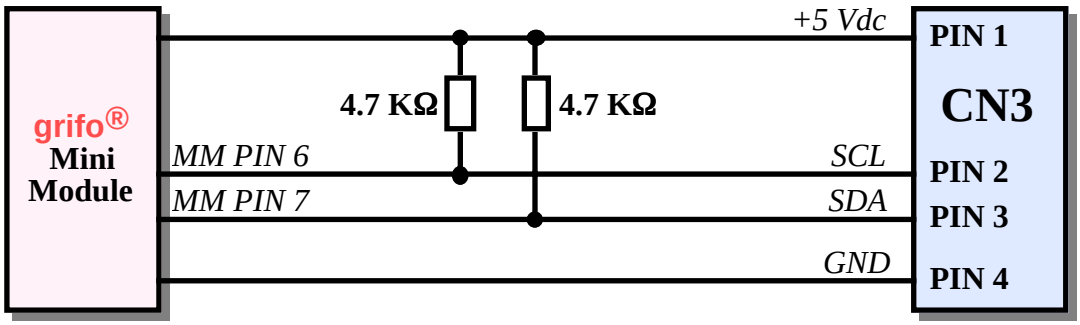


FIGURE 6: I²C BUS CONNECTION DIAGRAM

ZC1 - CONTROL DEVICE SOCKET

ZC1 is a 40 pin, 600 mils DIL socket.
Its purpose is to install the interlligent hardware module that manages all **GMB HR 84** on board signals (reads optocoupled inputs, set relays outputs, etc.).
Hardware strucuture of **GMB HR 84** is designed for use with **grifo®** Mini Modules. If you are using a combination **GMB HR 84 + grifo®** Mini Module please refer to its specific manual.
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 which on board hardware resource is connected to each signal of 28 pins socket ZC1.
For further details about hardware, please refer to following paragraphs.
For further details about hardware, please refer to chapter "PERIPHERAL DEVICES SOFTWARE DESCRIPTION".
For purpose of jumpers, please refer to chapter "JUMPERS".

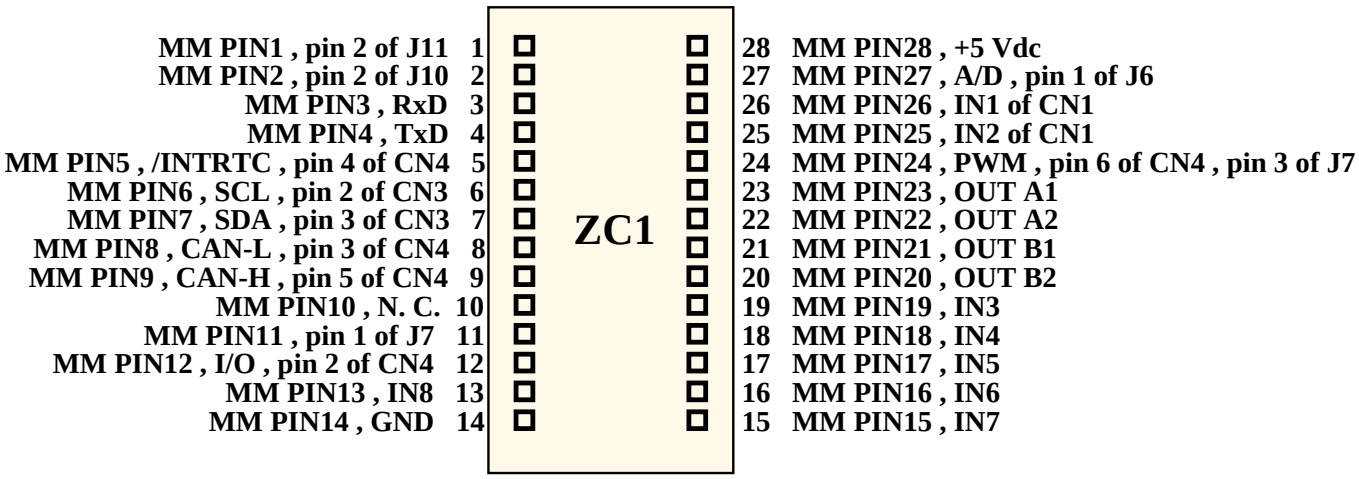


FIGURE 7: ZC1 - CONTROL DEVICE SOCKET

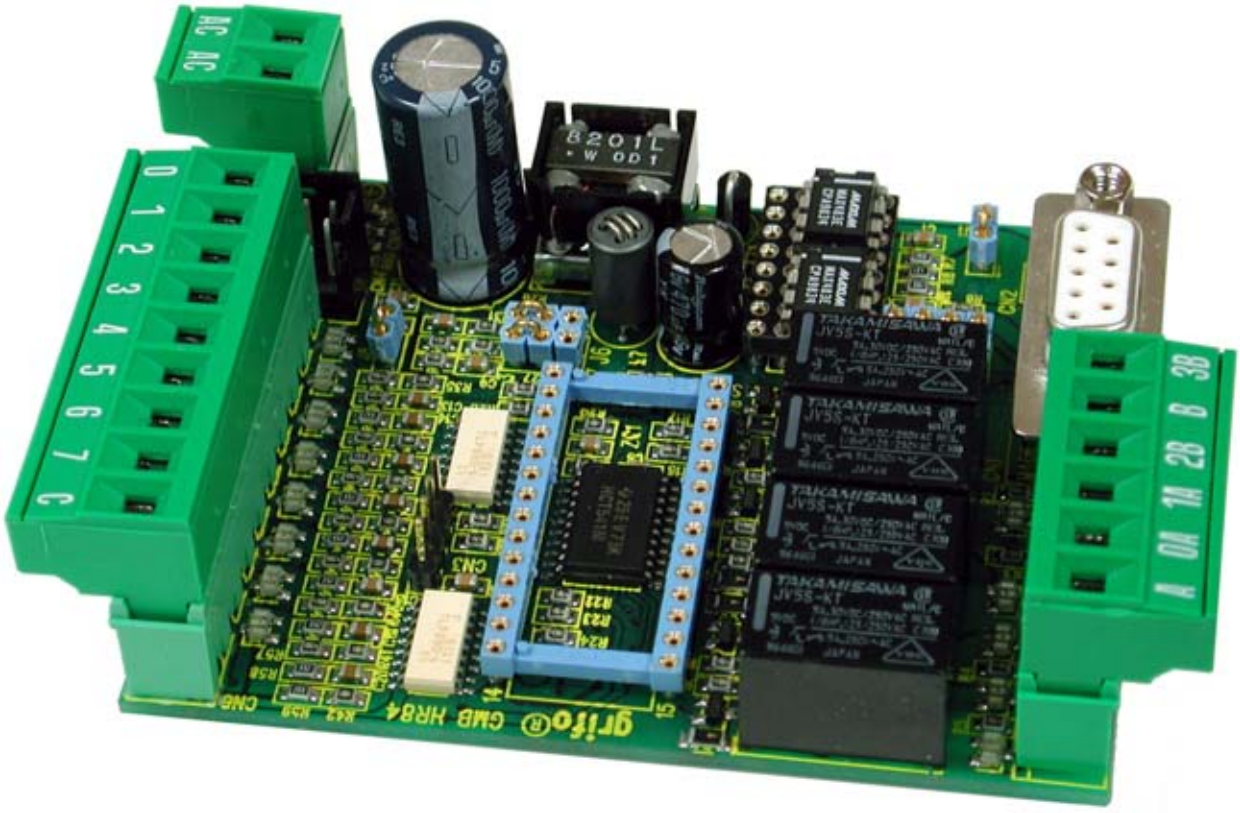


FIGURE 8: PHOTO OF GMB HR84 WITHOUT MINI MODULE INSTALLED

CN2 - SERIAL LINE CONNECTOR

CN2 is a 9 ways, female, vertical, D-type type connector.
This connector features signals for serial communication in RS 232, RS 422, RS 485, current loop and TTL, performed through hardware module on ZC1 hardware serial port.
Signals position, reported as follows, has been designed to reduce interferences and easy connections to the field, while signals are compliant to CCITT standard of protocol used.

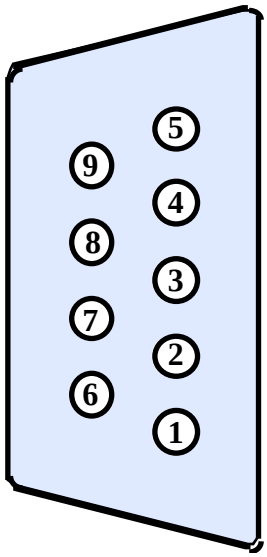


FIGURE 9: CN2 - SERIAL LINE CONNECTOR

Pin	*Signal*	*Direction*	*Description*
RS 232 serial line (please see paragraph "SERIAL COMMUNICATION SELECTION"):			
2	**RX RS232**	= I -	Receive Data for RS 232.
3	**TX RS232**	= O -	Transmit Data for RS 232.
5	**GND**	= -	Ground signal.
RS 422 serial line (please see paragraph "SERIAL COMMUNICATION SELECTION"):			
1	**RX- RS422**	= I -	Receive Data Negative for RS 422.
2	**RX+ RS422**	= I -	Receive Data Positive for RS 422.
3	**TX- RS422**	= O -	Transmit Data Negative for RS 422.
4	**TX+ RS422**	= O -	Transmit Data Positive for RS 422.
5	**GND**	= -	Ground signal.
RS 485 serial line (please see paragraph "SERIAL COMMUNICATION SELECTION"):			
1	**RXTX+ RS485**	= I/O-	Receive/Trasmit Data Positive for RS 485.
2	**RXTX- RS485**	= I/O-	Receive/Trasmit Data Negative for RS 485.
5	**GND**	= -	Ground signal.
Current Loop serial line (please see paragraph "SERIAL COMMUNICATION SELECTION"):			
9	**RX- C.L.**	= I -	Receive Data Negative for Current Loop.
8	**RX+ C.L.**	= I -	Receive Data Positive for Current Loop.
7	**TX- C.L.**	= O -	Transmit Data Negative for Current Loop.
6	**TX+ C.L.**	= O -	Transmit Data Positive for Current Loop.
5	**GND**	= -	Ground signal.

