GMB HR168

grifo® Mini BLOCK Housing
16 opto inputs, 8 Relay outputs

TECHNICAL MANUAL

GMB HR168   Rel. 5.00   *Ed. 02 April 2004*

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Modular plastic container **DIN 50022** modulbox, model **M6 HC53**; size: front **90** x **106** mm, heigh **58** mm; mounting on **Omega** rail DIN 46277-1 and DIN46277-3; **16** optocoupled inputs indifferently **NPN** or **PNP**; status of **16** inputs visualized by **16 LEDs**; some inputs can be counters and interrupt generators; **8** Relays Outputs **5 A**; status of 8 outputs visualized by **8 LEDs**; some outputs can feature **PCA** for automatic timed commands; **1 TTL** output driven by optional on board **RTC** and visualized by its own LED; **serial line** in RS 232, RS 422 , RS 485, Current loop and **TTL**; **1 A/D** line with full range selectable; **1** TTL **PWM** to generate a **D/A**-like signal by software; connection of all signals through Comfortable connectors featuring standard pin-out; up to **5** lines of **I/O TTL**; line **I²C BUS** available for external devices on dedicated connector; on-board Switching power supply; protection for on-board logic through **TransZorb**; **DC** or **AC** power supply: 10÷38Vdc or 8÷23Vac for logic and 9÷28Vdc or 9÷23Vac for optocoupled intputs; **40** pin 600 mils socket for connection of Mini Modules **grifo®** like: **GMM AC2** , **GMM AM32**, **GMM 4620**, etc.

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IMPORTANT

SYMBOLS DESCRIPTION

In the manual could appear the following symbols:

⚠	Attention: Generic danger
⚡	Attention: High voltage
	Attention: ESD sensitive device
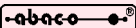
Trade Marks

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 HR168** card release **110104** and later. The validity of the bring informations is subordinate to the number of the card release. The user must always verify the correct correspondence among the two denotations. On the card the release number is present in more points both board printed diagram (serigraph) and printed circuit (for example near connector CN2 on the solder and component side side).

GENERAL INFORMATION

GMB HR168 is a module for DIN rail capable to host a 28 or 40 pins Mini Module CPU card type **CAN xxx** or **GMM xxx.**
The board features galvanically isolated inputs, relays outputs, LEDs visualizations, serial line and several other characteristics; its rank is low cost controller, that can work as intelligent peripheral in autonomy and/or remoted inside a wider telecontrol/teleacquisition network.
GMB HR168 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 for **GMB HR168**, like **BASCOM 8051**.
If you prefer to work with C, the good and inexpensive development package µC/51 is available, while for who is used to work with relay ladder logic, **LADDER WORK** is the right choice.
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.
Such connectors easy also update and assistance phases, that can be needed in time.
Of course, board features change according to the Mini Module installed, but a common overall is:

- Modular plastic **container DIN 50022** modulbox, model M6 HC53
- Size: front **90** x **106** mm, heigh **58** mm
- Mounting on **Omega** rail DIN 46277-1 and DIN 46277-3
- **16 optocoupled inputs** indifferently **NPN** or **PNP**
- Status of 16 inputs visualized by **16 LEDs**
- Some inputs can be **counters** and **interrupt generators**
- **8 relays outputs** 5 A
- Status of 8 outputs visualized by **8 LEDs**
- Some outputs can feature **PCA** for automatic timed commands
- **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 and TTL
- 1 **A/D** line with full range selectable
- 1 TTL **PWM** to generate a **D/A**-like signal by software
- Connection of all signals through **comfortable connectors** featuring **standard pin-out**
- Up to **5 lines** of **I/O TTL**

- Line **I²C BUS** available for external devices on dedicated connector
- On-board **switching** power supply
- Protection for on-board logic through **TransZorb**
- **DC** or **AC** power supply: 10÷38Vdc ± 5% or 8÷23Vac ± 5% for logic and 9÷28 Vdc ± 5% or 9÷23Vac ± 5% for optocoupled intputs
- **40 pin** socket for connection of Mini Modules **grifo®** like: **GMM AC2** , **GMM AM32**, **GMM 4620**, **GMM 932**, 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 1.

ANALOG INPUT

One analog input is available on signal MM PIN 33, it has been connected through a specific circuitery that allows to acquire the analog signal directly or divided by 4.

OPTOCOUPLED DIGITAL INPUT LINES

The card features 16 NPN/PNP inputs connected to two quick release screw terminal connectors that are directly acquired by 16 I/O lines of 40 pins socket through a galvanically isolated interface.
These lines are visualized by specific LEDs and have been selected to be able to take advantage completely of eventual **grifo®** Mini Module internal peripherals, in such case the inputs can generate interrupts, be counted by hardware counters, etc.
Optocoupled inputs are supplied by a specific voltage called +Vopto generated on board by a specific circuitery separated from +5 Vdc generation circuitery.

SERIAL COMMUNICATION

GMB HR168 features one AMP 4+4 connector (CN6) dedicated to serial communication.
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 (this means to connect signals MM PIN 9 and MM PIN 10 directly to CN6) 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 using signals MM PIN 17 or MM PIN 30.
In case a **grifo®** Mini Module is installed, protocols TTL and RS 232 are immedatly available.
Please remark that by default the board is provided without drivers, so any configuration must be specified in the order.
For further information about serial communication please refer to paragraph: "CONNECTIONS" and "SERIAL COMMUNICATION SELECTION".

I²C BUS LINES

GMB HR168 is provided with one connector (CN8) dedicated to I²C BUS, connected to two signals of the 40 pins socket, MM PIN 12 and MM PIN 13, each provided with a 4.7 kΩ pull-up.
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 and satisfy any need of the user.
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.
GMB HR168 can be ordered with a Real Time Clock provided with 256 bytes of SRAM already installed (option **.RTC**), in such case the slave address **A0H** is already taken by this peripheral, eventual third part hardware cannot use it, in addition a **grifo®** Mini Module provided with its own Real Time Clock cannot be installed for the same reason.

MINI MODULE

By **Mini Module** it is meant the component installed in the 40 pins socket ZC1 that decides the functionality of all board signals.

Such component is also in condition to take control of all on board resources and can be In-Circuit programmale, e. g. using a boot loader on serial interface, like for **grifo®** Mini Modules.

GMB HR 168 has been designed to accept all 28 or 40 pins **grifo®** Mini Modules or any hardware that can fit in a standard 40 pins 600 mils DIP socket.

For further information please refer to description of socket ZC1 in the chapter dedicated to connectors and to chapter "PERIPHERAL DEVICES SOFTWARE DESCRIPTION".

Every combination **GMB HR 168** + 28 or 40 pins **grifo®** Mini Module is a separated item on our listing, in addition each **grifo®** Mini Module has specific features (e. g. different size of FLASH memory, number of digital I/O signals, etc.), for this reason each combination is described by its own manual.

If a combination **GMB HR 168** + **grifo®** Mini Module has been ordered, it will be delivered already installed, configured and ready for use.

I/O TTL SIGNALS

GMB HR168 features up to 5 digital I/O TTL signals of 40 pins socket connected to a specific AMP 4+4 connector (CN7).

In case a **grifo®** Mini Module or the optional Real Time Clock is installed, some of these features become available on CN7: PWM line from CPU internal PCA to generate an analog signal, count signal from CPU internal 16 bit Timer Counter, etc.

DIGITAL RELAYS OUTPUTS

The board is provided with 8 relays outputs 4 A, normally open, whose status is visualized by 8 LEDs. Each line is driven directly by a signal of the 40 pins socket, buffered through a specific driver and connected to a comfortable quick release screw terminal connector to easy interface to the field signals.

In this casea **grifo®** Mini Module is installed, it is possible to take advantage of internal peripherals, like PCAs, that allow to generate timings and developed funcitons.

POWER SUPPLY SECTION

GMB HR168 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.

A second section is present and generates the rectified voltage +Vopto, allowing to use the optocoupled inputs simply closing its contact with the respective common terminal.

This latter section requires a separated power source.

The board features components and circuits designed to reduce consumptions 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 a voltage between 12÷24 Vdc is needed.

For further information please refer to chapter "ELECTRIC FEATURES" and paragraph "SUPPLY VOLTAGES".

TELECONTROL FIRMWARE

The Mini Module installed on **GMB HR168** 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.

For **grifo®** Mini Module, 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.

CN1 8 INPUT LINES	CN2 8 INPUT LINES	CN5 POWER SUPPLY	CN6 SERIAL LINE

OPTO COUPLERS

RECTIFIER SECTION

SERIAL DRIVERS

INPUT DRIVERS

SWITCHING POWER SUPPLY

+5 Vdc

grifo®
MINI MODULE
40 PINS SOCKET

OUTPUT DRIVERS

LITHIUM BATTERY

N.O. RELAYS

RTC + SRAM

ANALOG ADAPTER

6 OUTPUT LINES CN3	2 OUTPUT LINES CN4	I2C BUS CN8	PWM, A/D, I/O, etc. CN7
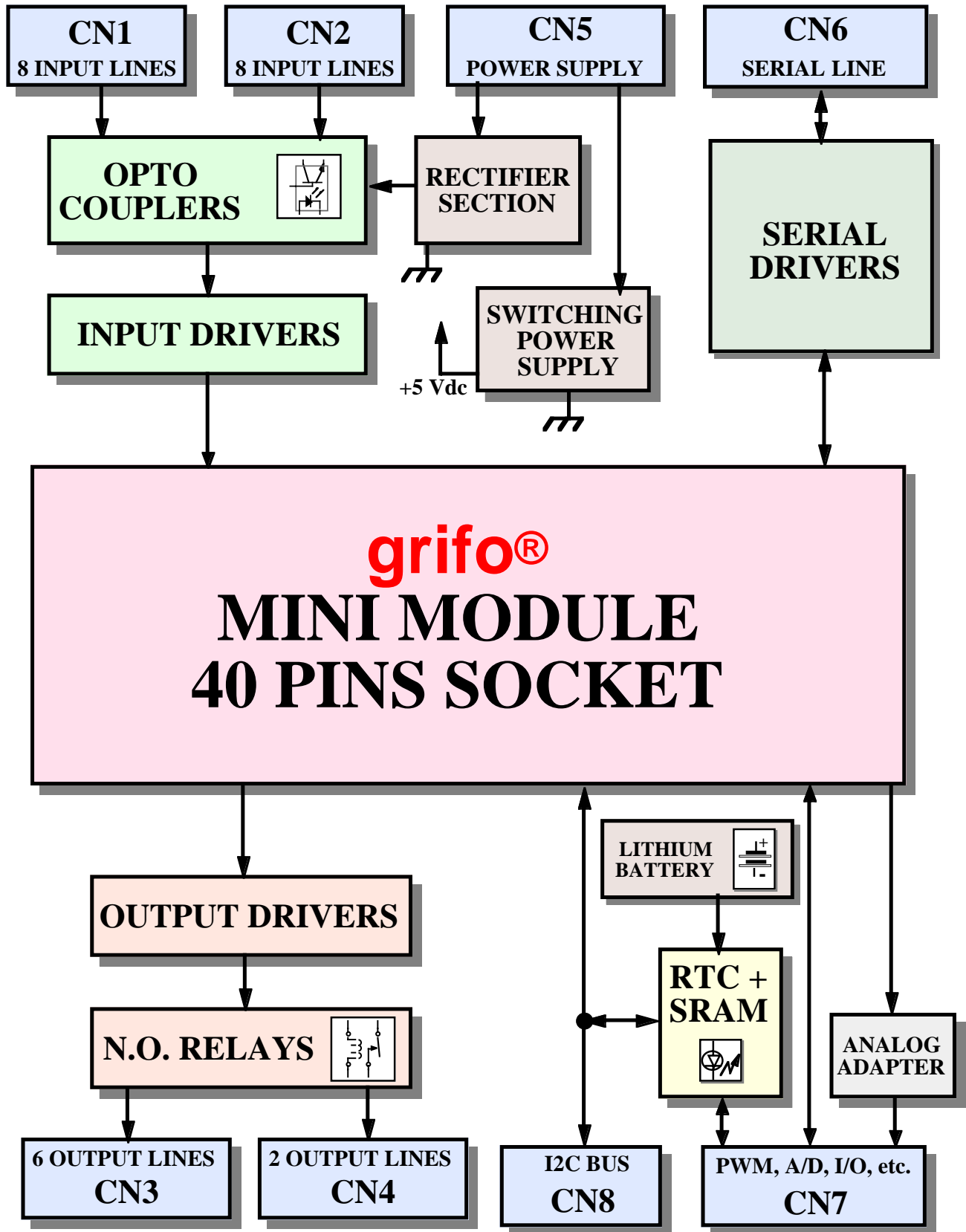
FIGURE 1: BLOCK DIAGRAM

TECHNICAL FEATURES

GENERAL FEATURES

On board resources:
16 optocoupled digital inputs NPN and PNP
8 relays digital buffered outputs
1 TTL serial line (RS 422, RS 485, current loop, etc.)
1 connector for I²C BUS lines
1 analog input and up to 5 digital I/O TTL
1 switching power supply section
1 rectifier power supply section
28 status LEDs

Mini Modules:
28 or 40 pins like **GMM AM32**, **GMM AC2** etc.