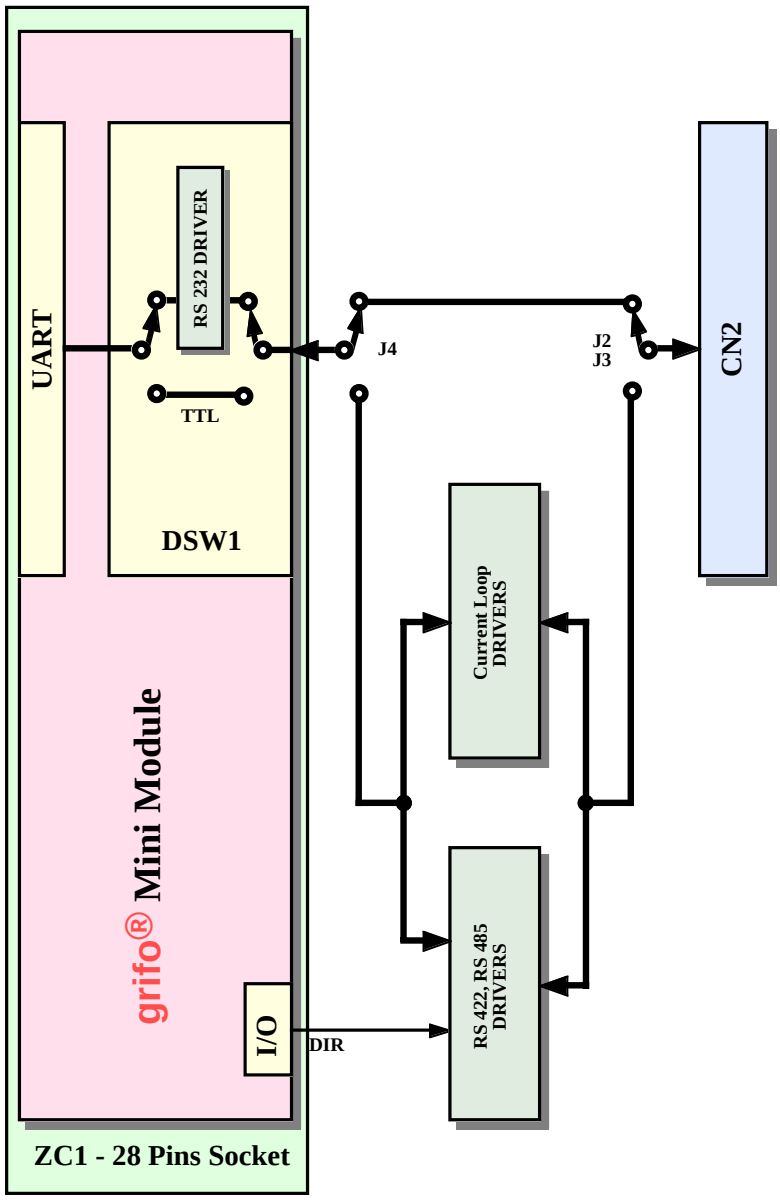


FIGURE 10: SERIAL COMMUNICATION BLOCK DIAGRAM

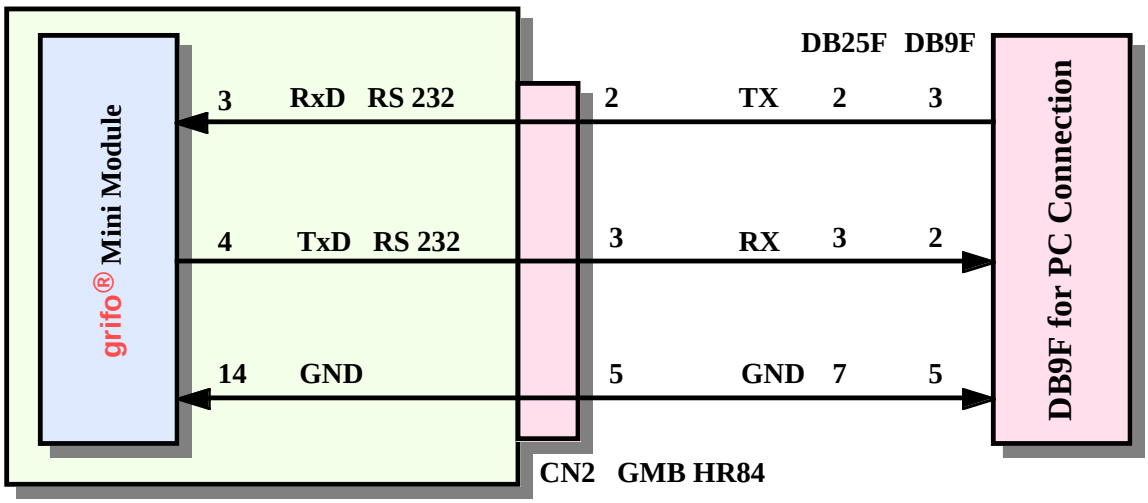


FIGURE 11: RS 232 PC POINT TO POINT CONNECTION EXAMPLE

FIGURE 12: RS 232 POINT TO POINT CONNECTION EXAMPLE

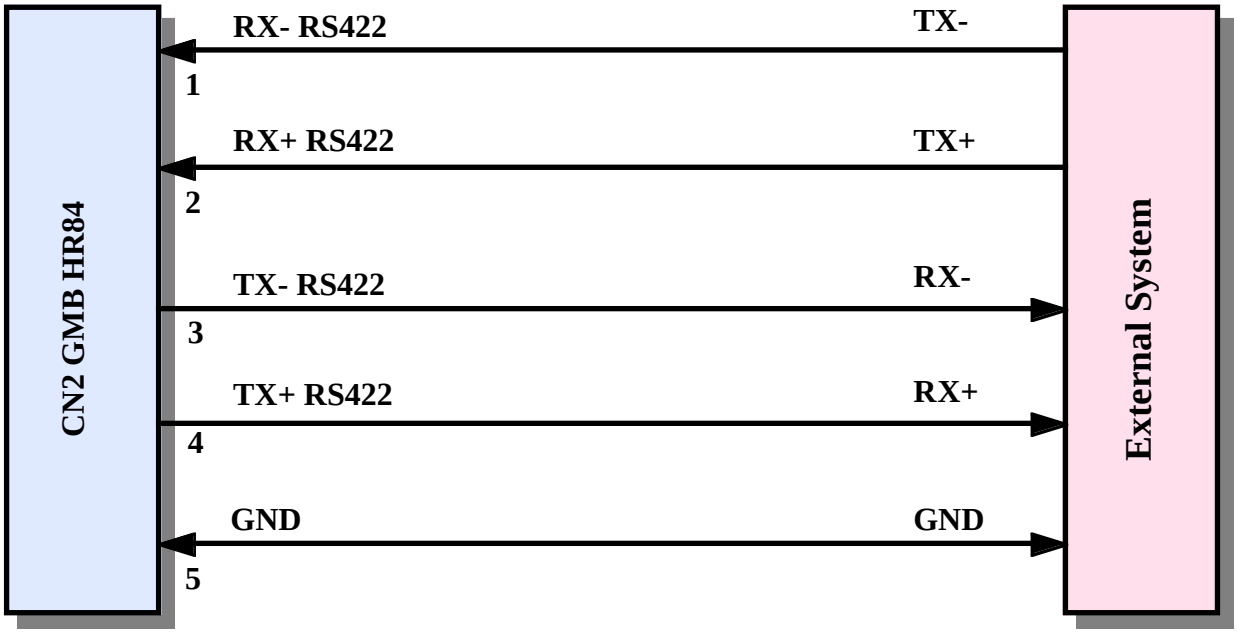


FIGURE 13: RS 422 POINT TO POINT CONNECTION EXAMPLE

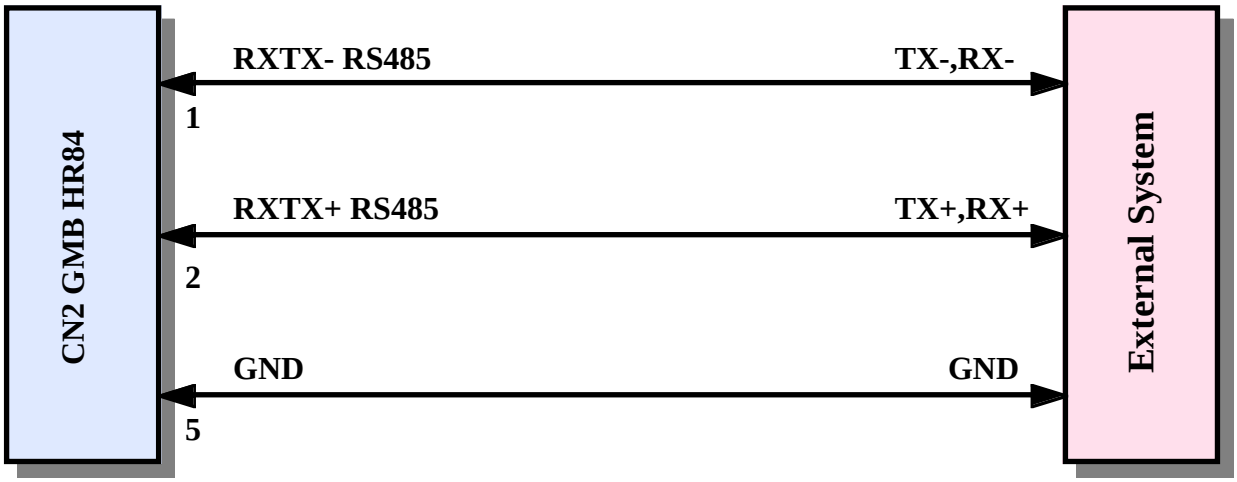


FIGURE 14: RS 485 POINT TO POINT CONNECTION EXAMPLE

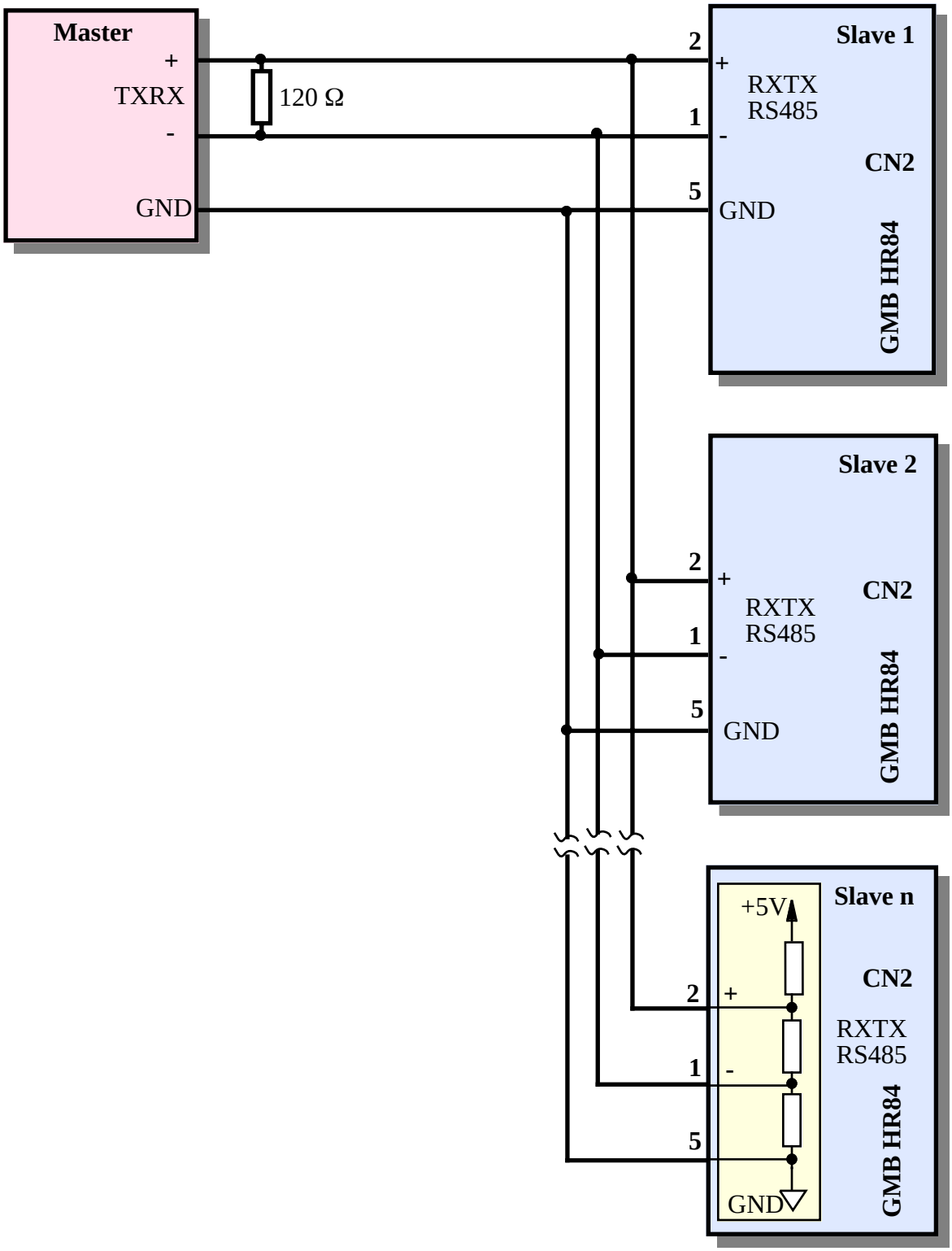


FIGURE 15: RS 485 NETWORK CONNECTION EXAMPLE

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 HR84** board. It can be enabled or disabled through specific jumers, as explained later.
For further information please refr to TEXAS INSTRUMENTS Data-Book , "*RS 422 and RS 485 Interface Cicuits*", the introduction about RS 422-485.