Opto input cut-off frequency:
13 KHz

PHYSICAL FEATURES

Size:
90 x 106 x 58 mm (container DIN 50022)
85 x 120 x 32 mm (without container)

Container:
DIN 50022 modulbox, model M6 HC53

Weight:
240 g   (without Mini Module)

Connectors:

CN1:	9 pins quick release screw terminal connector
CN2:	9 pins quick release screw terminal connector
CN3:	9 pins quick release screw terminal connector
CN4:	3 pins quick release screw terminal connector
CN5:	4 pins quick release screw terminal, pitch 3.5 mm
CN6:	4+4 AMP Mod II, male, vertical
CN7:	4+4 AMP Mod II, male, vertical
CN8:	4 pins strip, male, vertical

Temperature range:
from 0 to 50 centigrad degreeses

Relative humidty:
20% up to 90%   (without condense)

ELECTRIC FEATURES

Power supply:	10÷38Vdc ± 5% or 8÷23Vac ± 5%	(control logic)
Power required for logic:	5 W	
Output power supply:	+5 Vdc	
Current on +5 Vdc output:	1000 mA - current required - current required by ZC1 hw	
Current required by GMB HR168:	542 mA max	(+5 Vdc)
	32÷150 mA max	(+V opto)
Relays max current:	5 A	(resistive load)
Relays max voltage:	35 Vdc	
Power required for optocouplers:	4.4 W	
Optocouplers input voltage:	+Vopto = 9÷28 Vdc ± 5% or 9÷23Vac ± 5%	(*)
Analog input range:	depends on hardware installed on ZC1 (for **grifo®** Mini Modules: 0÷2.5 ; 0÷10 V)	
Pull-up on I²C BUS dedicated lines:	4.7 kΩ	
Termination network RS 422-485:	Line termination resistor	=120 Ω
	Positive pull up resistor	=3.3 KΩ
	Negative pull down resistor	=3.3 KΩ

* 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, LED, jumper, etc. and some explanatory diagrams.

CONNECTIONS

Module **GMB HR168** has 8 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 24).

CN5 - POWER SUPPLY CONNECTOR

CN5 is a 4 pins quick release screw terminal connector, vertical, 3.5 mm pitch.
CN5 allows to provide power needed by the switching power supply to generate logic control and optocouplers supply voltage.
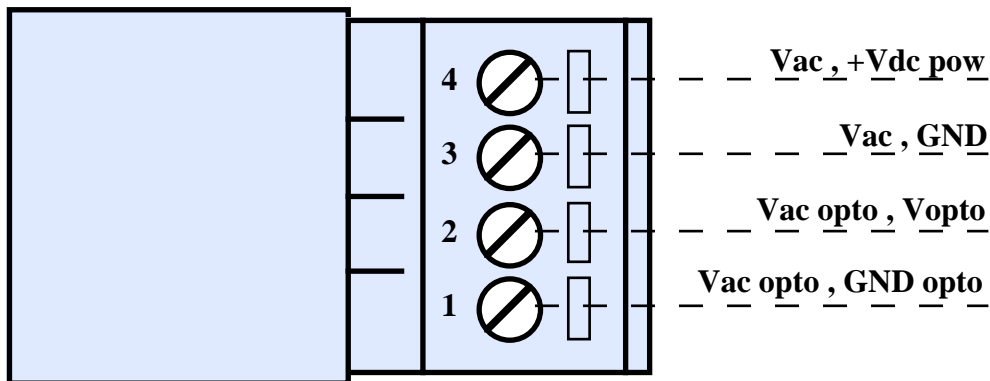
FIGURE 2: CN5 - POWER SUPPLY CONNECTOR

Signals description:

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

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

CN8 - I²C BUS LINE CONNECTOR

CN8 is a 4 pins, male, vertical, strip connector with 2.54mm pitch.
On CN8 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.

```
4 ○— — — — — — — — GND

3 ○— — — — _MM PIN 13 , SDA

2 ○— — — — _MM PIN 12 , SCL

1 ○— — — — — — — +5 Vdc
```
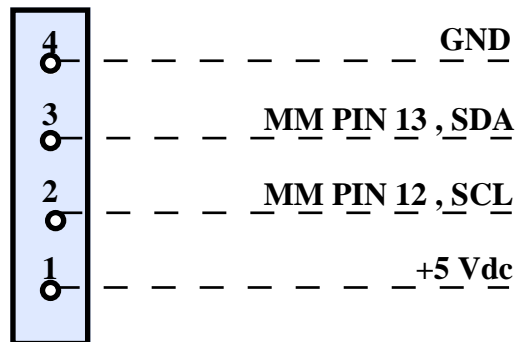
FIGURE 3: CN8 - I²C BUS LINE CONNECTOR

Signals description:

SDA	= I/O - Data signal of I²C BUS software serial line.
SCL	= O - Clock signal of I²C BUS software serial line.
MM PIN 12	= I/O - Connected to signal 12 of 40 pins socket.
MM PIN 13	= I/O - Connected to signal 13 of 40 pins socket.
+5 Vdc	= O - Unique +5 Vdc power supply.
GND	= - Ground.

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 168** on board signals (reads optocoupled inputs, set relays outputs, etc.).

Hardware strucuture of **GMB HR 168** is designed for use with **grifo®** Mini Modules. If you are using a combination **GMB HR 168** + **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 40 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".

MM PIN1 , IN1-2 of CN2	1		40	MM PIN40 , +5 Vdc
MM PIN2 , IN2-2 of CN2	2		39	MM PIN39 , N. C.
MM PIN3 , IN3-2 of CN2	3		38	MM PIN38 , IN8-2 of CN2
MM PIN4 , IN4-2 of CN2	4		37	MM PIN37 , IN7-2 of CN2
MM PIN5 , pin 2 of CN7	5		36	MM PIN36 , IN6-2 of CN2
MM PIN6 , pin 3 of CN7	6		35	MM PIN35 , IN5-2 of CN2
MM PIN7 , Vref	7		34	MM PIN34 , +5 Vdc
MM PIN8 , N. C.	8		33	MM PIN33 , pin 1 of J11
MM PIN9 , RX	9		32	MM PIN32 , IN1-1 of CN1
MM PIN10 , TX	10	**ZC1**	31	MM PIN31 , IN2-1 of CN1
MM PIN11 , pin 4 of CN7	11		30	MM PIN30 , pin 6 of CN7 , pin 3 of J10
MM PIN12 , SCL , pin 2 of CN8	12		29	MM PIN29 , OUT A1
MM PIN13 , SDA , pin 3 of CN8	13		28	MM PIN28 , OUT A2
MM PIN14 , OUT C1	14		27	MM PIN27 , OUT B1
MM PIN15 , OUT C2	15		26	MM PIN26 , OUT B2
MM PIN16 , pin 5 of J10	16		25	MM PIN25 , IN2-1 of CN1
MM PIN17 , pin 1 of J10	17		24	MM PIN24 , IN4-1 of CN1
MM PIN18 , OUT D1	18		23	MM PIN23 , IN5-1 of CN1
MM PIN19 , IN8-1 of CN1	19		22	MM PIN22 , IN6-1 of CN1
MM PIN20 , GND	20		21	MM PIN21 , IN7-1 of CN1

FIGURE 4: ZC1 - CONTROL DEVICE SOCKET

FIGURE 5: PHOTO OF GMB HR168

CN6 - SERIAL LINE CONNECTOR

CN6 is a 8 pins, male, vertical, AMP Mod II 4+4 type connector, 2.54 mm pitch.
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.
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).
For further information please refer to figure 8 or to the manual of a **grifo®** Mini Module combinaton.
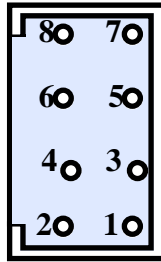
FIGURE 6: CN6 - SERIAL LINE CONNECTOR

Pin	Signal	Direction		Description

RS 232 serial line (please see paragraph "SERIAL COMMUNICATION SELECTION"):

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 (please see paragraph "SERIAL COMMUNICATION SELECTION"):

6	**RX- RS422**	= I	-	Receive Data Negative for RS 422.
5	**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.
7	**GND**	=	-	Ground signal.

RS 485 serial line (please see paragraph "SERIAL COMMUNICATION SELECTION"):

6	**RXTX+ RS485**	= I/O	-	Receive/Trasmit Data Positive for RS 485.
5	**RXTX- RS485**	= I/O	-	Receive/Trasmit Data Negative for RS 485.
7	**GND**	=	-	Ground signal.

Current Loop serial line (please see paragraph "SERIAL COMMUNICATION SELECTION"):

6	**RX- C.L.**	= I	-	Receive Data Negative for Current Loop.
5	**RX+ C.L.**	= I	-	Receive Data Positive for Current Loop.
3	**TX- C.L.**	= O	-	Transmit Data Negative for Current Loop.
4	**TX+ C.L.**	= O	-	Transmit Data Positive for Current Loop.

Power supply voltages:

1	**+5 Vdc**	=	-	+5 Vdc generated by on board switching power supply.
7	**GND**	=	-	Ground signal.
2	**Vopto A**	= O	-	Optocoupled digital inputs power supply voltage.
8	**Vopto B**	= O	-	Optocoupled digital inputs power supply voltage.
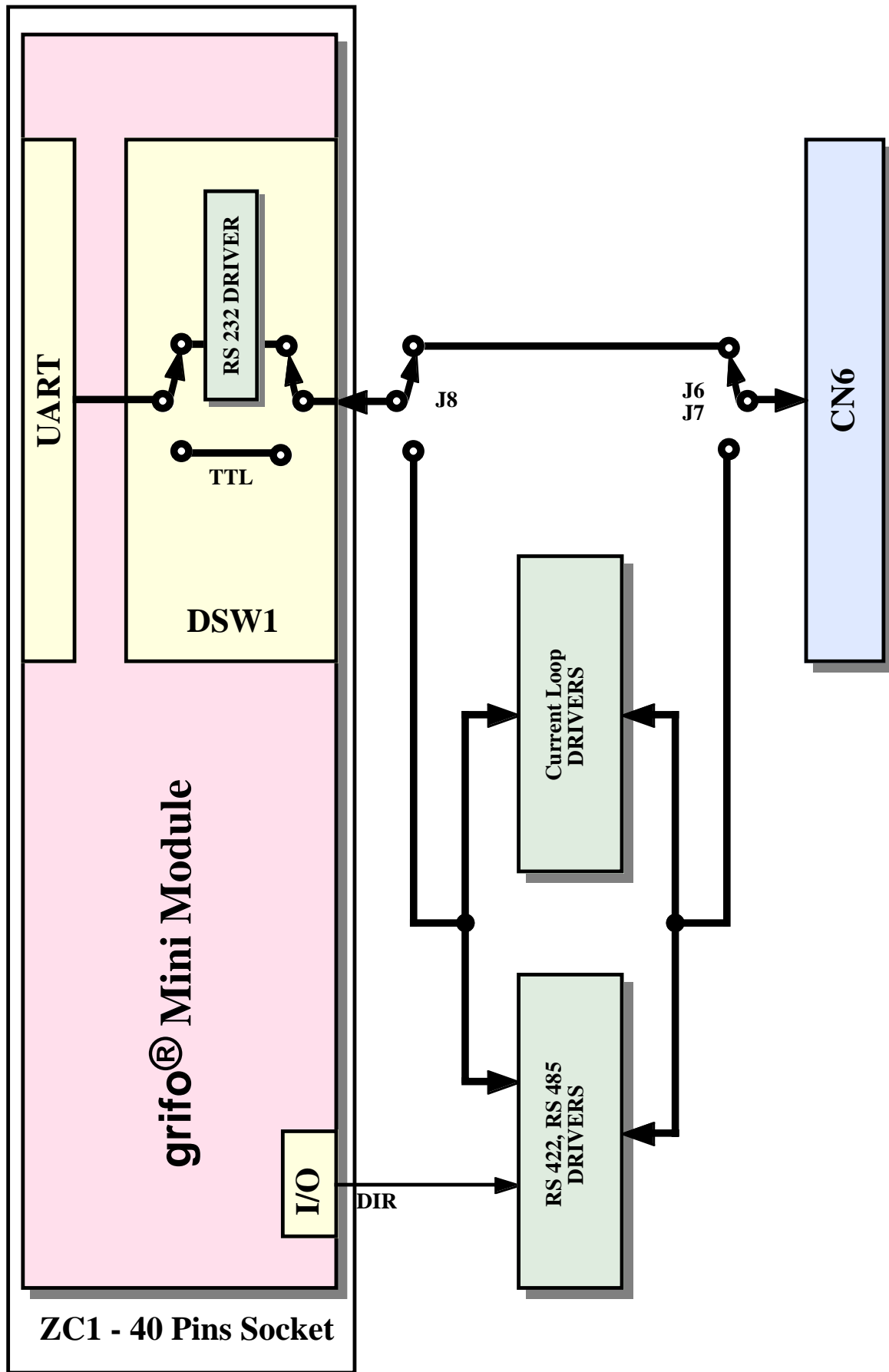
FIGURE 7: SERIAL COMMUNICATION BLOCK DIAGRAM