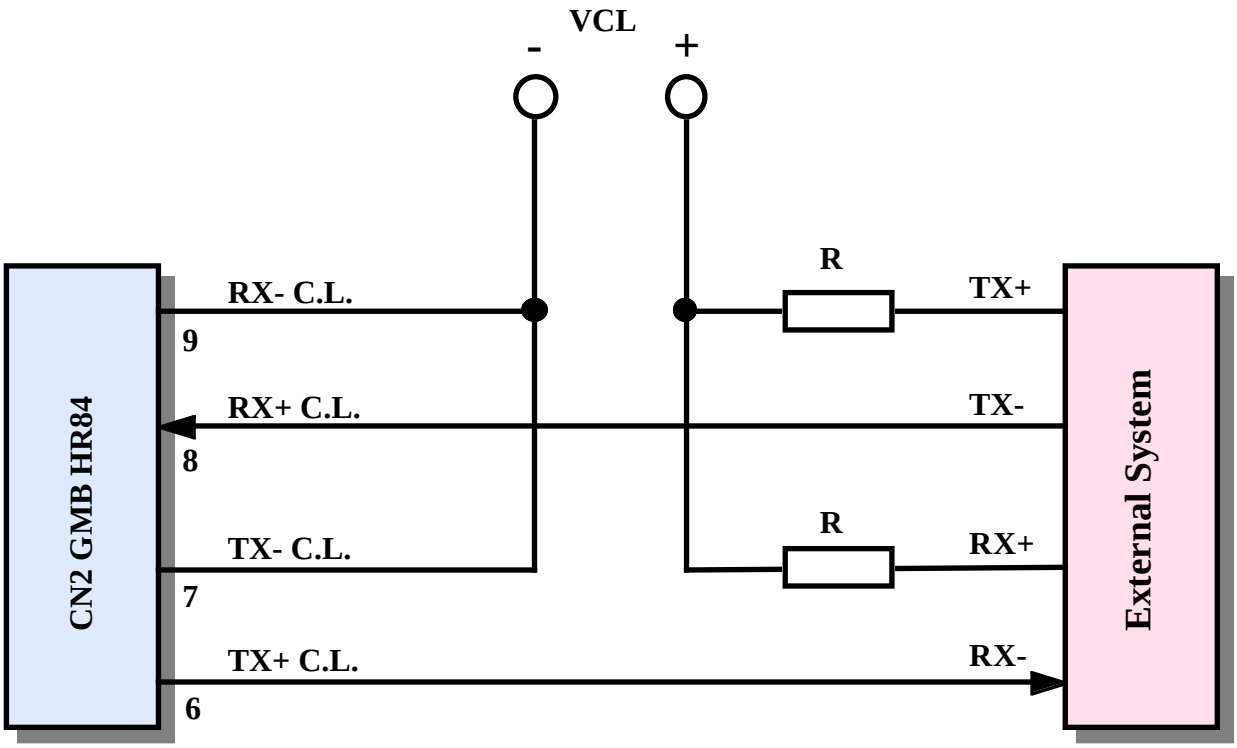


FIGURE 16: CURRENT LOOP 4 WIRES POINT-TO-POINT CONNECTION EXAMPLE

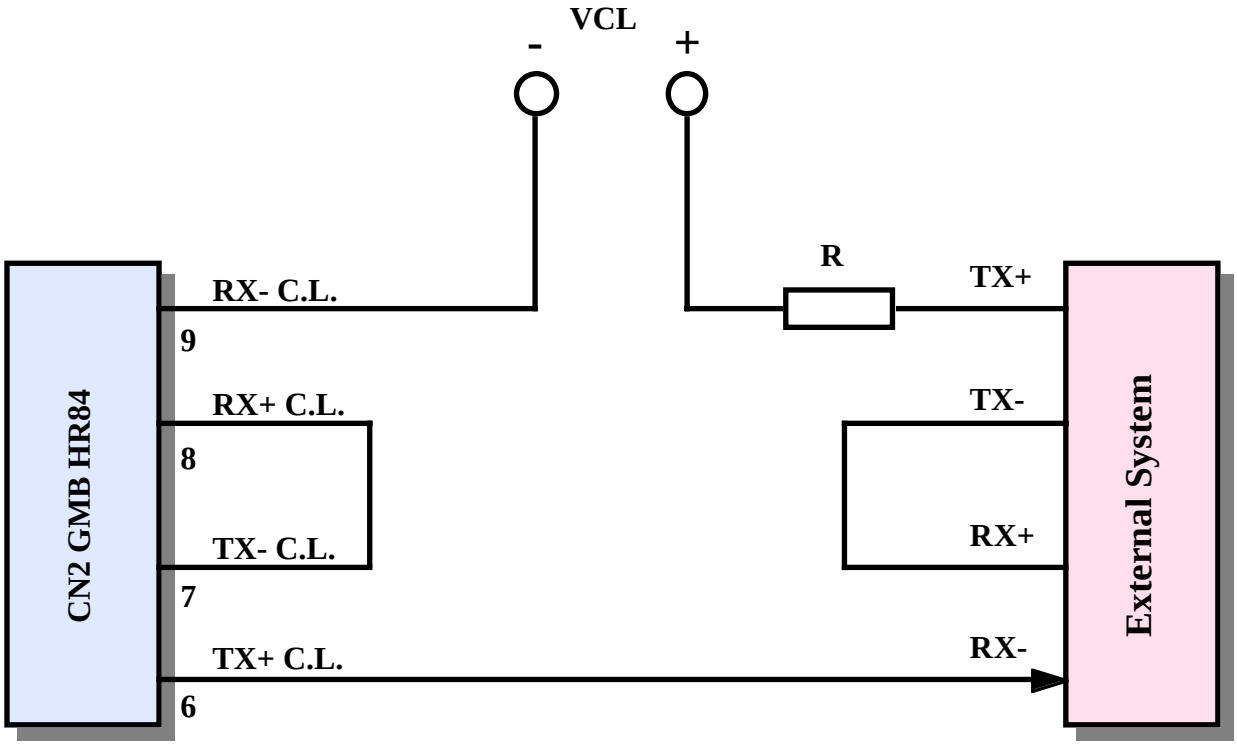


FIGURE 17: CURRENT LOOP 2 WIRES POINT-TO-POINT CONNECTION EXAMPLE

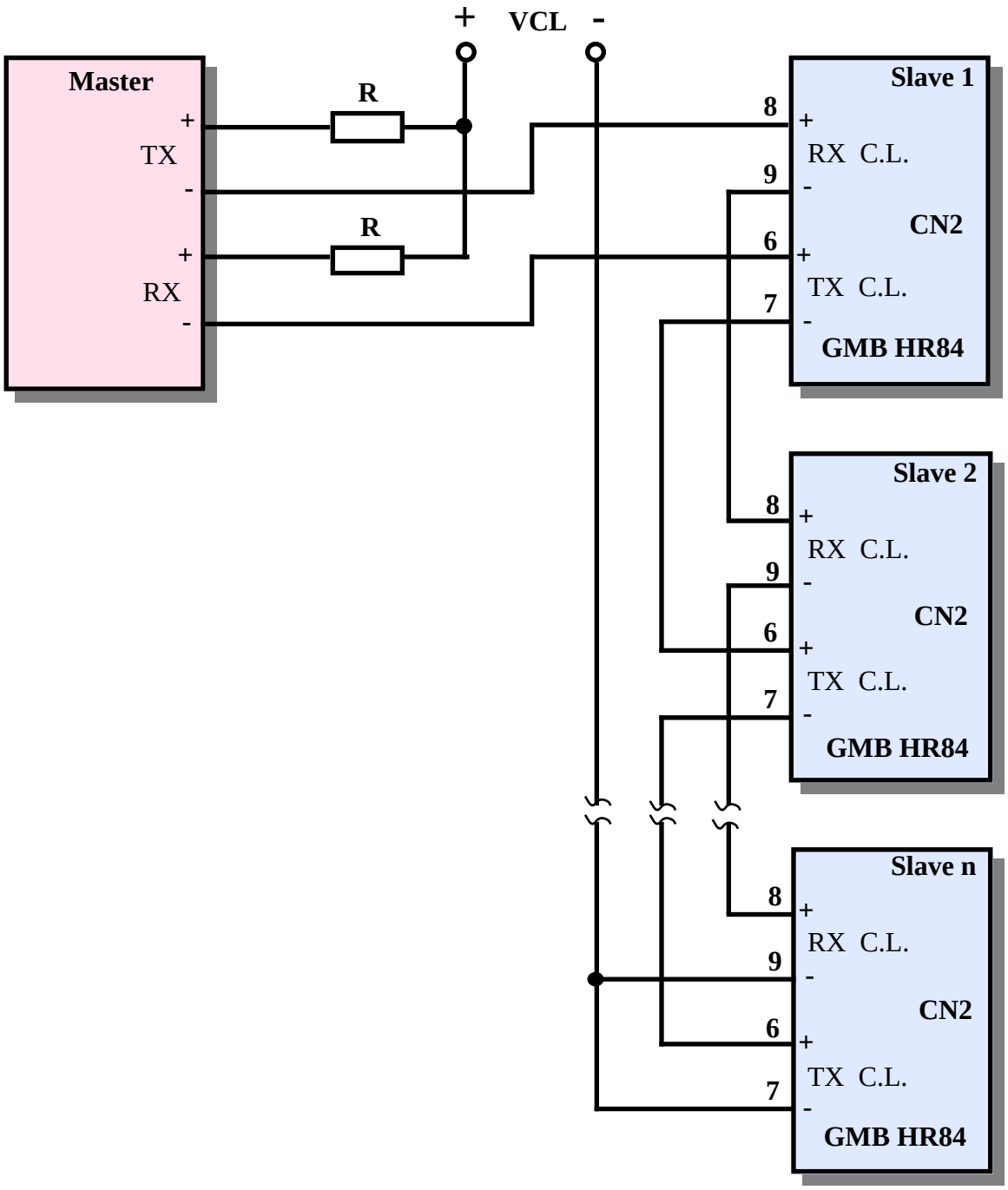


FIGURE 18: CURRENT LOOP NETWORK CONNECTION EXAMPLE

Possible Current Loop connections are two: 2 wires and 4 wires. These connections are shown in figures 16÷18 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).

CN6 - OPTOCOUPLED DIGITAL INPUTS CONNECTOR

CN6 is a 9 ways, quick release, screw terminal connector, pitch 5.0 mm.
CN6 is used to connect the 8 optocoupled NPN or PNP input signals that the card manages and are visualized by green LEDs.
Connector also features the common pin where to connect one input to close it.
These signals are software managed and have been carefully selected to take advantage of **grifo®** Mini Modules internal peripherals.

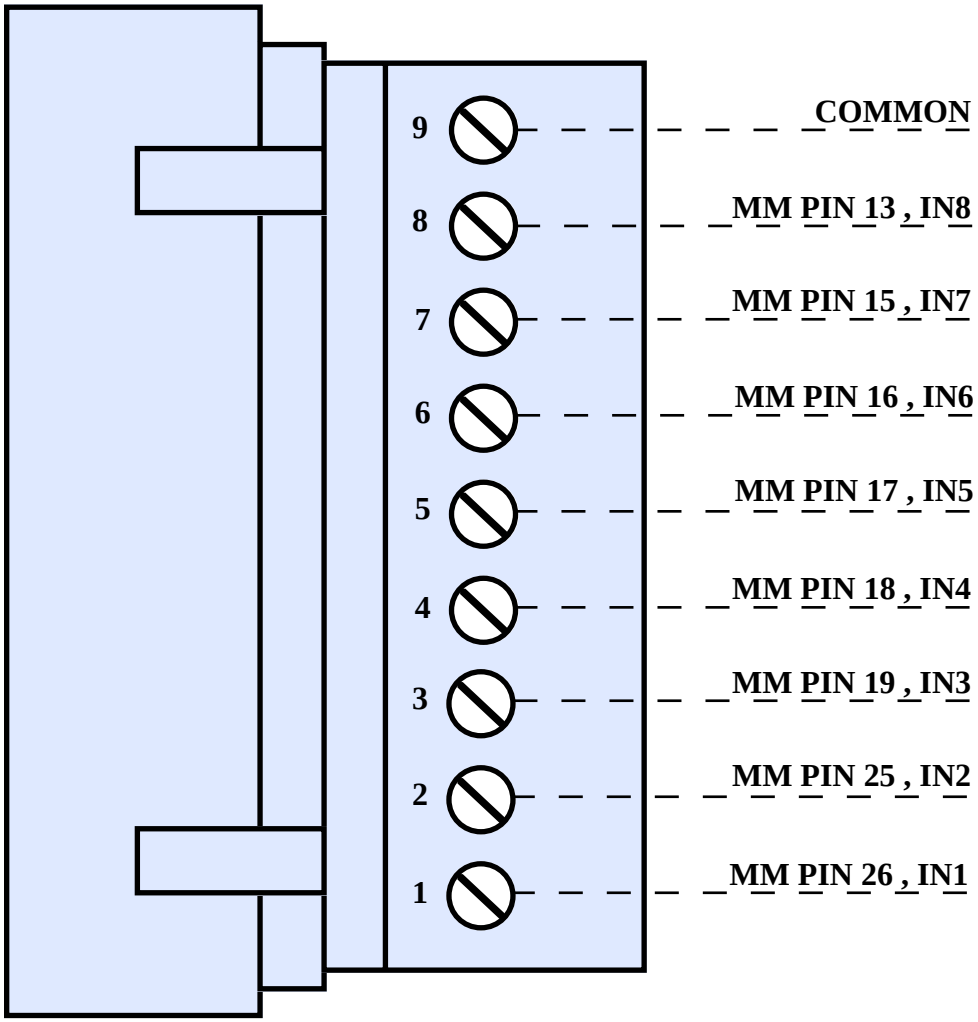


FIGURE 19: CN6 - OPTOCOUPLED DIGITAL INPUTS CONNECTOR

Signals description:

MM PIN x, INn = I - n-th optocoupled input type NPN or PNP, connected to indicated signal of Mini Module.
COMMON = - Common pin where an input must be connected to close it.

Input lines are optocoupled and provided with low-pass filter; this warrants a grade of protection for internal electronics against external noise.
Each line features a LED for visual signalation that turns ON whenever voltage +Vopto is connected between input pin and common pin, regardless polarity of connection.
This makes input lines suitable both for **PNP** and **NPN** drivers.