CN6 GMB HR168

5 RX RS232 o RX TTL → TX

3 TX RS232 o RX TTL → RX

7 GND ↔ GND

External System
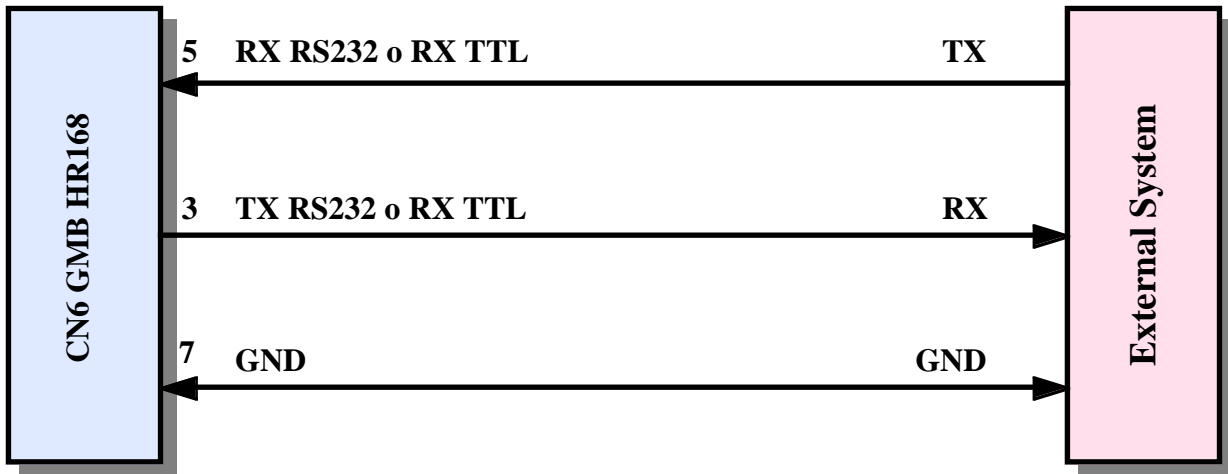
FIGURE 8: RS 232 AND TTL POINT TO POINT CONNECTION EXAMPLE

CN6 GMB HR168

RX- RS422 ← TX-
6

RX+ RS422 ← TX+
5

TX- RS422 → RX-
3

TX+ RS422 → RX+
4

GND ↔ GND
7

External System
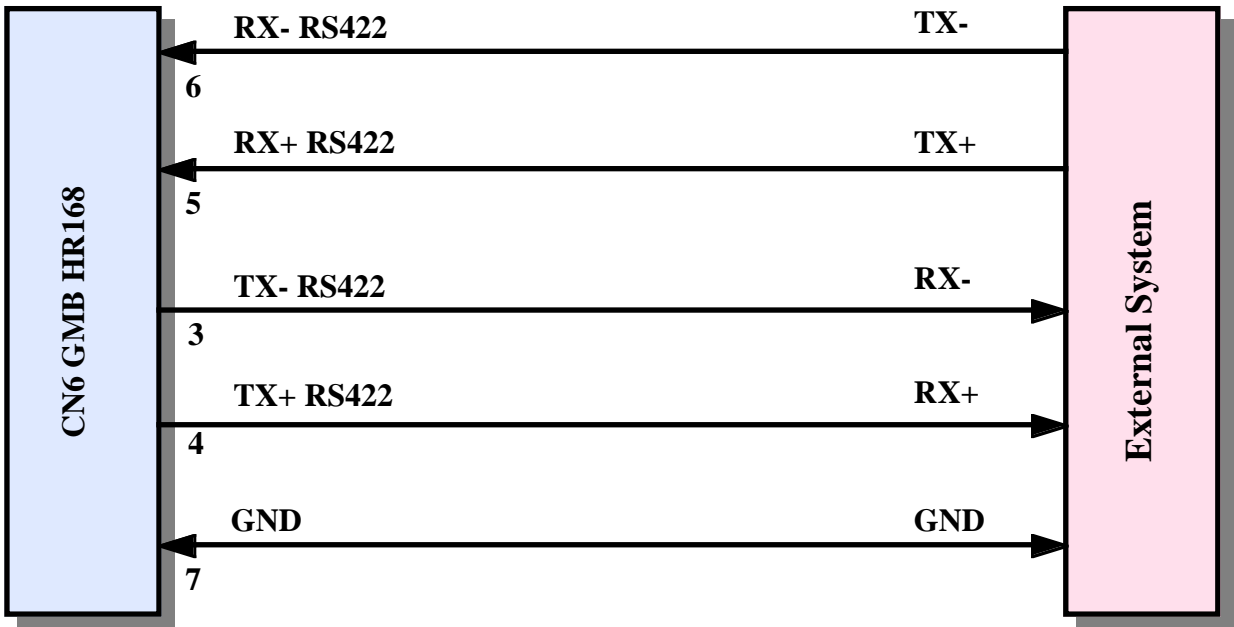
FIGURE 9: RS 422 POINT TO POINT CONNECTION EXAMPLE

CN6 GMB HR168

RXTX- RS485 ← TX-,RX-
6

RXTX+ RS485 ← TX+,RX+
5

GND ↔ GND
7

External System
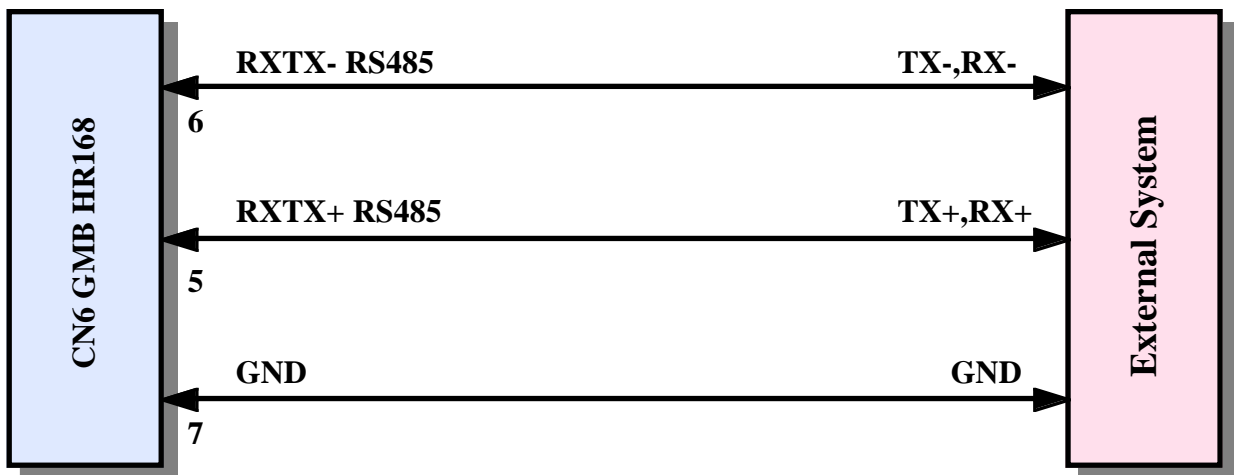
FIGURE 10: RS 485 POINT TO POINT CONNECTION EXAMPLE
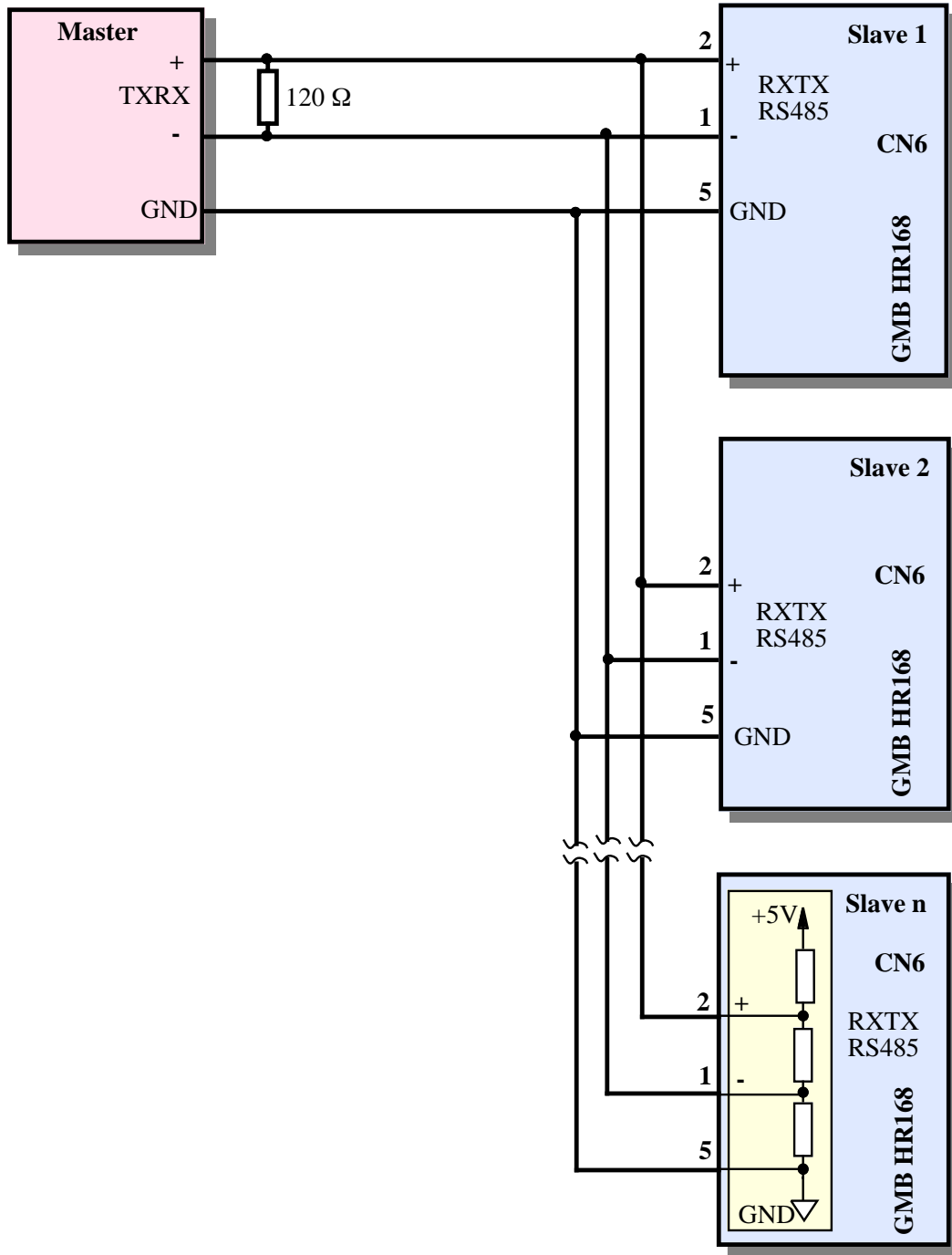
FIGURE 11: RS 485 NETWORK CONNECTION EXAMPLE