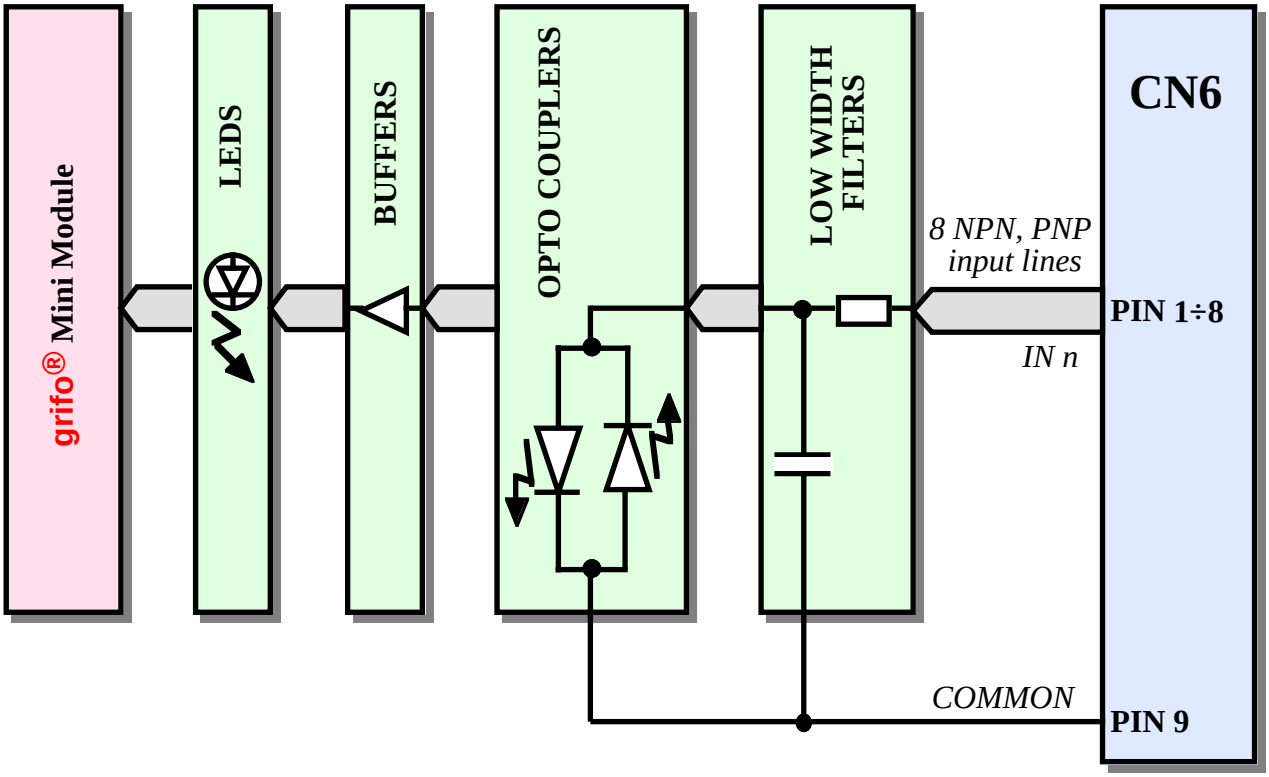


FIGURE 20: OPTOCOUPLED INPUTS BLOCK DIAGRAM

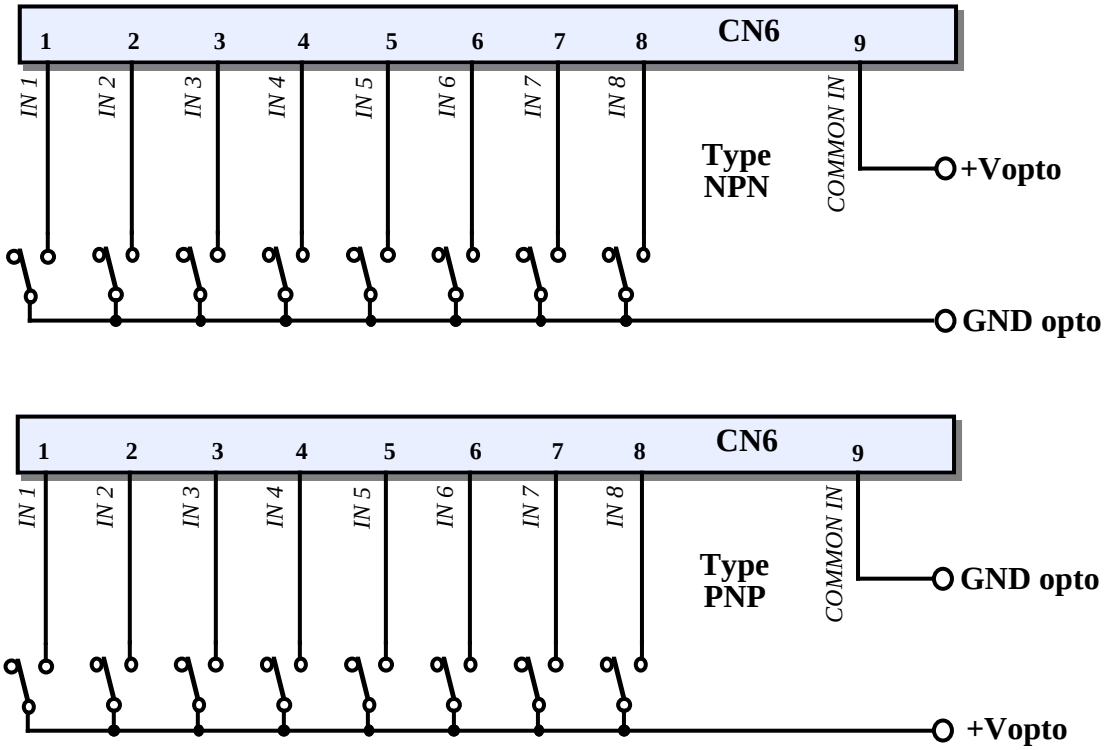


FIGURE 21: OPTOCOUPLED INPUTS CONNECTION DIAGRAM

CN1 - RELAYS OUTPUTS CONNECTOR GROUPS A AND B

CN1 is a 6 ways, quick release screw terminal connector, pitch 5.0 mm.
This connector allows to connect 4 normally open contacts and common pins relays outputs available on **GMB HR84**.
Please remark that maximum (resistive) load for each line is **5 A** and maximum voltage is **35 Vdc**.
These signals are software managed through Mini Module I/O ports, opportunely buffered, and selected carefully to easy management (plese refer to chapter "PERIPHERAL DEVICES SFOTWARE DESCRIPTION").

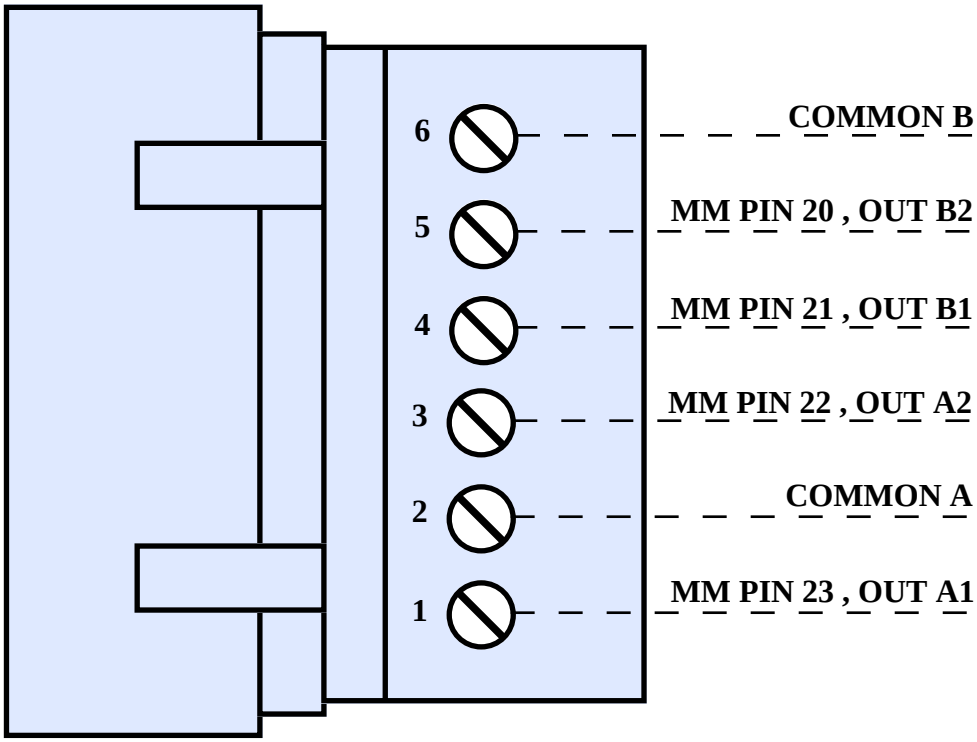


FIGURE 22: CN1 - RELAYS OUTPUTS CONNECTOR GROUPS A AND B

Signals description:

MM PIN x, OUT An = O - Normally open contact for n-th relay of group A, connected to indicated Mini Module pin.
COMMON A = - Common contact for relays of group A.
MM PIN x, OUT Bn = O - Normally open contact for n-th relay of group B, connected to indicated Mini Module pin.
COMMON B = - Common contact for relays of group B.

Le linee di output a relé, comprendono un diodo LED con funzione di segnalazione visiva (il LED si accenderà tutte le volte in cui il contatto del relé risulterà chiuso). I relè sono pilotati da 4 transistrors PNP che a loro volta sono gestiti attraverso altrettanti pins di I/O del Mini Modulo.

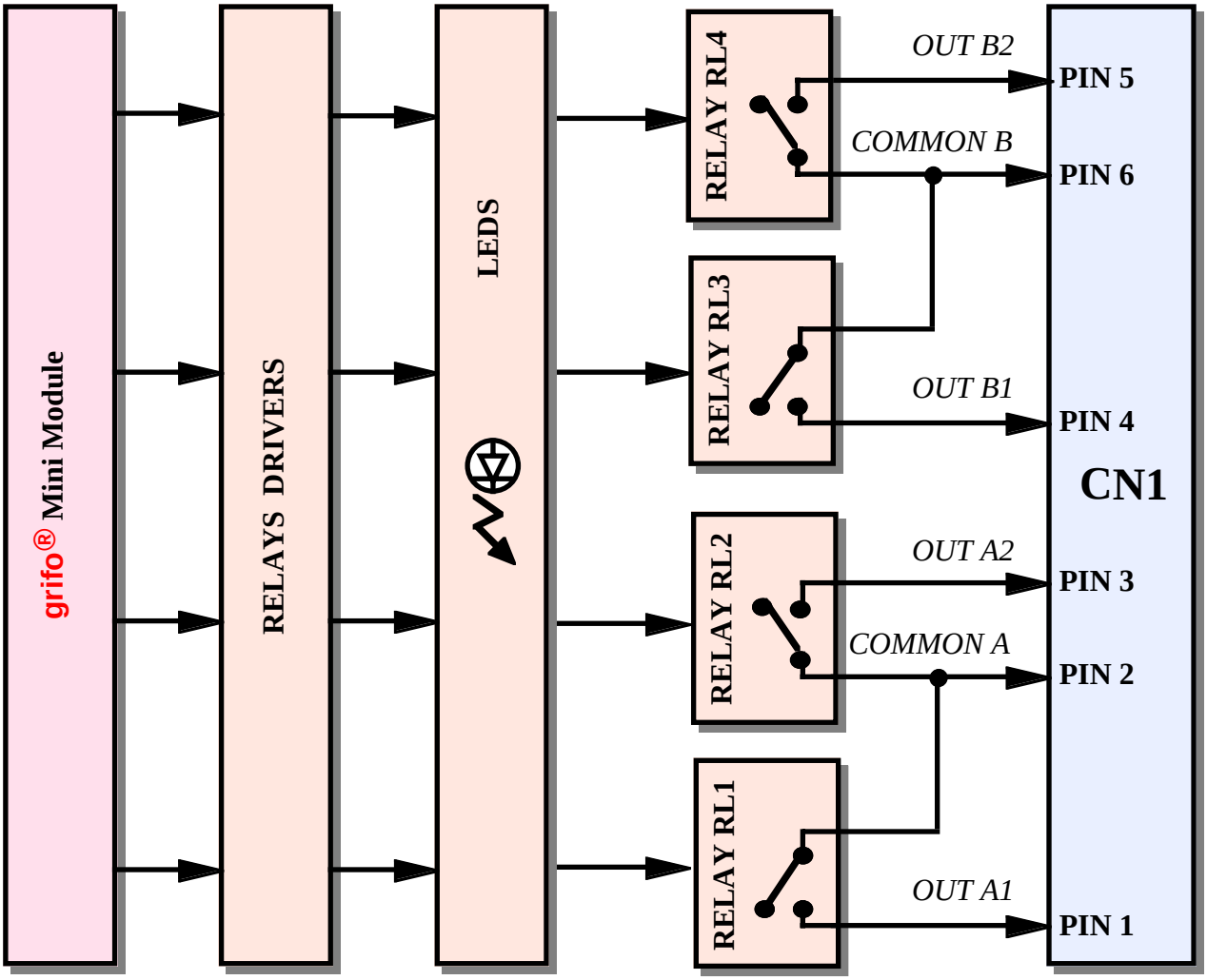


FIGURE 23: RELAY OUTPUTS A AND B BLOCK DIAGRAM

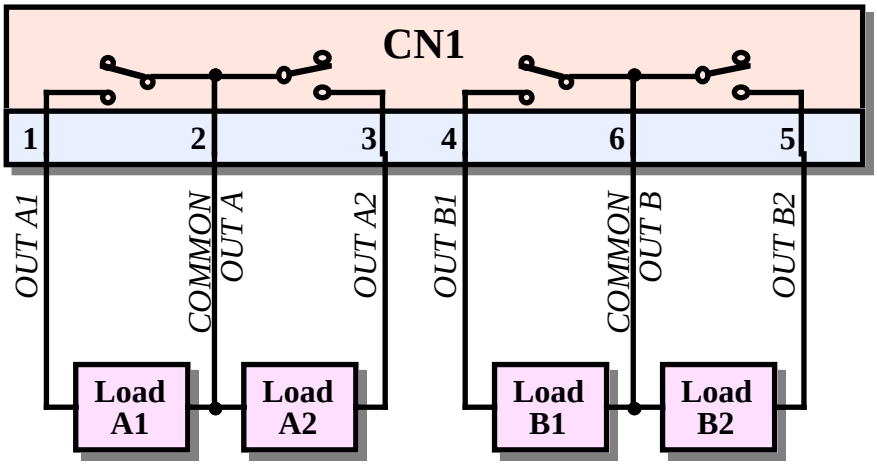


FIGURE 24: RELAY OUTPUTS A AND B CONNECTION DIAGRAM

CN4 - TTL I/O, A/D, ETC. CONNECTOR

CN4 is a 8 ways, male, vertical, AMP MODU II 2x4 connector with pitch 2.54 mm.
This connector features +5 Vdc supply voltage (generated by on board switching power supply), up to 4 TTL digital I/O signals and an analog input connected to A/D section.
Pin 4 is connected to Real Time Clock interrupt signal, so it cannot be used as generic I/O signal.
Female connector can be ordered from **grifo®** (cod. **CKS.AMP8**) or its parts can be purchased from AMP catalog (P/N 280365: connector and P/N 182206-2: pins to crimp).
It is also possible to order the female connector with pins to crimp already mounted and one meter long cables (**grifo®** cod. **AMP8.cable**).

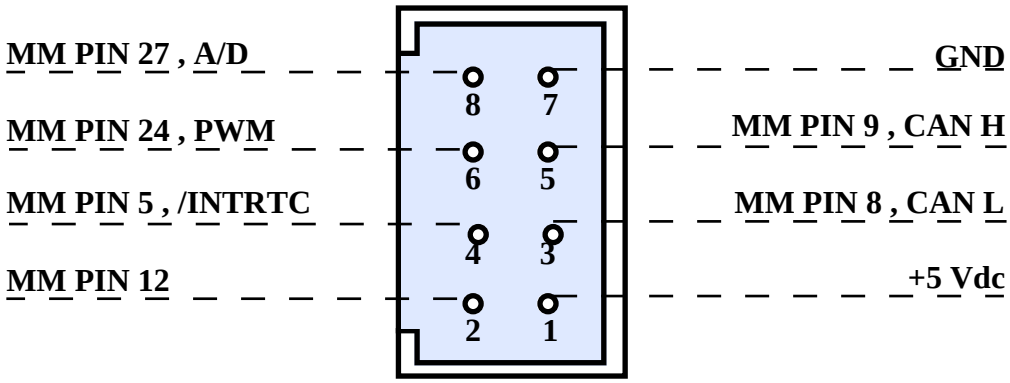


FIGURE 25: CN4 - TTL I/O, A/D, ETC. CONNECTOR

Signals description:

MM PIN x	= I/O	- TTL digital I/O signal, connected to pin x of Mini Module.
A/D	= I	- Analog input for A/D converter section of Mini Module.
CAN H	= I/O	- Differential line high of Mini Module's optional CAN interface.
CAN L	= I/O	- Differential line low of Mini Module's optional CAN interface.
/INTRTC	= I/O	- Interrupt signal of Mini Module's optional Real Time Clock.
PWM	= O	- Pulse Width Modulation TTL output of Mini Module.
+5 Vdc	= O	- Positive terminal of +5 Vdc power supply.
GND	=	- Ground signal.

Next figures show connection modalities of **GMB HR84** that will be explained more in detail futher; it is suggested to refer to table of figure 36 to see which signals are available on connector CN4 according to which Mini Module is installed.

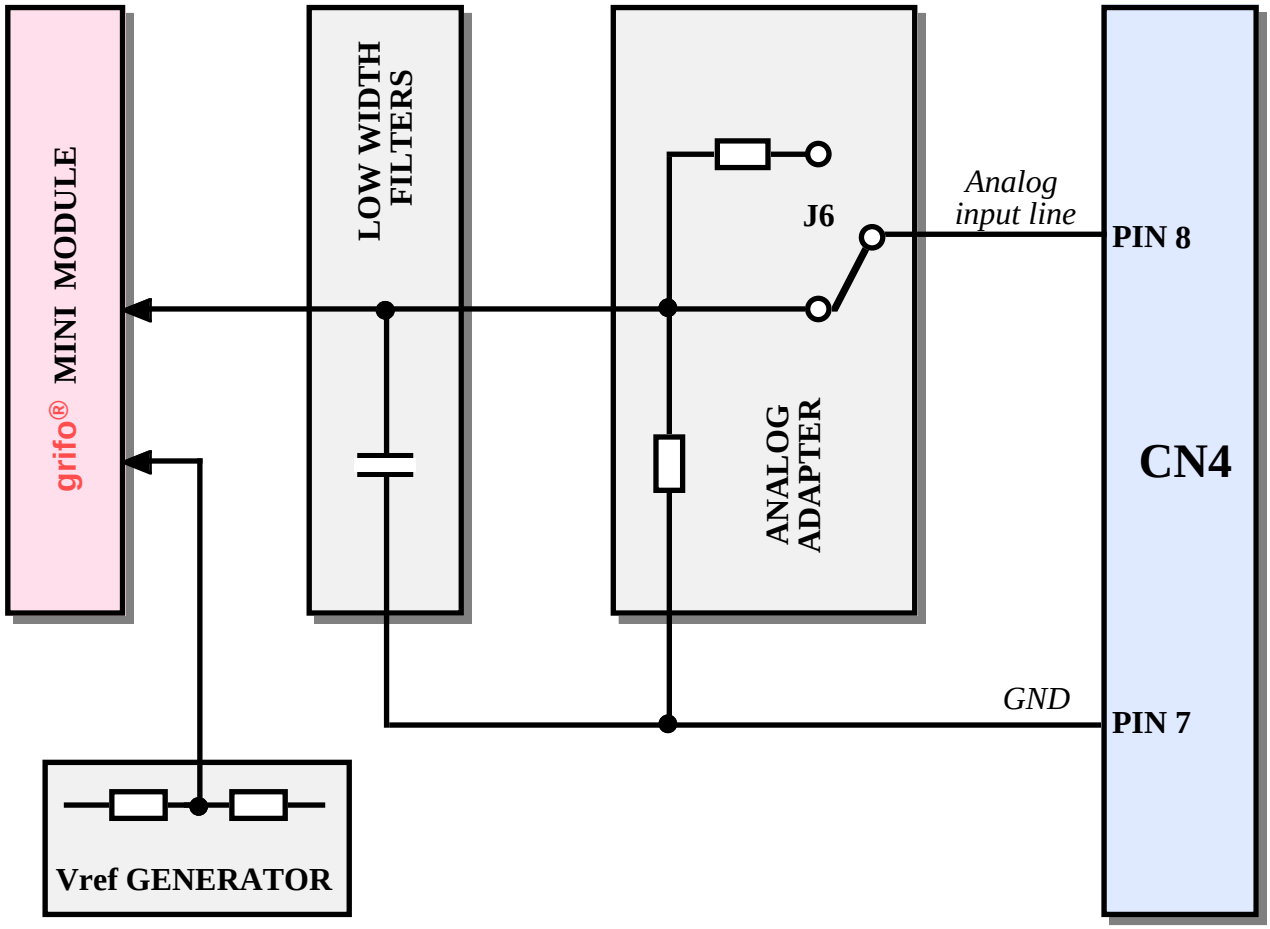


FIGURE 26: A/D ANALOG INPUT CONNECTION DIAGRAM

FIGURE 27: TTL SERIAL LINE CONNECTION EXAMPLE

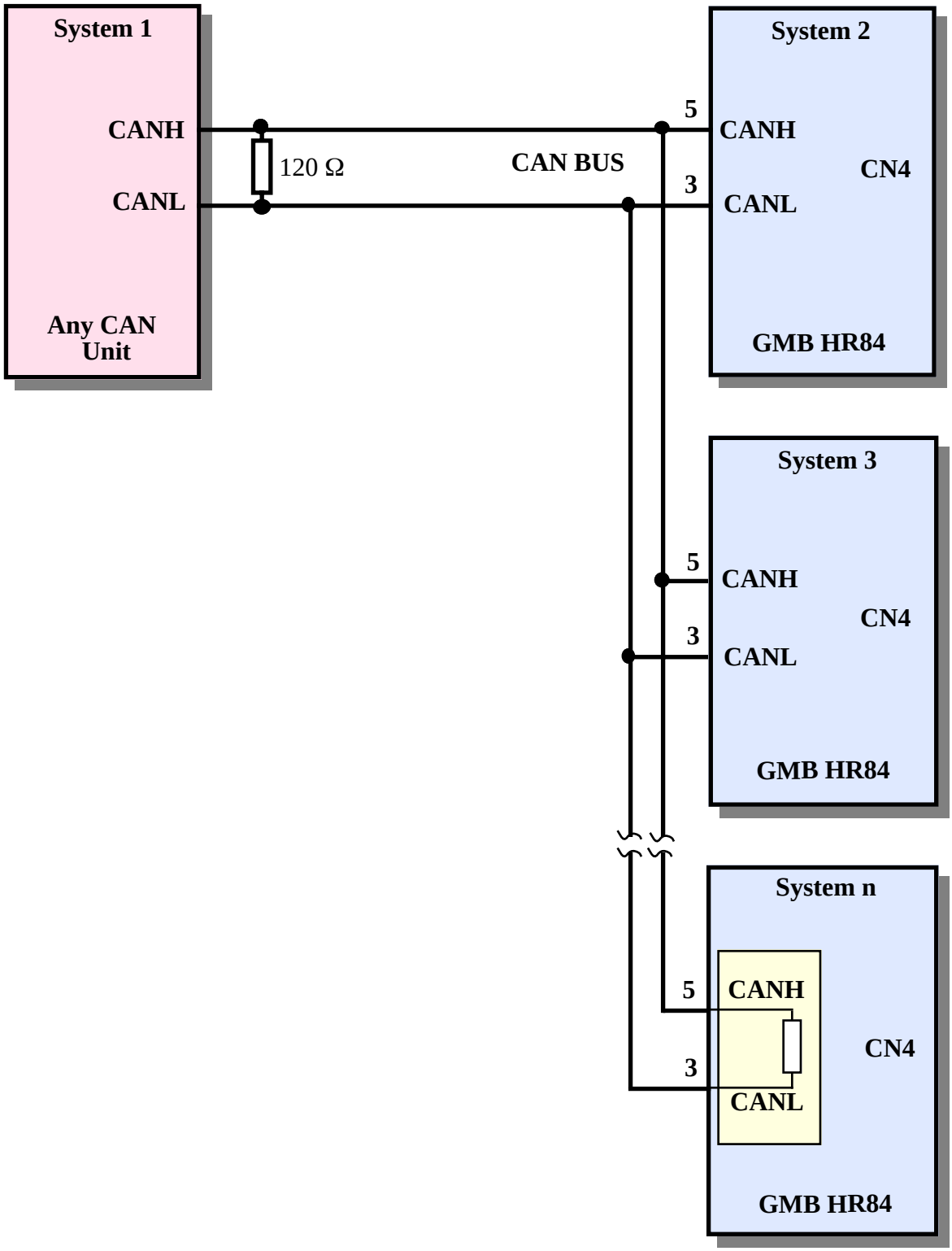


FIGURE 28: CAN INTERFACE CONNECTION EXAMPLE

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 master unit and the slave unit at the greatest distance from the master.
On **GMB HR84** board the terminating circuitry is already installed: it can be connected or not through specific jumper, as explained later, in paragraph "JUMPERS".
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 CN4, to solve eventual problems of communication and/or working.