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 HR168** 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.
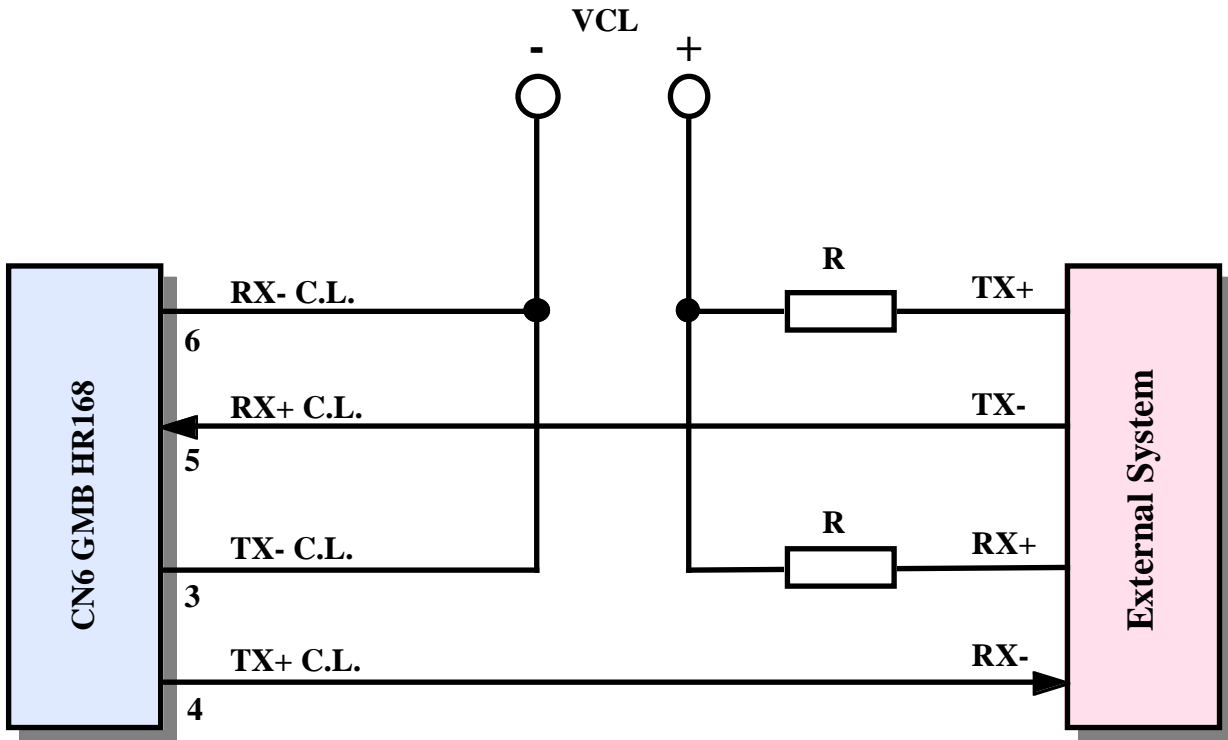
FIGURE 12: CURRENT LOOP 4 WIRES POINT-TO-POINT CONNECTION EXAMPLE
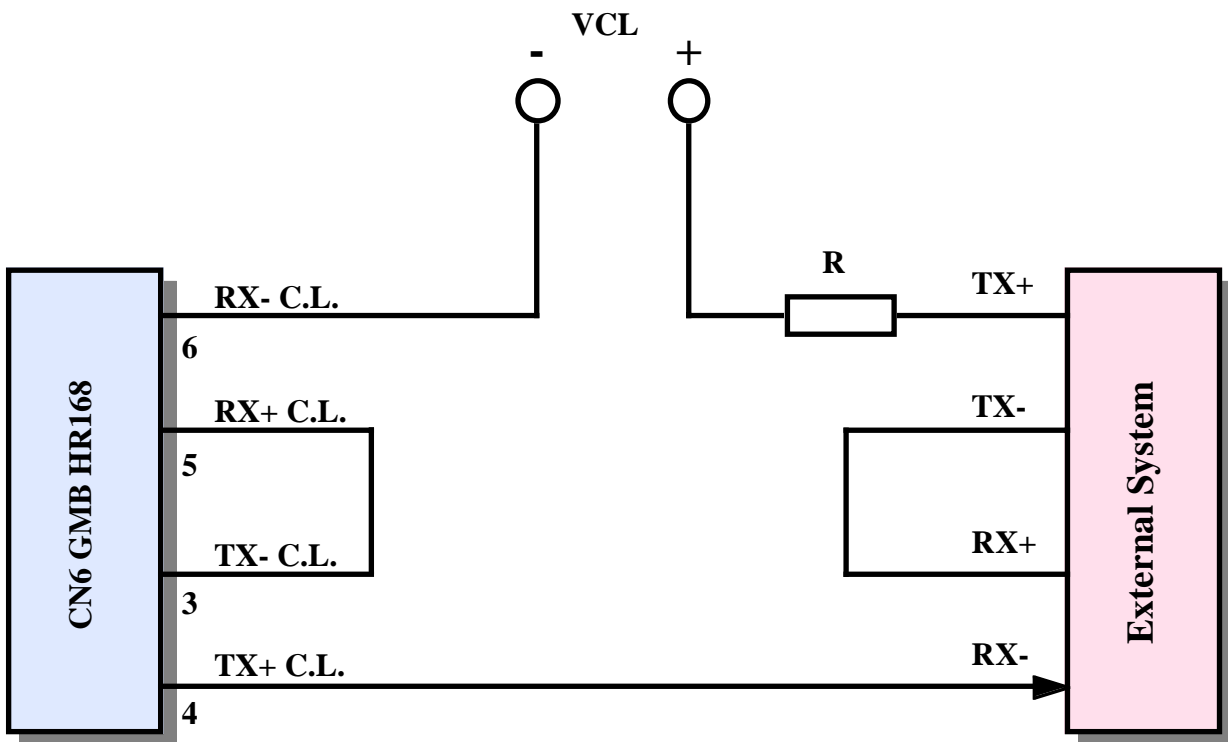
FIGURE 13: CURRENT LOOP 2 WIRES POINT-TO-POINT CONNECTION EXAMPLE
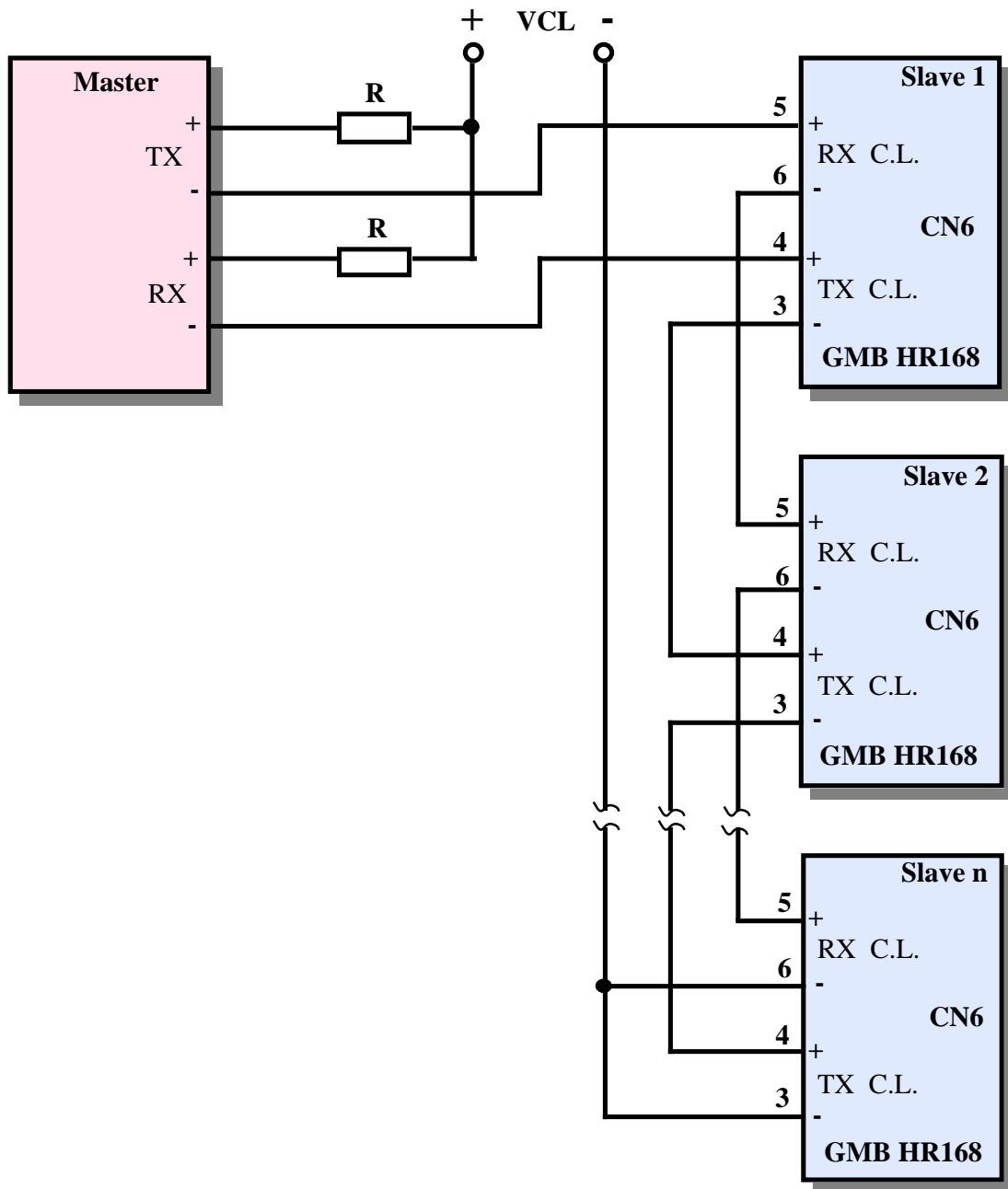
FIGURE 14: CURRENT LOOP NETWORK CONNECTION EXAMPLE

Possible Current Loop connections are two: 2 wires and 4 wires. These connections are shown in figures 13÷15 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 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).

CN1 - OPTOCOUPLED DIGITAL INPUTS CONNECTOR GROUP 1

CN1 is a 9 pins, quick release, screw terminal connector, pitch 5.00 mm.
CN1 is used to connect the 8 out of 16 optocoupled NPN or PNP input signals that the card manages. Connector also features the common pin where to connect the inputs.
The input lines are connected to 40 pins socket signals that have been carefully selected to take advantage of **grifo®** Mini Modules internal peripherals, so they can generate interrupts, count by hardware counters, etc.

```
9  ⊘ ─ ─ ─ ─ ─ ─ ─ COM 1

8  ⊘ ─ ─ ─ ─ MM PIN 19 , IN8-1

7  ⊘ ─ ─ ─ ─ MM PIN 21 , IN7-1

6  ⊘ ─ ─ ─ ─ MM PIN 22 , IN6-1

5  ⊘ ─ ─ ─ ─ MM PIN 23 , IN5-1

4  ⊘ ─ ─ ─ ─ MM PIN 24 , IN4-1

3  ⊘ ─ ─ ─ ─ MM PIN 25 , IN3-1

2  ⊘ ─ ─ ─ ─ MM PIN 31 , IN2-1

1  ⊘ ─ ─ ─ ─ MM PIN 32 , IN1-1
```
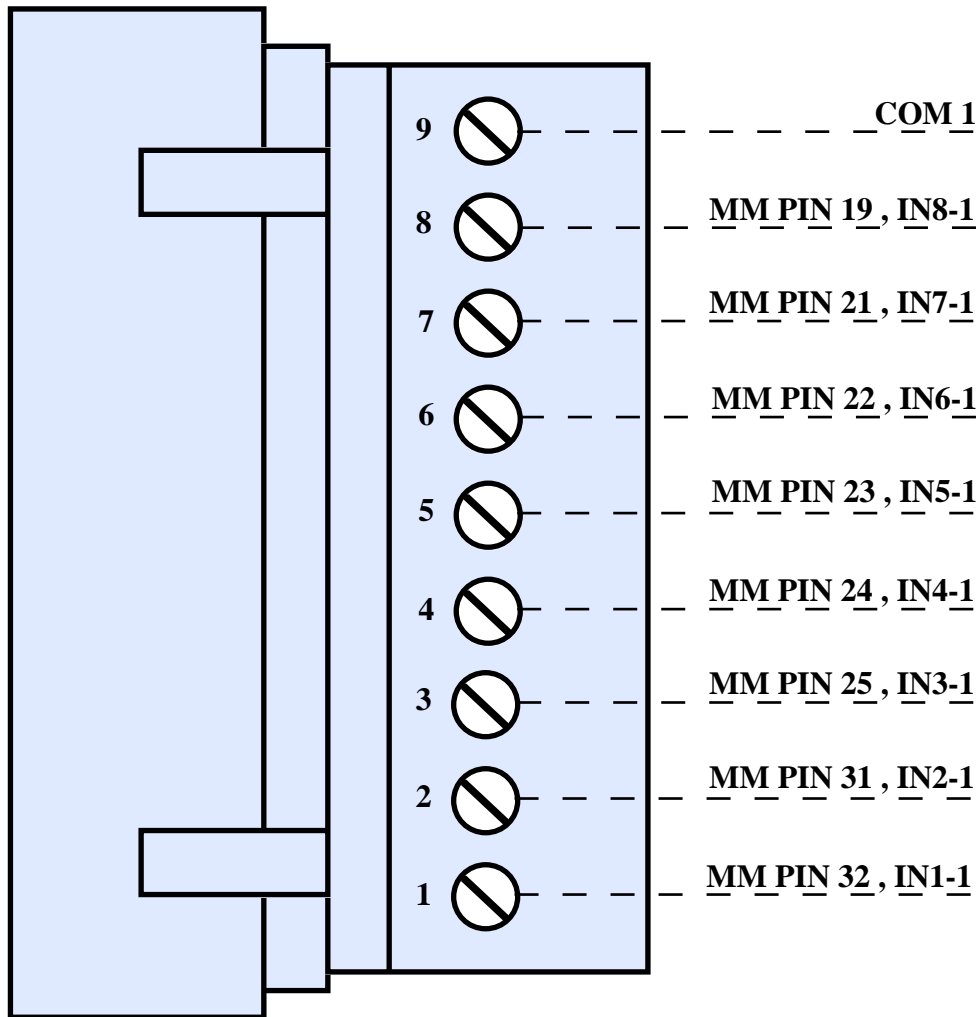
FIGURE 15: CN1 - OPTOCOUPLED DIGITAL INPUTS CONNECTOR GROUP 1