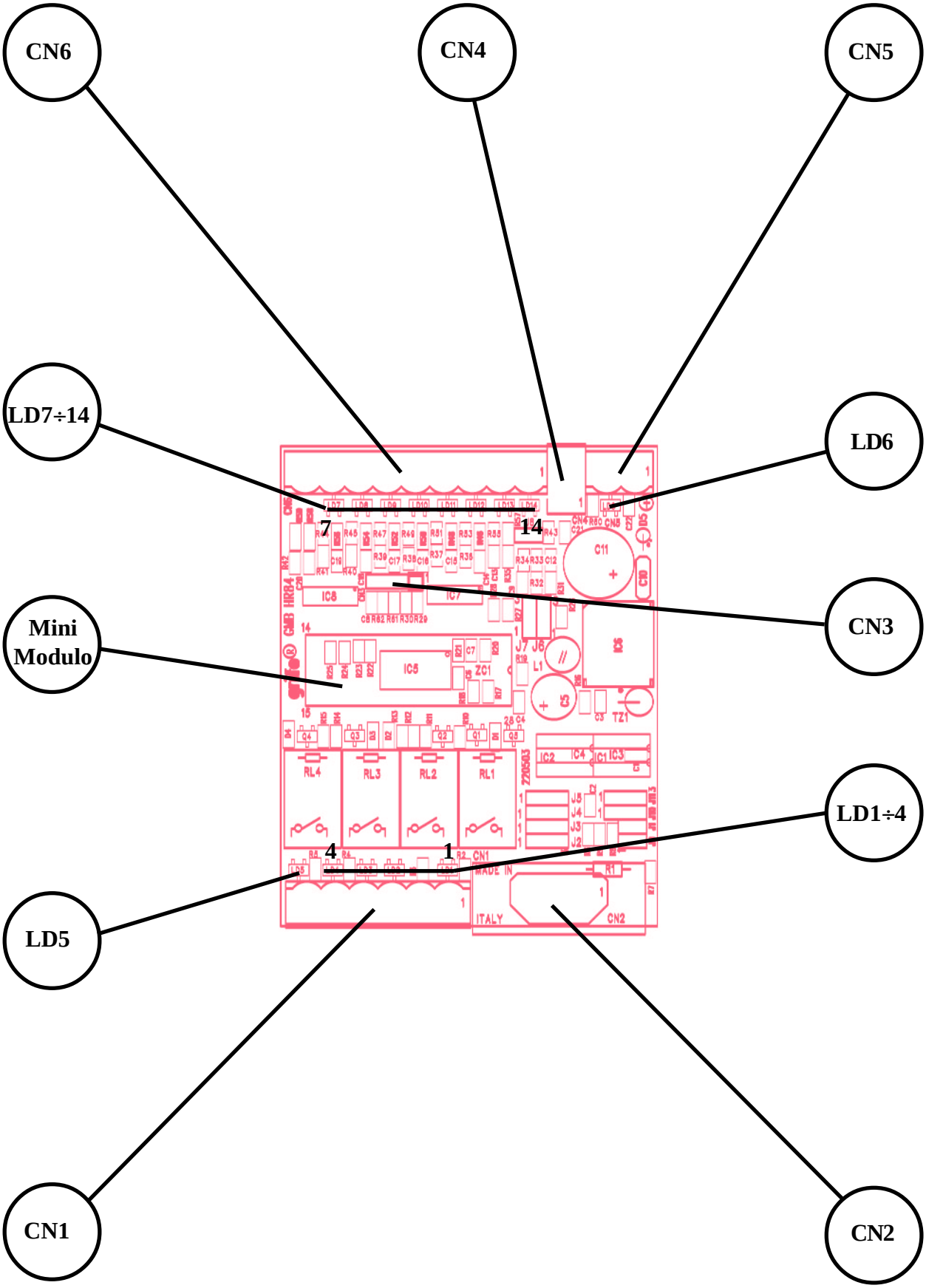


FIGURE 29: MINI MODULE, LEDS, CONNECTORS, ETC. LOCATION

INTERRUPTS

A remarkable feature of **GMB HR84** card is the powerful interrupt management, directly bound to the Mini Module, installed.
In fact, this latter has lines and controller for interrupt.
Please refer to Mini Module manual for further information about interrupts management, while to identify quickly the interrupt sources, please refer to figure 7.
On every Mini Module an interrupt manager (ICU) allows to enable, disable, mask and prioritize the interrupt sources, so the user has the possibility to respond promptly and efficently to any external event.

I/O CONNECTION

To prevent possible connecting problems between **GMB HR84** and the external systems, the user has to read carefully the previous paragraph information and he must follow these instrunctions:

- For RS 232, RS 422, RS 485, Current Loop and I^2C BUSsignals the user must follow the standard rules of each one of these protocols;

- For all TTL signals the user must follow the rules of this electric standard. The connected digital signal must be always referred to card digital ground and if an electric insulation is necessary, then an opto coupled interface must be connected. For TTL signals, the 0V level corresponds to logic state 0, while 5V level corrisponds to logic state 1.

- The analog inputs (A/D Converter section) must be connected to signals in the ranges available according to Mini Module installed. Inputs feature high impedance, anyway an eventual interfacing circuitery should provide low impedance to assure greater stability and precision. Please remark that the analog input on CN4 is provided with filtering capacitors that warrant more stability on the signal to acquire and lower the cut-off frequency. It also features a voltage divider to attenuate signale amplitde by 4.

- For optocoupled input signals, both the contact to acquire and external +Vopto must be connected in serie. In detail, contacts must perform the follwing connection:

	NPN	PNP
IN x	GND opto	+V opto
COMMON	+Vopto	GND opto

  to avoid problems with electric noise, it is suggestable to keep galvanically separated +Vopto and board power supply, this means to keep separate board GND and GND opto.

- Relays outputs must be connected directly to the load to drive (remote control switches, power relays, etc.). Board contact is normally open and can bear **5 A** up to **35 Vdc**. To drive load with different supplies, different COMMONS for two groups of relays are available.

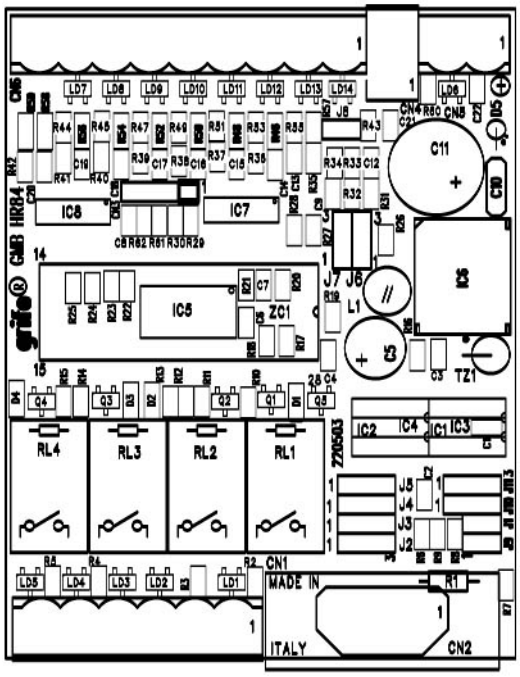


FIGURE 30: COMPONENTS MAP (COMPONENT SIDE)

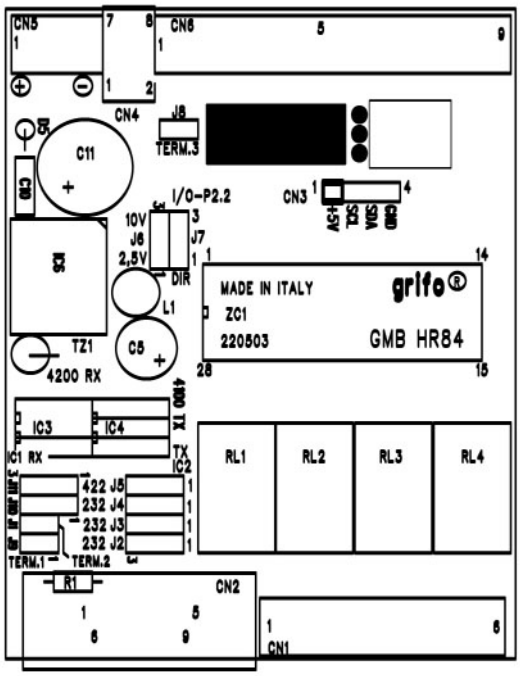


FIGURE 31: COMPONENTS MAP (SOLDER SIDE)

POWER SUPPLY

GMB HR84 is provided with an efficent circuitery that solves in a comfortable and efficent way the problem to supply the card in any condition of use.
Here follow the volages required by the card:

+V opto: Provides power supply to optocouplers of board input section; input voltage must be in the range 8÷30 Vdc and must be provided on connector CN6.

Vac, +Vdc pow, GND: Provide power supply to control logic and to output section of the board through the on board switching power supply; input voltage must be in the range 10 ÷ 40 Vdc or 8 ÷ 24 Vac and must be provided though puns 1 and 2 of CN5 (in case of Vdc, pin 1 must be connected to positive terminal). This allows to supply the cards using standard devices of industrial sector like transformers, batteries, solar cells, etc. Also, if there is the need to supply at +5 Vdc I^2C BUS external peripherals from **GMB HR84**, pins 1 and 4 of CN4 can be used. Please remark that on board switching power supply is provided with single diode rectifier, so in case of Vdc supply, all ground signals (GND) of the card are at the same potential.

To warrant highest immunity against noise and so a correct working of the cards, it is essential that these two voltages are galvanically isolated
In order to obtain this power supply **EXPS-2** can be ordered.
This device performs galvanic isolation starting from mains power supply.
GMB HR84 features a **TransZorb™**-based protection circuit to avoid damages from incorrect tensions and break-down of power supply section.
On board power supply is visualized through a LED on the bottom left corner.
Current available to supply external loads using +5 Vdc **must be less than:**

400 mA - current absorbed by **GMB HR84** - current absorbed by Mini Module

for example, in case of Mini Module **GMM 5115**:

400 mA - 310 mA - 20 mA = 70 mA.

For further information please refer to paragraph “ELECTRIC FEATURES”.

VISUAL SIGNALATIONS

GMB HR84 features the LEDs described in the following table:

LED	COLOUR	PURPOSE
LD1	Red	Visualizes status of relay output OUT A1. LED ON indicates that the input is connected to COMMON A.
LD2	Red	Visualizes status of relay output OUT A2. LED ON indicates that the input is connected to COMMON A.
LD3	Red	Visualizes status of relay output OUT B1. LED ON indicates that the input is connected to COMMON B.
LD4	Red	Visualizes status of relay output OUT B2. LED ON indicates that the input is connected to COMMON B.
LD5	Yellow	Visualizes presence of +5 Vdc power supply for logic.
LD6	Red	Visualizes status of signal MM PIN 5 connected to pin 4 of CN4, which normally corresponed to interrupt of Mini Module RTC.
LD7÷LD14	Green	Visualize status of optocoupled intpus 1÷8. One LED ON indicates current circulation between input INP n-th and COMMON.

FIGURE 32: LEDS TABLE

The main function of LEDs is to inform the user about card status, with a simple visual indication and in addition to this, LEDs make easier the debug and test operations of the complete system. To recognize the LED location on the card, please refer to figure 29.
All the LEDs described in figure 32 are visible from the breaks on the plastic container dedicated to the connectors, to allow inspection also when the board is closed and installed in the electric panel. In addition, LEDs that display buffered I/O are physically located near the corresponding pins to easy cabling verification and all other evental working tests.

JUMPERS

On **GMB HR84** there are 11 jumpers for card configuration.
Here below is the jumpers list, location and function:

JUMPER	N° PINS	PURPOSE
J1	2	Connects termination and forcing circuitery to RS 422 or RS 485 serial line.
J2	3	Selects connection of pin 2 on serial connector CN2.
J3	3	Selects connection of pin 3 on serial connector CN2.
J4	3	Selects connection of signals MM PIN 3, that is Mini Module's serial reception line.
J5	3	Selects direction and operational modality for serial line in RS 422, RS 485.
J6	3	Selects connection of signals MM PIN 27, that is range of analog input signal.
J7	3	Selects DIR signal connectoins for serial communication in RS 422, RS 485.
J8	2	Connects termination circuitery to CAN line.
J9	2	Connects termination and forcing circuitery to RS 422 or RS 485 serial line.
J10	3	Connects the reset signal to signal DTR from serial interface, to be able to program Mini Module GMM 935.
J11	3	Connects the input Vref to signal RTS from serial interface, to be able to program Mini Module GMM 935.

FIGURE 33: JUMPERS SUMMARIZING TABLE

The following tables describe all the right connections of **GMB HR84** jumpers with their relative functions.
To recognize these valid connections, please refer to the board printed diagram (serigraph) or to figures 30 and 31 of this manual, where the pins numeration is listed; for recognizing jumpers location, please refer to figure 29.
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.

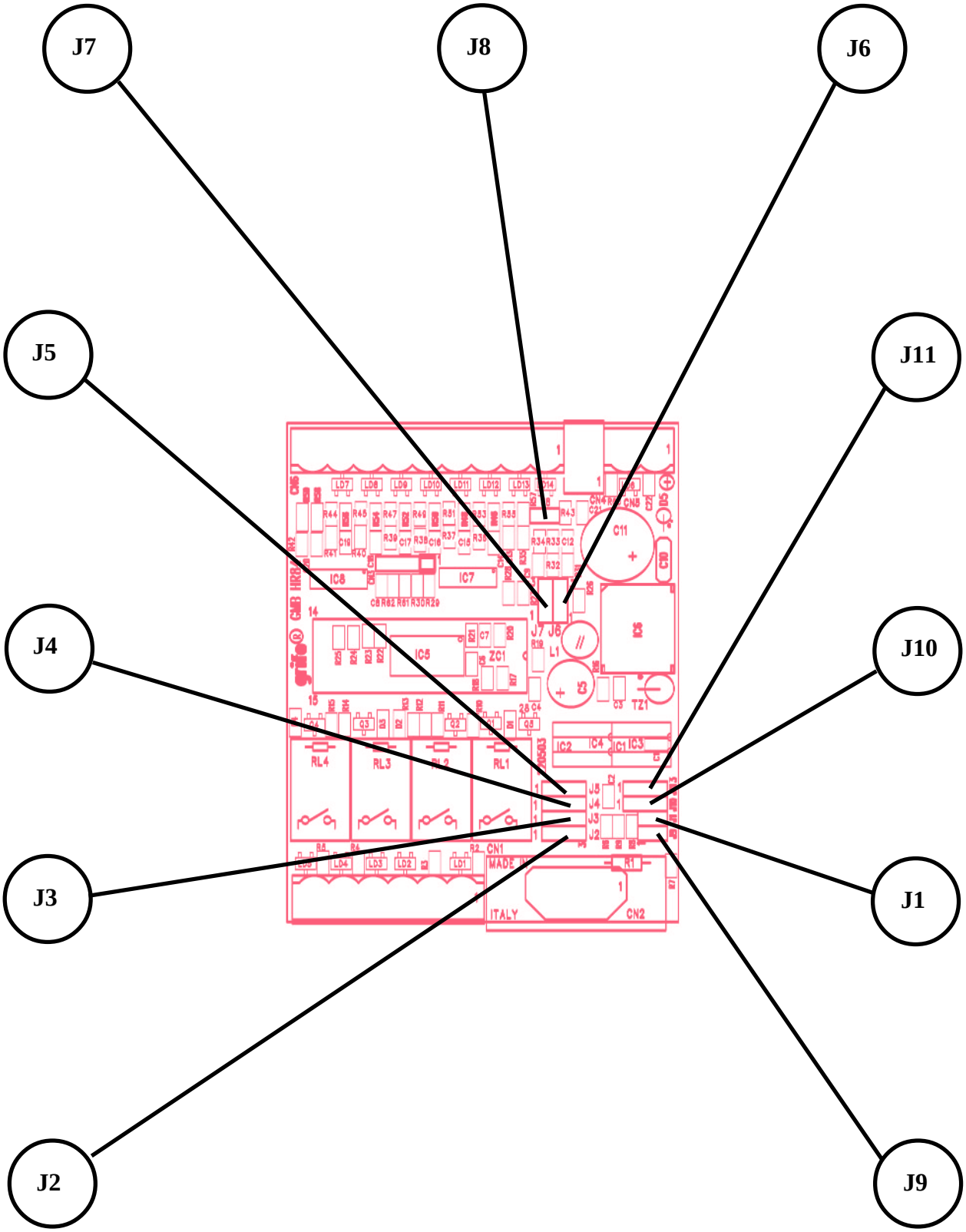


FIGURE 34: JUMPERS LOCATION

2 PINS JUMPERS

JUMPER	CONNECTION	PURPOSE	DEF.
J1	not connected	Does not connect termination and forcing circuitery to serial line RS 485 receiver/transmitter or RS 422 receiver.	*
	connected	Connects termination and forcing circuitery to serial line RS 485 receiver/transmitter or RS 422 receiver.	
J8	not connected	Does not connect 120 Ω termination reisitor to CAN line.	*
	connected	Connect 120 Ω termination reisitor to CAN line.	
J9	not connected	Does not connect termination and forcing circuitery to serial line RS 485 receiver/transmitter or RS 422 receiver.	*
	connected	Connects termination and forcing circuitery to serial line RS 485 receiver/transmitter or RS 422 receiver.	

FIGURE 35: 2 PINS JUMPERS TABLE

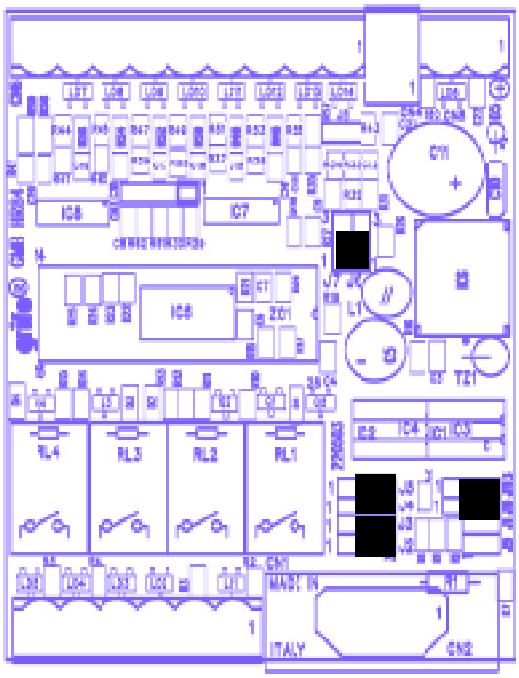


FIGURE 36: DEFAULT JUMPERS CONNECTION

3 PINS JUMPERS

JUMPER	CONNECTION	PURPOSE	DEF.
J2	position 1-2	Connects pin 2 of connector CN2 to serial line in RS 422 or RS 485.	
	position 2-3	Connects pin 2 of connector CN2 to serial line in RS 232 or TTL.	*
J3	position 1-2	Connects pin 3 of connector CN2 to serial line in RS 422 or RS 485.	
	position 2-3	Connects pin 3 of connector CN2 to serial line in RS 232 or TTL.	*
J4	position 1-2	Connects Mini Module serial line reception signal to serial line in RS 422, RS 485 or current loop.	
	position 2-3	Connects Mini Module serial line reception signal to serial line in RS 232 or TTL.	*
J5	position 1-2	Configures serial line for electric standard RS 485 (2 wires half duplex).	
	position 2-3	Configures serial line for electric standard RS 422 (4 wires full duplex or half duplex).	*
J6	position 1-2	Connects signal MM PIN 27 directly to pin 4 of CN4, that is selects range 0÷2.5 Vdc for analog input of A/D.	*
	position 2-3	Connects signal MM PIN 27 directly to pin 4 of CN4, that is selects range 0÷10 Vdc for analog input of A/D.	
J7	position 1-2	Connects signal DIR (used for RS 422 and RS 485 communication) to pin 11 of Mini Module.	*
	position 2-3	Connects signal DIR (used for RS 422 and RS 485 communication) to pin 24 of Mini Module.	
J10	position 1-2	Connects Mini Module reset signal to serial interface DTR signal to program in ISP mode Mini Module GMM 935 and similar.	
	position 2-3	Does not connect Mini Module reset signal.	*
J11	position 1-2	Connects Mini Module Vref input to serial interface RTS signal to program in ISP mode Mini Module GMM 935 and similar.	
	position 2-3	Connects Mini Module Vref input to GMB HR84 on board reference voltage generator.	*

FIGURE 37: 3 PINS JUMPERS TABLE

ISP PROGRAMMING

Every Mini Module that can be instaleld on **GMB HR84** can be programmed in-circuit (In System Programming) that 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, fetch and set configurations data and/or data gathered by the program, etc.
ISP activation mode changes according to which Mini Module is used but, in general, require a manual intervent on a jumper or dip switch.
When **GMB HR84** is closed in its container, it is not possible to acces the Mini Module so ISP can be actived externally acting on connector CN4.
It is enough to short-circuit pins 7 and 8 of this latter (see figure below) with a jumper or a little switch, it pins are already used:

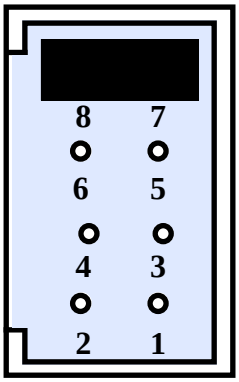


FIGURE 38: ISP ACTIVATION THROUGH CN4

NOTE
Activating ISP through CN4 can be done only on Mini Modules that have ISP abilitation on pin 27 of their socket (e.g. CAN GM2, GMM 5115) and setting jumper J6 in position 1-2.
On other Mini Modules, you must open the container and act on specific selector.

ANALOG INPUT

GMB HR84 features an interface for one analog input that can accept an input voltage in a variable range according to the Mini Module installed and the connection of jumper J6.
Please refer to figure 7 and to manual of **GMB HR84** + Mini Module for further information.
As shown in figure 26, 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, the best thing is to make a software calibration of the signal acquired, that is to calculate a correction coeffincent using a reference signal, then to use such coefficent for successive analog signal acquisitions.
Examples provided with delivey show some calibration techniques that the user can modify according to his/her needs.

FIGURE 39: PHOTO OF EXPS-2 POWER SUPPLY

SERIAL COMMUNICATION SELECTION

Serial line of **GMB HR84** can be buffered in RS 232, RS 422, RS 485, Current Loop or TTL.
By hardware can be selected which one of these electric standards is used, through jumpers connection (as described in the previous tables) and drivers installation.
By software the serial line can be programmed to operate with all the standard physical protocols, in fact the bits per character, parity, stop bits and baud rates can be decided by setting opportunes CPU internal registers. In the following paragraphs there are all the informations on serial communication configurations.
Some devices needed for RS 422, RS 485 and Current Loop configurations are not mounted on the board in standard configuration; this is why each fist non-standard (non-RS 232) serial configuration for line A must be always performed by **grifo®** technicians.
This far the user can change in autonomy the configuration following the informations below:

- HW SERIAL LINE IN RS 232 (default configuration)

J1, J9	=	not connected	Mini Module	= serial in RS 232 (#)
J2, J3	=	position 2-3	IC1	= no device
J4	=	position 2-3	IC2	= no device
J5	=	indifferent	IC3	= no device
J7	=	indifferent	IC4	= no device

- HW SERIAL LINE A IN CURRENT LOOP (option .CLOOP)

J1, J9	=	not connected	Mini Module	= serial in TTL (#)
J2, J3	=	indifferent	IC1	= no device
J4	=	position 1-2	IC2	= no device
J5	=	indifferent	IC3	= driver HP 4200
J7	=	indifferent	IC4	= 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 16÷18. Current Loop interface can be employed to make both point-to-point and multi-point connections through a 2-wires or a 4-wires connection.