Signals description:

IN n-1 = I - n-th optocoupled input type NPN or PNP.
COM 1 = - 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.
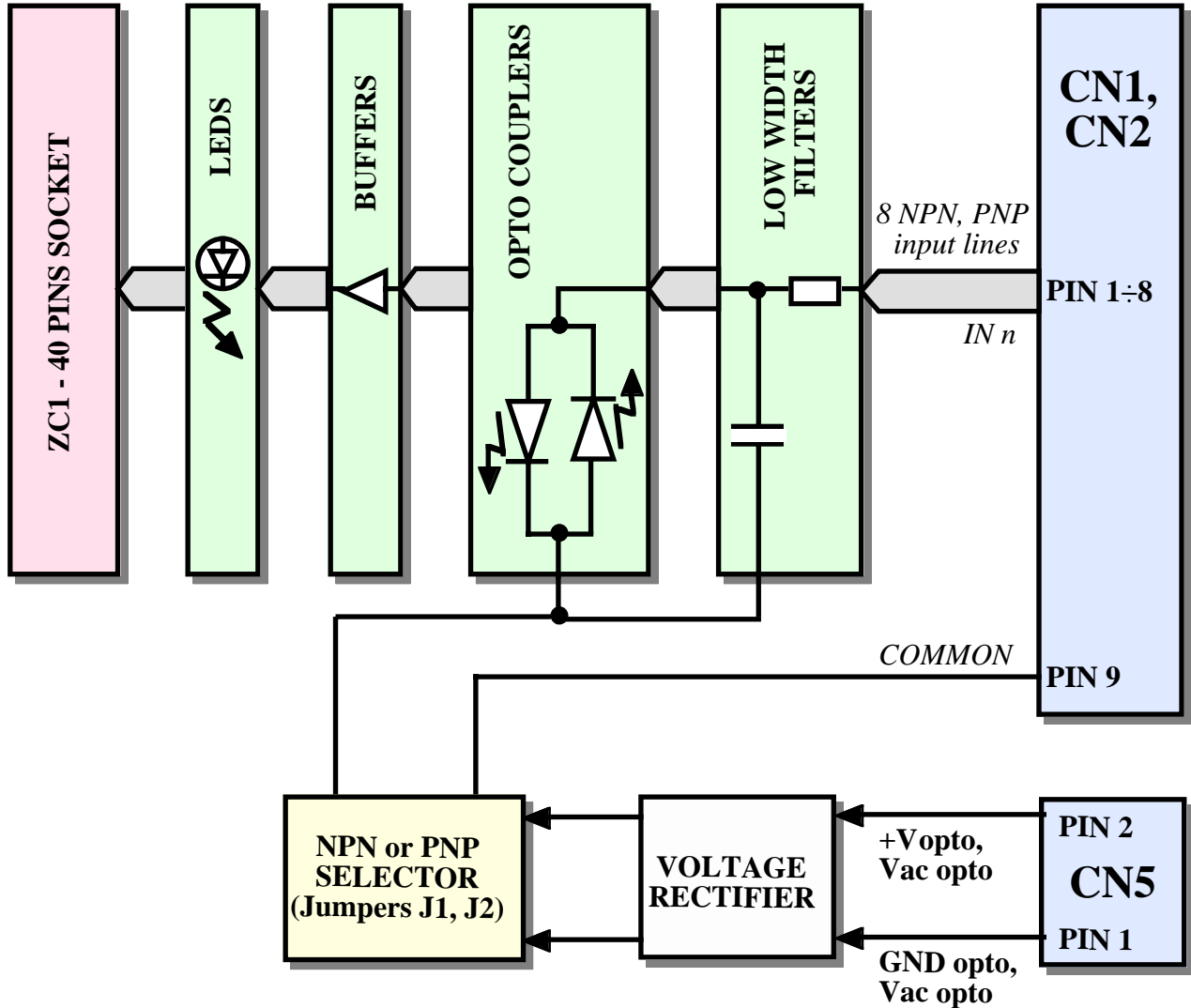
FIGURE 16: OPTOCOUPLED INPUTS BLOCK DIAGRAM

Supply voltage for optocouplers (+Vopto) is generated on board starting from the external supply voltage provided on connector CN5, so to close an input it is enough to conneft it to its common pin. +Vopto is available also on CN6.

The above mentioned external voltage must be compiant to the requirements written in paragraph "ELECTRIC FEATURES".

CN2 - OPTOCOUPLED DIGITAL INPUTS CONNECTOR GROUP 2

CN2 is a 9 pins, quick release, screw terminal connector, pitch 5.00 mm.
CN2 is used to connect the 8 out of 16 optocoupled NPN or PNP input signals that the card manages.
Connector also features the common pin where to connect the inputs.
The input lines are connected to 40 pins socket signals that have been carefully selected to take advantage of **grifo®** Mini Modules internal peripherals, so they can generate interrupts, count by hardware counters, etc.
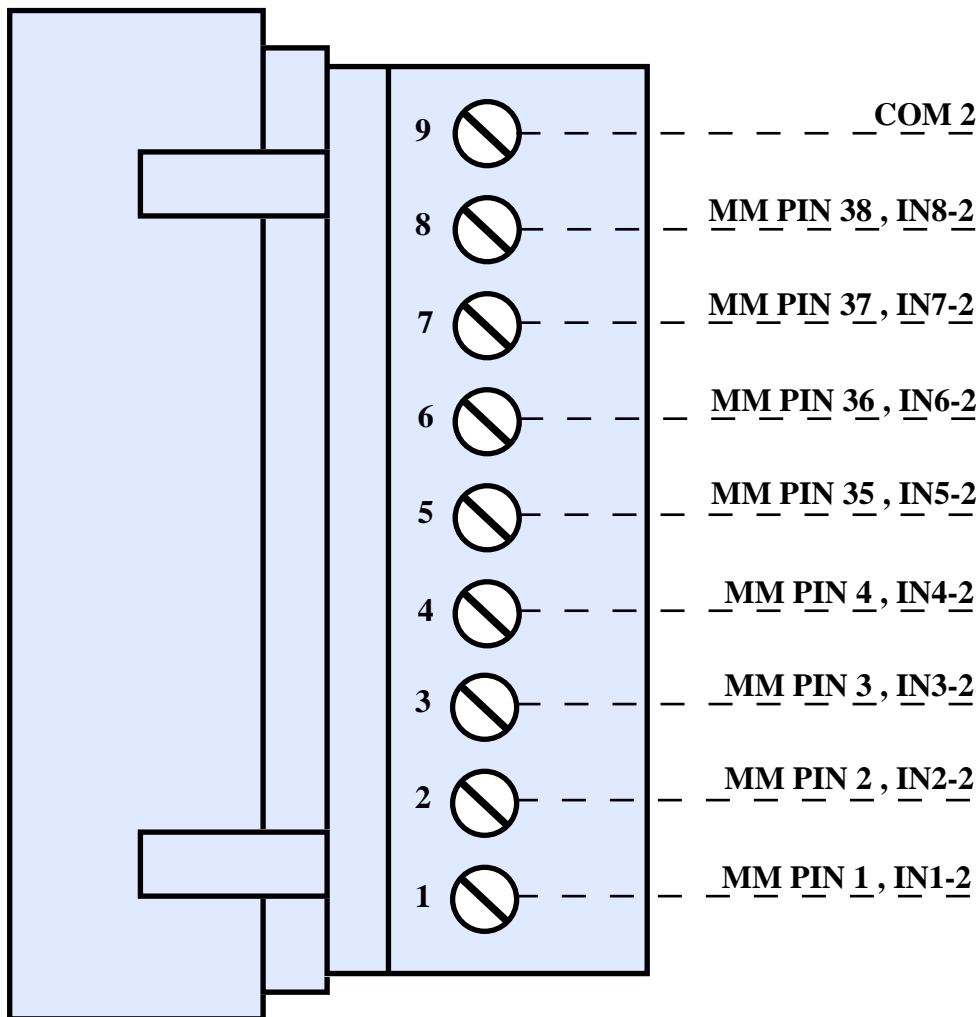
FIGURE 17: CN2 - OPTOCOUPLED DIGITAL INPUTS CONNECTOR GROUP 2

Signals description:

IN n-2 = I - n-th optocoupled input type NPN or PNP.
COM 2 = - 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.
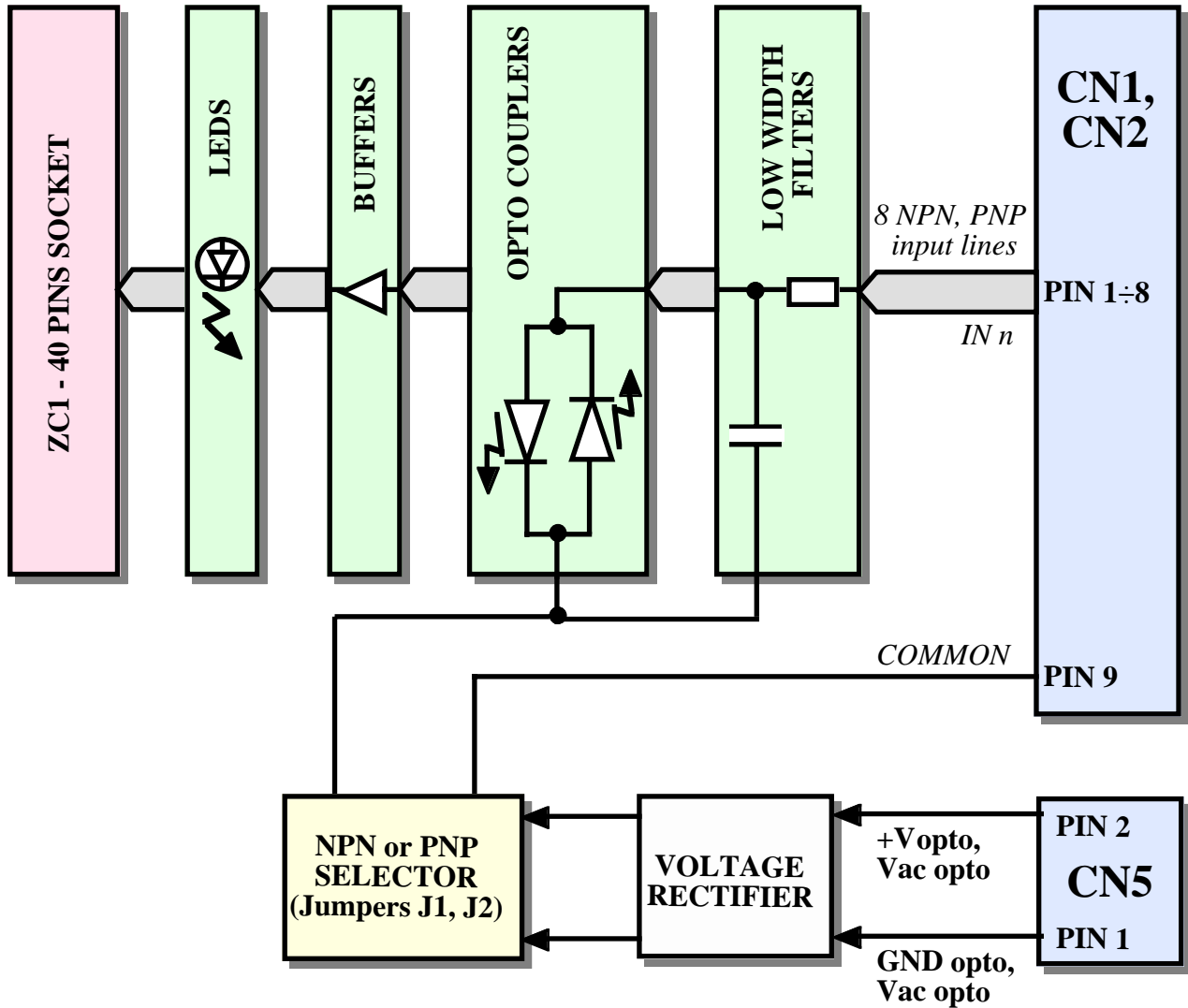
FIGURE 18: OPTOCOUPLED INPUTS BLOCK DIAGRAM

Supply voltage for optocouplers (+Vopto) is generated on board starting from the external supply voltage provided on connector CN5, so to close an input it is enough to connect it to its common pin. +Vopto is available also on CN6.

The above mentioned external voltage must be compiant to the requirements written in paragraph "ELECTRIC FEATURES".

CN3 - RELAYS OUTPUTS CONNECTOR GROUPS A, B AND C

CN3 is a 9 pins quick release screw terminal connector, pitch 5.00 mm.
This connector allows to connect 6 normally open contacts and common pins out of 8 relays outputs available on **GMB HR168**.
Please remark that maximum (resistive) load for each line is **5 A** and maximum voltage is **30 Vdc**. These lines are software managed through signals of 40 pins socket, opportunely buffered, and selected carefully to easy management (plese refer to chapter "PERIPHERAL DEVICES SFOTWARE DESCRIPTION").
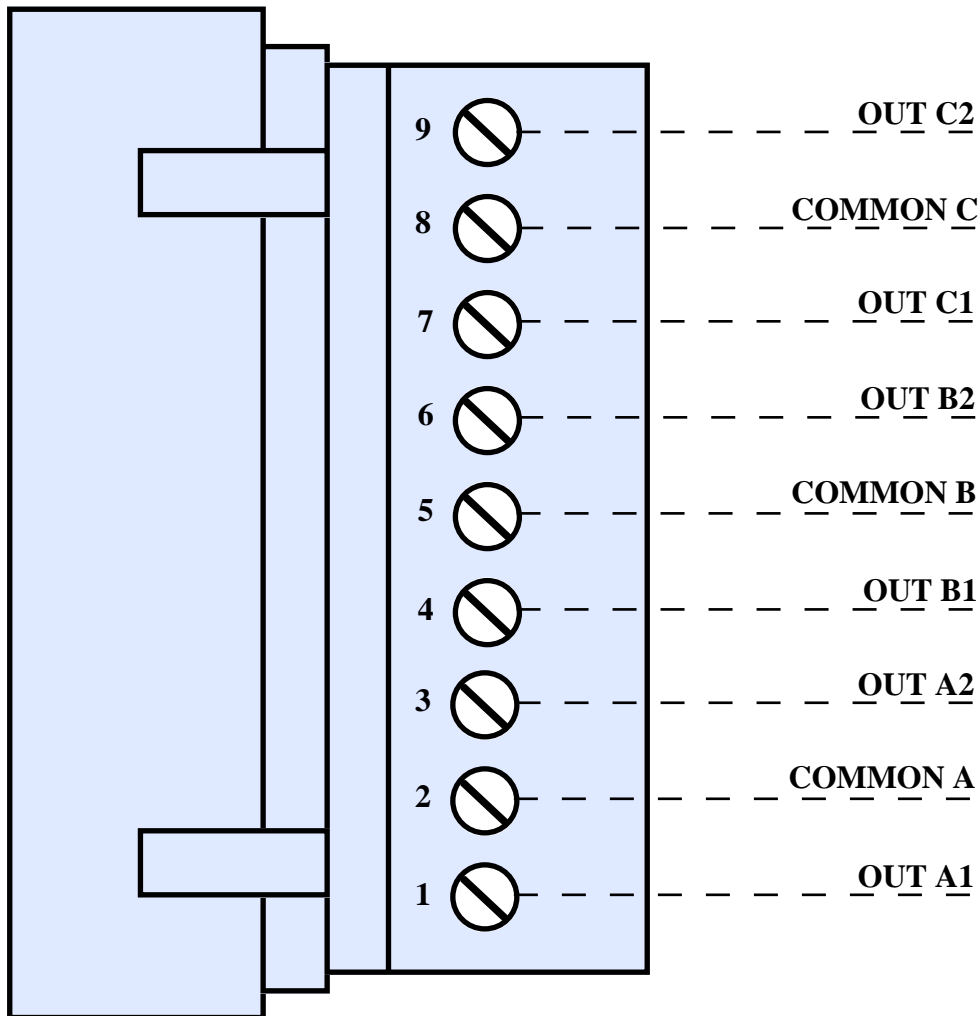
FIGURE 19: CN3 - RELAYS OUTPUTS CONNECTOR GROUPS A, B AND C

Signals description:

OUT An	= O	- Normally open contact for n-th relay of group A.
COMMON A	=	- Common contact for relays of group A.
OUT Bn	= O	- Normally open contact for n-th relay of group B.
COMMON B	=	- Common contact for relays of group B.
OUT Cn	= O	- Normally open contact for n-th relay of group C.
COMMON C	=	- Common contact for relays of group C.

Relays output lines are provided with a LED to visualize the status (LED ON when relay contact closed).
Relays are driven by PNP transistors that are driven by 40 pins socket signals.
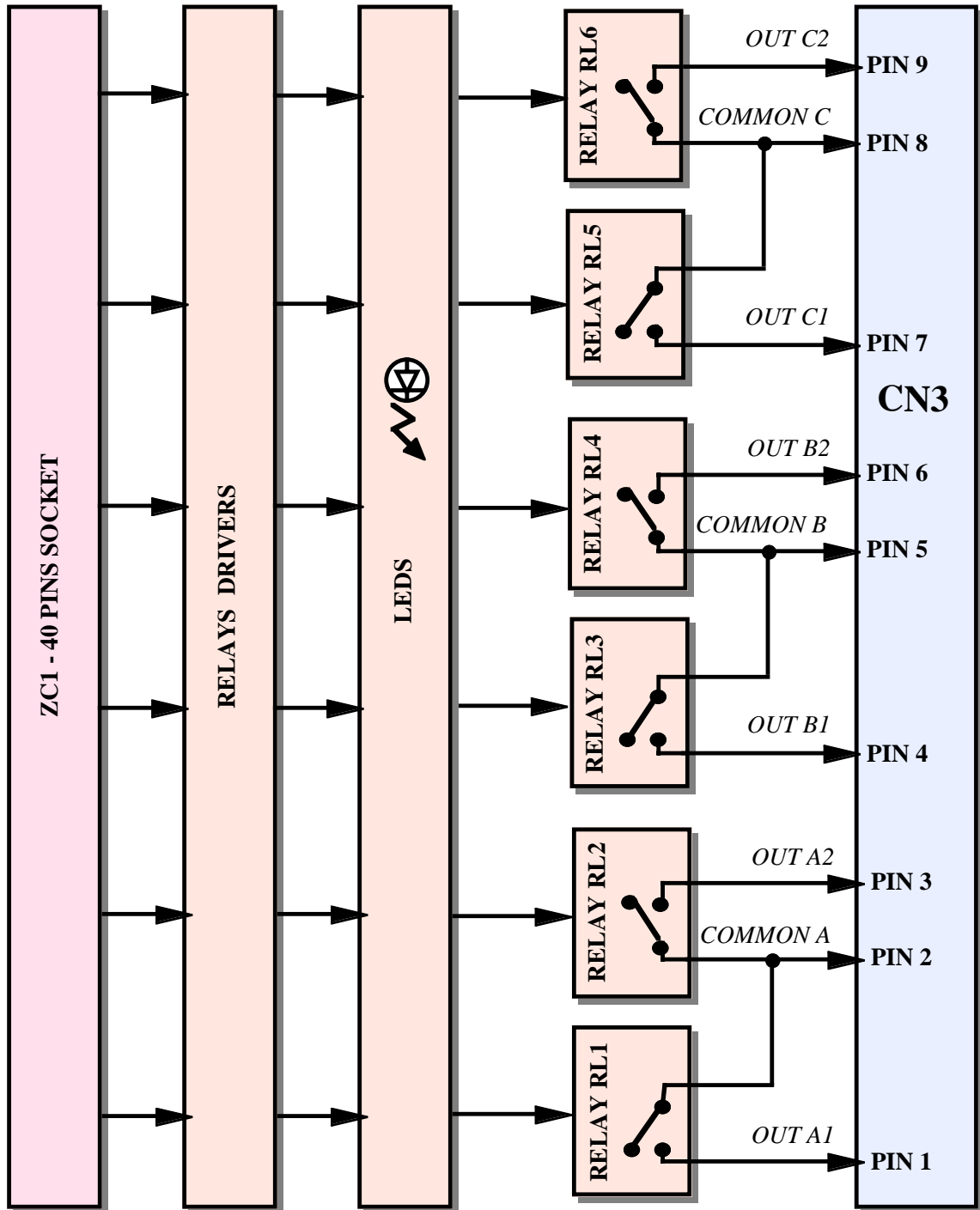
FIGURE 20: RELAYS OUTPUTS GROUPS A, B AND C BLOCK DIAGRAM

There are three groups of two relays, called A1 and A2, B1 and B2, C1 and C2, each group with its own common terminal (A, B and C).
This allows to connect external loads supplied by three different sources, making the cabling of the whole system very easier.

CN4 - RELAYS OUTPUTS CONNECTOR GROUP D

CN4 is a 3 pins quick release screw terminal connector, pitch 5.00 mm.
This connector allows to connect 2 normally open contacts and common pins out of 8 relays outputs available on **GMB HR168**.
Please remark that maximum (resistive) load for each line is **5 A** and maximum voltage is **30 Vdc**. These lines are software managed through signals of 40 pins socket, opportunely buffered, and selected carefully to easy management (plese refer to chapter "PERIPHERAL DEVICES SFOTWARE DESCRIPTION").
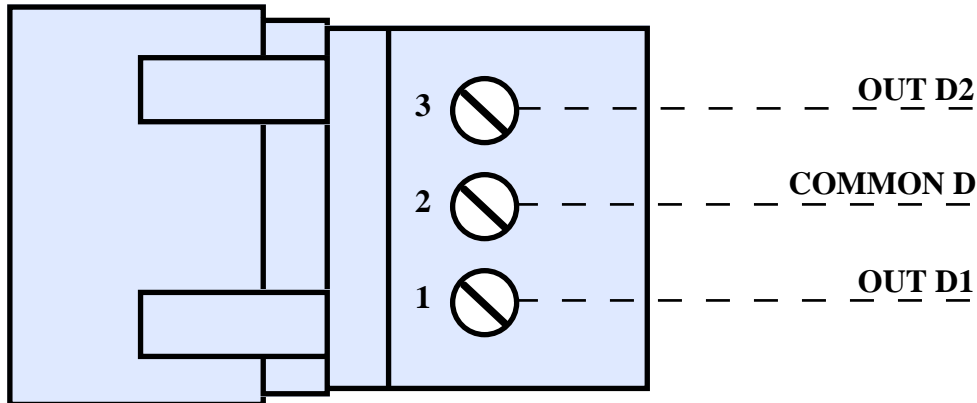
FIGURE 21: CN4 - RELAYS OUTPUTS CONNECTOR GROUP D

Signals description:

OUT Dn   = O - Normally open contact for n-th relay of group D.
COMMON D   =   - Common contact for relays of group D.

Relays output lines are provided with a LED to visualize the status (LED ON when relay contact closed).