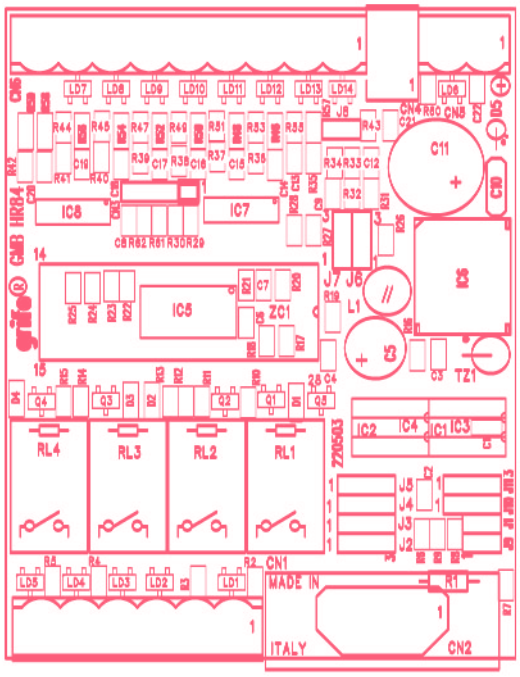
- HW SERIAL LINE A IN RS 422 (option .RS 422)

J1, J9	=	(*)	Mini Module	= serial in TTL (#)
J2, J3	=	position 1-2	IC1	= driver SN 75176 or MAX 483
J4	=	position 1-2	IC2	= driver SN 75176 or MAX 483
J5	=	position 2-3	IC3	= no device
J7	=	(**)	IC4	= no device

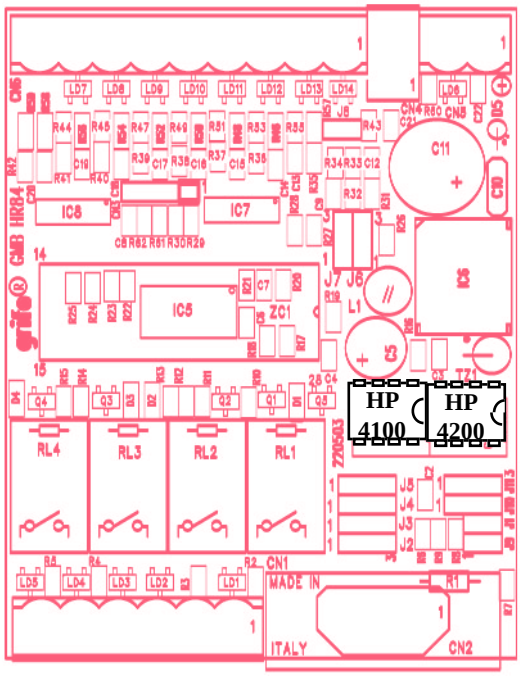
Status of signal DIR (software managed with Mini Module signal selected with J7), allows to enable or disable the transmitter:

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

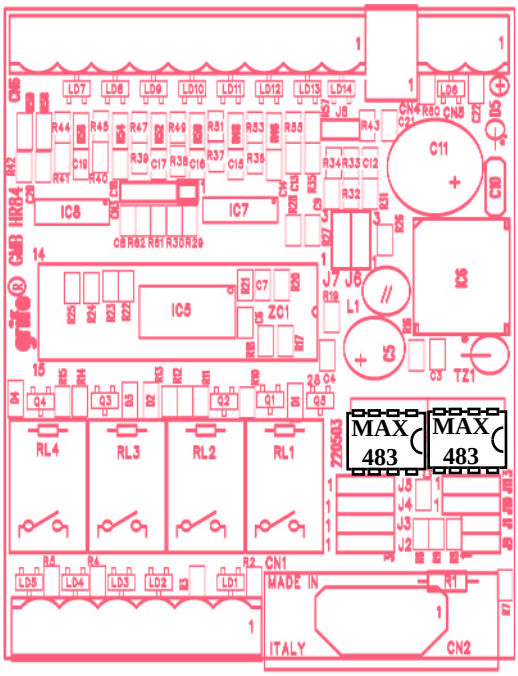
In point-to-point connections, signal DIR can be always kept low (trasnmitter always enabled), while in multi-point connections transmitter must be enabled only when a transmission is requested.



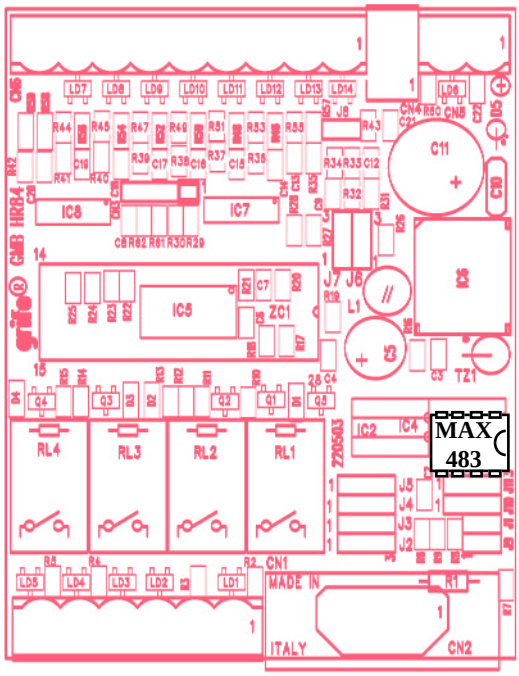
Serial in RS 232, TTL



Serial in Current Loop



Serial in RS 422



Serial in RS 485

FIGURE 40: SERIAL COMMUNICATION DRIVERS

- HW SERIAL LINE A IN RS 485 (option .RS 485)

J1, J9	=	(*)	Mini Module	= serial in TTL (#)
J2, J3	=	position 1-2	IC1	= driver SN 75176 or MAX 483
J4	=	position 1-2	IC2	= no device
J5	=	position 1-2	IC3	= no device
J7	=	(**)	IC4	= no device

In this modality the signals to use are pins 1 and 2 of connector CN2, that become transmission or reception lines according to the status of signal DIR, managed by software, as follows:

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

This kind of serial communication can be used for multi-point connections, in addition it is possible to listen to own transmission, so the user is allowed to verify the succes of transmission. In fact, any conflict on the linecan be recognized by testing the received character after each transmission.

- HW SERIAL LINE A IN TTL (option .RS 485)

J1, J9	=	not connected	Mini Module	= serial in TTL (#)
J2, J3	=	position 2-3	IC1	= no device
J4	=	position 2-3	IC2	= no device
J5	=	indifferent	IC3	= no device
J7	=	indifferent	IC4	= no device

(*) If using the RS 422 or RS 485 serial line, it is possible to connect the terminating and forcing circuit on the line by using J1 and J9. In case of point-to-point connections this circuit must be always connected, 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 reset or a power on, signal DIR is at logic level high, so during these phases driver RS 485 is in reception or transmission driver RS 422 is disabled, to avoid confilcts on line.

(**) In case of RS 422 or RS 485 communication, signal DIR can be selected according to the Mini Module installed:

J7 in position 1-2	->	DIR = pin 11 of Mini Module (e.g. **CAN GM1**)
J7 in position 2-3	->	DIR = pin 24 of Mini Module (e.g. **CAN GM2,GMM 5115**)

This allows to use the Mini Module resources the best way possible, whithout havin to use and I/O signal of CN4 for serial communication.

(#) Serial line of Mini Module installed on **GMB HR84** must be configure through the specific selectors on board of this latter, as described in its technical manual.
For example:

CAN GM1, CAN GM2, GMM 5115	->	DSW1.2,3 ON ; DSW1.4,5 OFF -> RS 232
	->	DSW1.2,3 OFF ; DSW1.4,5 ON -> TTL

For further information, refer to figures 11÷18 and 27.

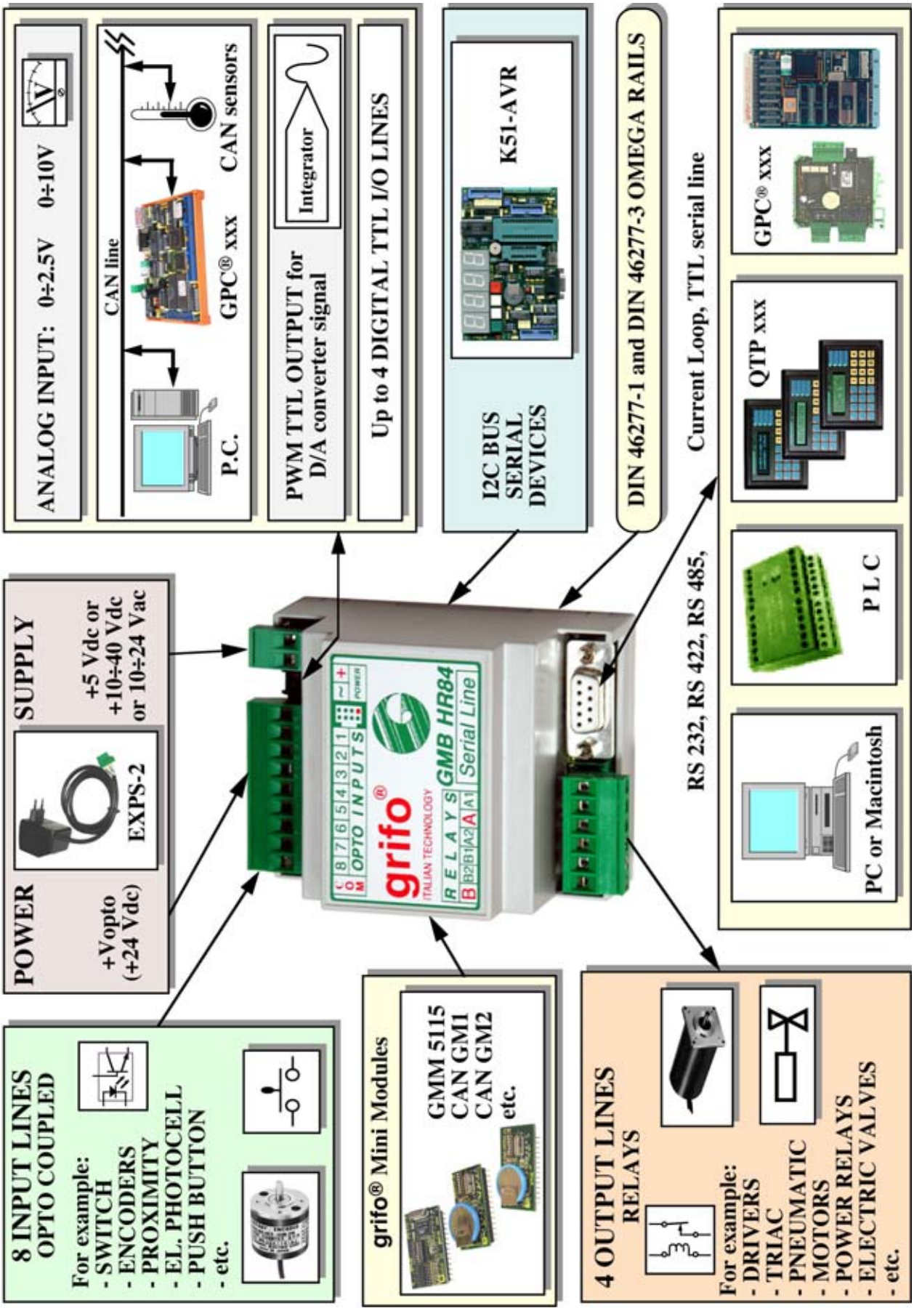


FIGURE 41: CONNECTIONS EXAMPLE

PERIPHERAL DEVICES SOFTWARE DESCRIPTION

Below there is a specific description of the software managements of the on board peripheral devices through the Mini Module connections. Whenever the reported documentation is not sufficient, please search a more detailed description of the devices in manufacturing company data sheets. In the following paragraphs the **D7÷D0** and **.0÷7** indications denote the eight bits of the combination involved in I/O operations.

RELAYS OUTPUTS

Staus of 4 digital relays outputs is set through 4 I/O pins of Mini Module, as described in table of figure 7.
When a line is set to logic state low (logic 0), corresponding output is enabled (relay contact connected to its common contact), vicecersa when the line is set to logic state high (logic 1), the output is disabled (relay contact open).
As previously said, LEDs LD1÷4 give a visual indication of digital outputs status (LED ON means output actived).
Remarkable is the fact that the lines driving the relays can perform also high level actions; for example wave forms generation, timed activations, etc.
During reset or power on, the 4 signals must be kept at logic 1 by Mini Module, if outputs must be disabled during these phases.

OPTOCOUPLED INPUTS

Status of 8 digital optocoupled inputs can be acquired by software by reading the status of corresponding pins of Mini Module, described in table of figure 7.
When NPN or PNP inputs are enabled, corresponding lines are at logic state low (logic 0), viceversa when inputs are disabled a logic level high is acquired (logic 1).
As previously said, LEDs LD7÷14 give a visual indication of digital inputs status (LED ON means input actived).
Mini Modules pins have been selected to simplify software management; in fact they can generate interrupts, be counted by hardware counters or simply be acquired.

SERIAL LINE

Please refer to Mini Module manual, signals used are the ones called TxD and RxD in figure 7.

I2C BUS

Please refer to Mini Module manual, signals used are the ones called SDA and SCL in figure 7.

CAN LINE

Please refer to Mini Module manual, signals are the ones called CAN L and CAN H in figure 37.

ANALOG INPUT

Please refer to Mini Module manual, signal used is the one called A/D in figure 7.

DIGITAL TTL I/O

Please refer to Mini Module manual, signals used are the ones called PIN n on CN4 in figure 7.

BIBLIOGRAPHY

In this chapter there is a complete list of technical books, where the user can find all the necessary documentations on the components mounted on **GMB HR84**.

Manual TEXAS INSTRUMENTS: *The TTL Data Book - SN54/74 Families*

Manual PHILIPS: *I^2C bus compatible ICs*

Manual SGS-THOMSON: *Small signal transistor - Data Book*

Manual TAKAMISAWA: *Relays index Book*

Technical papers S.E.: *SI series - Switching power supply*

Manual TOSHIBA: *Mos Memory Products*
Manual TOSHIBA: *Photo couplers - Data Book*

Please connect to the manifactures Web sites to get the latest version of all manuals and data sheets.

APPENDIX A: ALPHABETICAL INDEX