Relays are driven by PNP transistors that are driven by 40 pins socket signals.
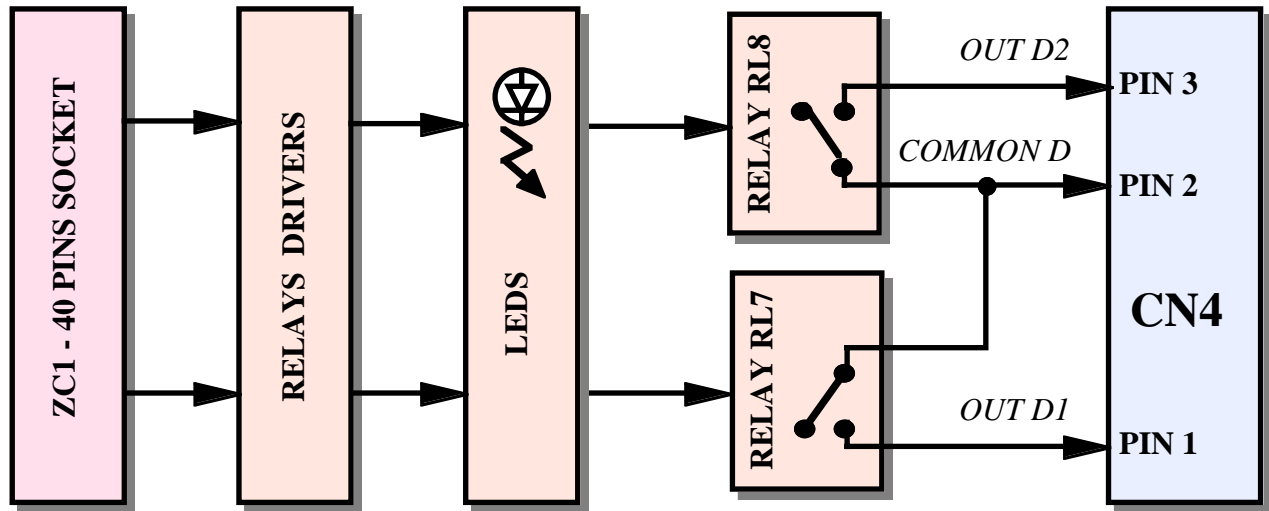
FIGURE 22: RELAYS OUTPUTS GROUP D BLOCK DIAGRAM

There is one group of two relays, called D1 and D2, with its own common terminal (D).

NOTE
Relays connectors are two for container physical facts.
However the pattern of signals and common pins disposition is the same for each group, this means that to transfer a connection from one group to another it is not required to recable, it is enough to move the existing cabling (e. g. using 3 pins female connectors both on CN3 and on CN4).

CN7 - TTL I/O, A/D, ETC. CONNECTOR

CN7 is a 8 pins, male, vertical, AMP Mod II 4+4 connector with pitch 2.54 mm.

This connector features +5 Vdc supply voltage (generated by on board switching power supply), up to 5 TTL digital I/O signals and an analog input connected to A/D section.

In case an optional Real Time Clock is installed, pin 4 is connected to its 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. **CKS.AMP8**).

For further information please refer to figure 8 or to the manual of a **grifo®** Mini Module combinaton.
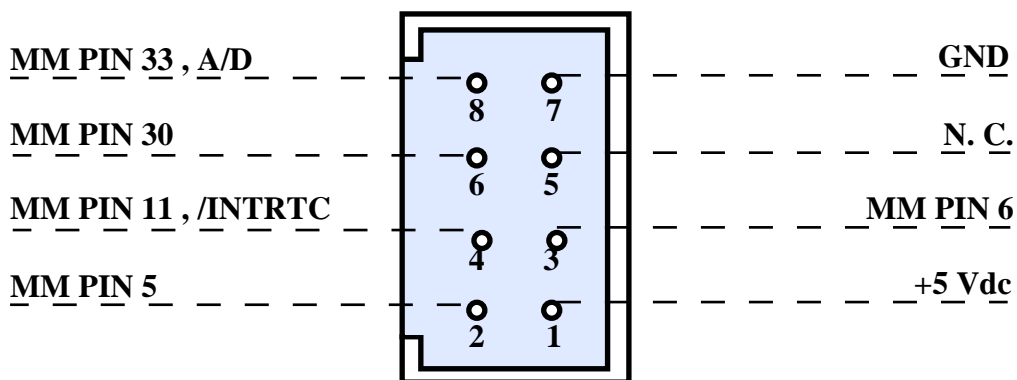
FIGURE 23: CN7 - TTL I/O, A/D, ETC. CONNECTOR

Signals description:

MM PIN x	= I/O - TTL digital I/O signal, connected to pin x of socket ZC1.
A/D	= I - Analog input for A/D converter section (please see figure 24).
/INTRTC	= I/O - Interrupt signal of optional Real Time Clock (option **.RTC**).
+5 Vdc	= O - Positive terminal of +5 Vdc power supply.
GND	= - Ground signal.
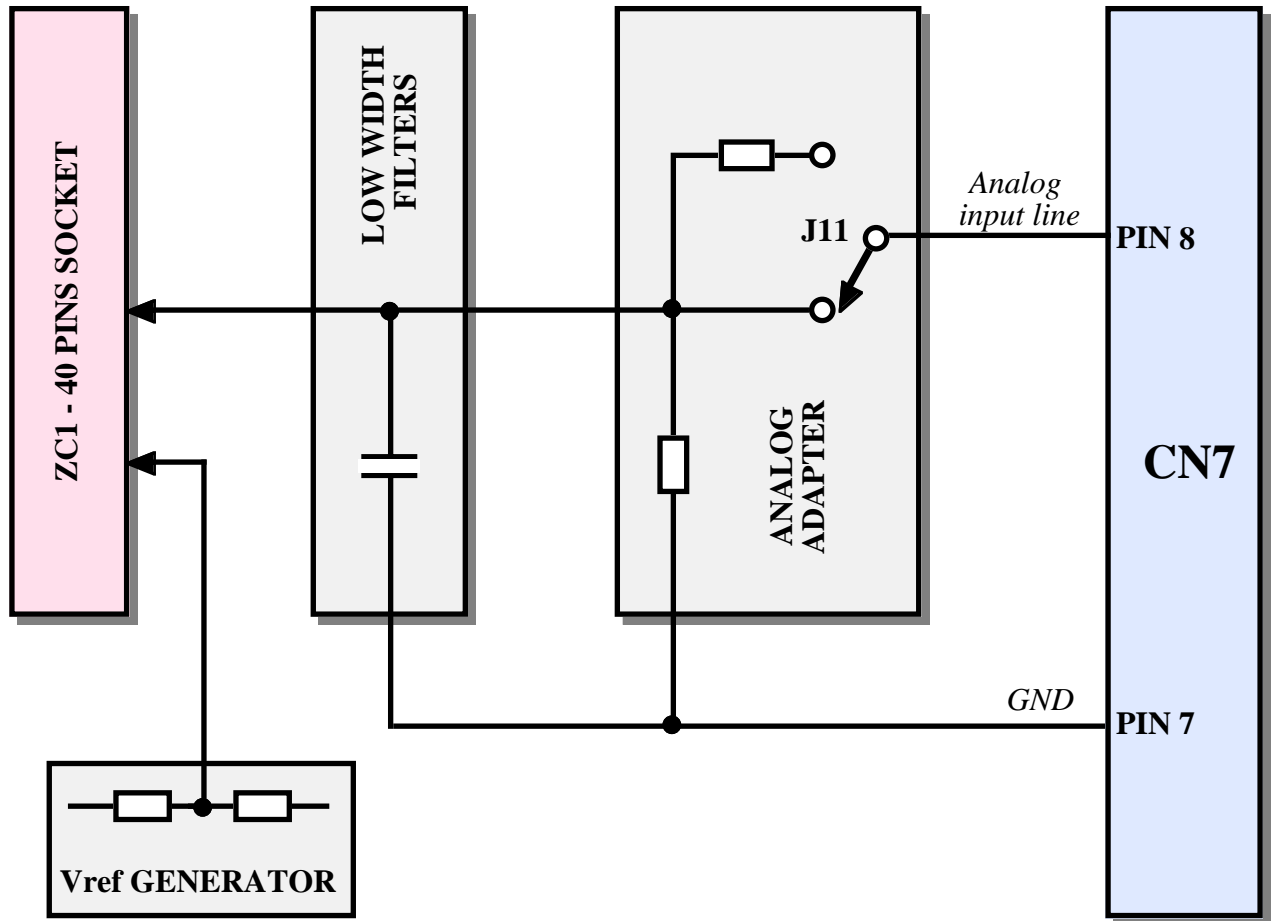
FIGURE 24: A/D ANALOG INPUT CONNECTION DIAGRAM

INTERRUPTS

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

I/O CONNECTION

To prevent possible connecting problems between **GMB HR168** and the external systems, the user has to read carefully the previous paragraph information and he must follow these instructions:

- For RS 232, RS 422, RS 485, Current Loop and I²C BUS signals the user must follow the standard rules of each one of these protocols, I²C BUS signals are also provided with 4.7 kΩ pull up.

- 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) on CN7 is provided with filtering capacitors that warrant more stability on the signal to acquire and lower the cut-off frequency. It is also possible to connect a voltage divider that divides by 4 the signal amplitude.

- Optocoupled input signals can be configured as NPN or PNP through jumpers J1 and J2, these jumpers must be moved together. In detail, if inputs are configured as NPN, positive voltage is present on input pins (INx-1, INy-2) and ground is present on the common pins (COM1 and COM2), while if the inputs are configured as PNP the situation is reversed, this means ground on input pins and positive signal on common pins.

- 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 **30 Vdc**. To drive load with different supplies, different COMMONS for the groups of relays are available.
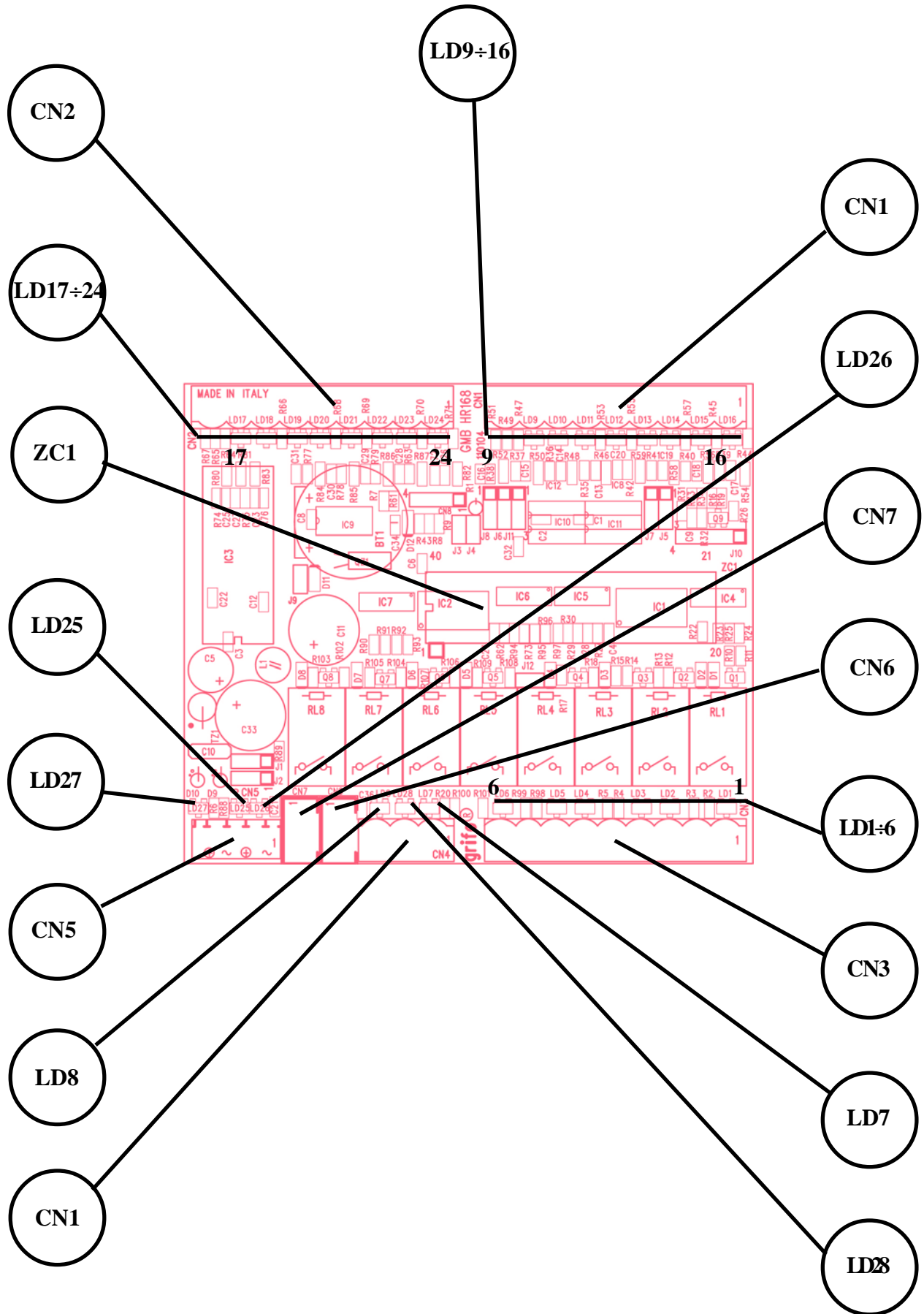
FIGURE 25: LEDS, CONNECTORS, ETC. LOCATION

POWER SUPPLY

GMB HR168 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 9÷28 Vdc ± 5% or 9÷23Vac ± 5% and must be provided on connector CN5 through pins 1 and 2, connecting pin 2 to the positive terminal of external power supply and pin 1 to its ground terminal, if it is direct voltage.

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÷38Vdc ± 5% or 8÷23Vac ± 5% and must be provided though puns 3 and 4 of CN5 (in case of Vdc, pin 4 must be connected to positive terminal). This allows to supply the cards using standard devices of industrial sector like transfrmers, batteries, solar cells, etc. If external loads must be supplied, a +5 Vdc voltage can be fetched from pins 1 and 7 of CN6, CN7 or pins 1 and 4 of CN8. Please remark that on board switching power supply is provided with single diode rectifier, so in case of Vdc supply, underline 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 HR168 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 is less than:

1000 mA - current absorbed by **GMB HR168** - current absorbed by hardware on ZC1

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

1000 mA - 542 mA - 49 mA = 409 mA.

For further information please refer to paragraph "ELECTRIC FEATURES".

FIGURE 26: PHOTO OF EXPS-2 POWER SUPPLY

VISUAL SIGNALATIONS

GMB HR168 features the LEDs described in the following table:

LED	COLOUR	FUNCTION
LD1	Red	Visualizes status of relay output OUT A1 on CN3. When the LED is lit the output is connected to common terminal COMMON A.
LD2	Red	Visualizes status of relay output OUT A2 on CN3. When the LED is lit the output is connected to common terminal COMMON A.
LD3	Red	Visualizes status of relay output OUT B1 on CN3. When the LED is lit the output is connected to common terminal COMMON B.
LD4	Red	Visualizes status of relay output OUT B2 on CN3. When the LED is lit the output is connected to common terminal COMMON B.
LD5	Red	Visualizes status of relay output OUT C1 on CN3. When the LED is lit the output is connected to common terminal COMMON C.
LD6	Red	Visualizes status of relay output OUT C2 on CN3. When the LED is lit the output is connected to common terminal COMMON C.
LD7	Red	Visualizes status of relay output OUT D1 on CN4. When the LED is lit the output is connected to common terminal COMMON D.
LD8	Red	Visualizes status of relay output OUT D2 on CN4. When the LED is lit the output is connected to common terminal COMMON D.
LD9÷LD16	Green	Visualize status of optocoupled inputs 1÷8 on CN1. When one LED is lit there is a current flowing between input INP n-1 and common terminal COM 1.
LD17÷LD24	Yellow	Visualize status of optocoupled inputs 1÷8 on CN2. When one LED is lit there is a current flowing between input INP n-2 and common terminal COM 2.
LD25	Green	If lit, then the combination of jumpers J1 and J2 is set to make the optocoupled inputs on CN1 and CN2 type NPN.
LD26	Red	If lit, then the combination of jumpers J1 and J2 is set to make the optocoupled inputs on CN1 and CN2 type PNP.
LD27	Yellow	If lit, indicates that switching power supply is generating +5 Vdc.
LD28	Yellow	Visualizes status of signal MM PIN 11 connected to pin 4 of CN7, which is also optional Real Time Clock interrupt signal.

FIGURE 27: 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 25.
All the LEDs described in figure 27 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.
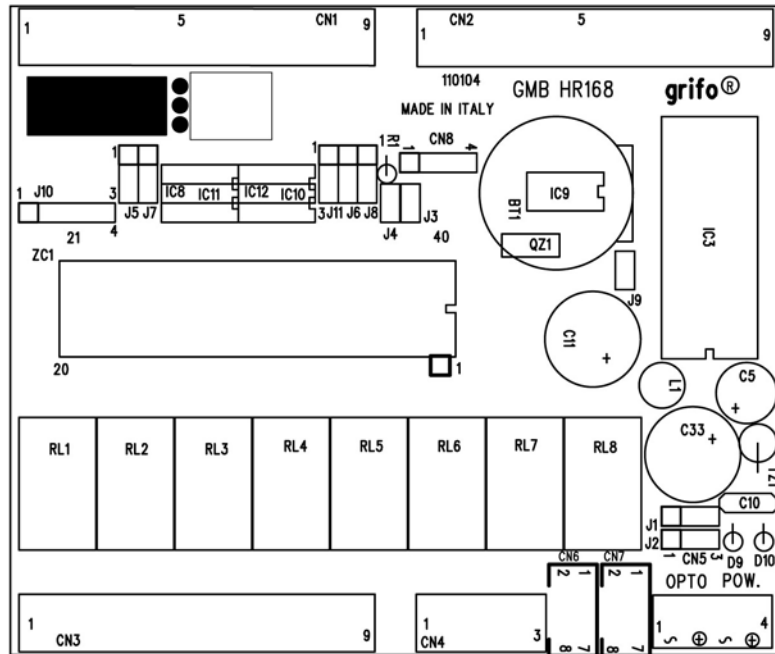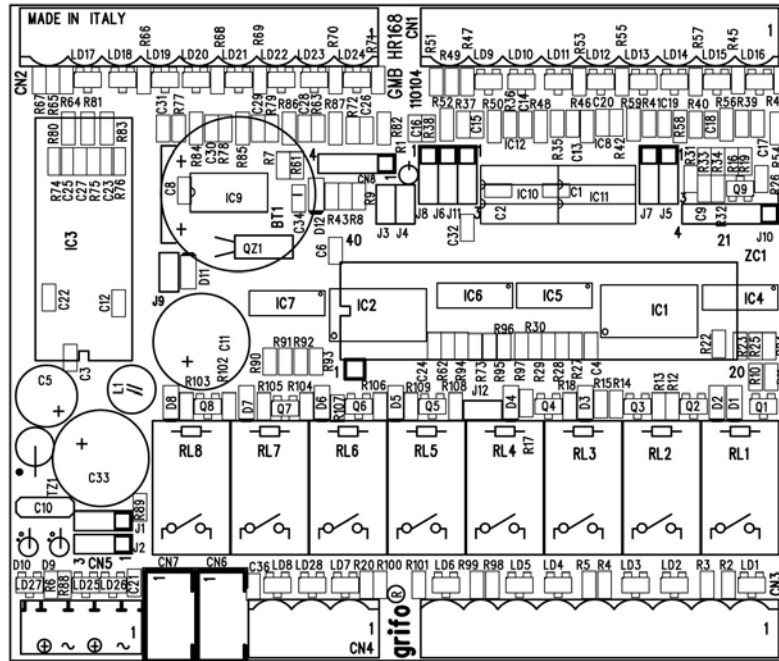
FIGURE 28: COMPONENTS MAP (COMPONENT SIDE AND SOLDER SIDE)

JUMPERS

On **GMB HR168** there are 12 jumpers for card configuration.
Here below is the jumpers list, location and function:

JUMPER	N. PINS	PURPOSE
J1, J2	2	Select optocoupled inputs type between NPN or PNP.
J3, J4	2	Connect termination and forcing circuitery to RS 422, RS 485 serial line.
J5	3	Selects direction and operating mode for RS 422, RS 485 serial line.
J6	3	Selects connection for pin 3 of serial connector CN6.
J7	3	Selects connection of signal MM PIN 10, that is the serial transmission signal of Mini Module.
J8	3	Selects connection of signal MM PIN9, that is the serial reception signal of Mini Module.
J9	2	Connects Lithium battery for backup of optional RTC and its SRAM.
J10	5	Selects DIR signal used for RS 422, RS 485 serial communication and selects which signal drives relay output OUT D2.
J11	3	Selects connection for signal MM PIN 33, that is the range for analog input signal.
J12	2	Connects a voltage of 2.5 Vdc to signal MM PIN7, that is the Vref reference voltage for Mini Module A/D converter.

FIGURE 29: JUMPERS SUMMARIZING TABLE

The following tables describe all the right connections of **GMB HR168** jumpers with their relative functions.
To recognize these valid connections, please refer to the board printed diagram (serigraph) or to figures 26 of this manual, where the pins numeration is listed; for recognizing jumpers location, please refer to figure 30.
The "*" (asterisk) 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.
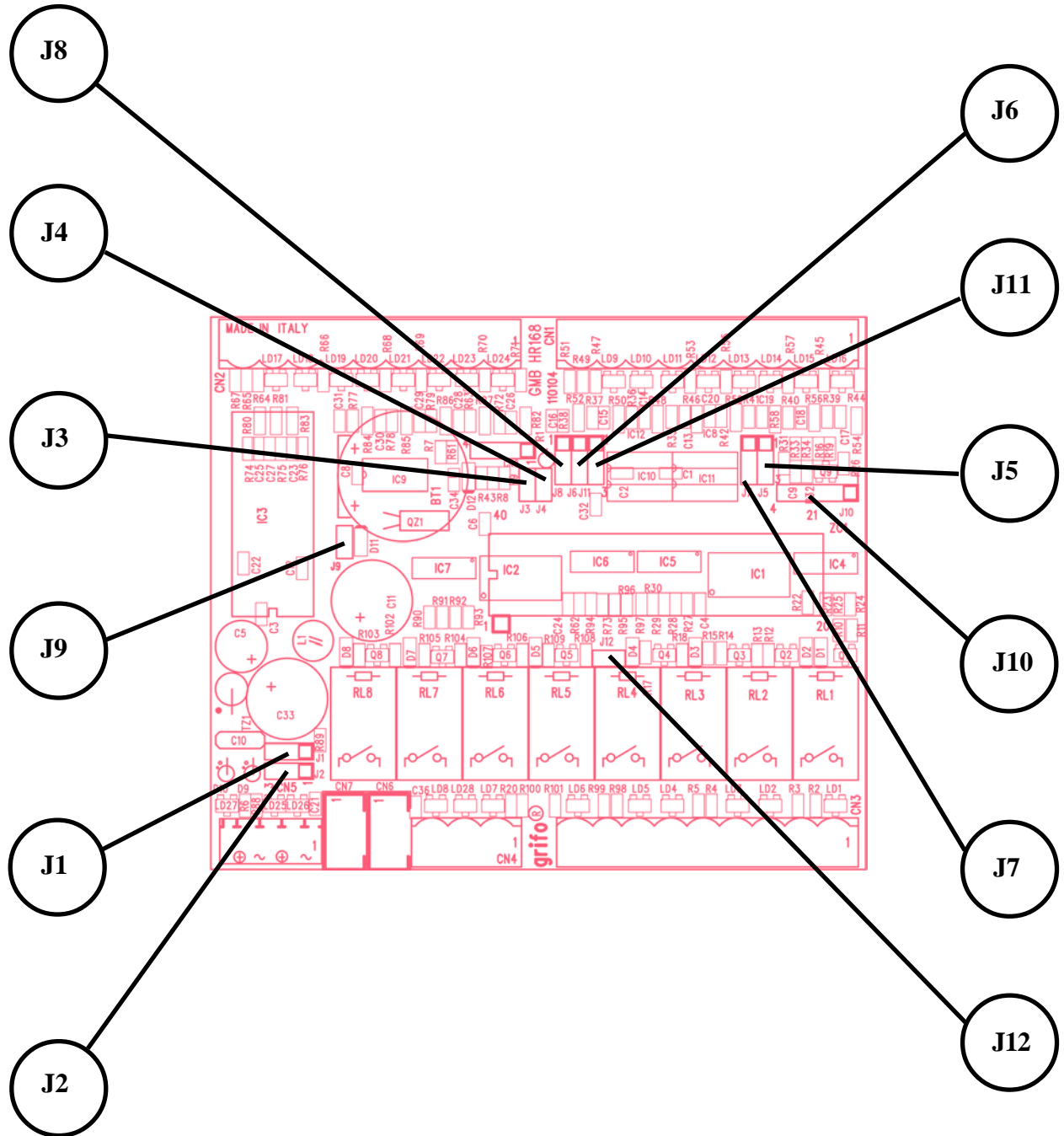
FIGURE 30: JUMPERS LOCATION

2 PINS JUMPERS

JUMPER	CONNECTION	PURPOSE	DEF.
J3, J4	not connected	Do not not connect termination and forcing circuitery to RS 485 receiver/transmitter or to RS 422 receiver of serial line	*
	connected	Connect termination and forcing circuitery to RS 485 receiver/transmitter or to RS 422 receiver of serial line	
J9	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.	
J12	not connected	Does not connect 2.5 Vdc to signal MM PIN 7 of socket ZC1.	*
	connected	Connects 2.5 Vdc to signal MM PIN 7 of socket ZC1. If a grifo® Mini Module is installed, this tension is used as reference voltage (Vref) for on board A/D converter.	

FIGURE 31: 2 PINS JUMPERS TABLE

5 PINS JUMPERS

JUMPER	CONNECTION	PURPOSE	DEF.
J10	position 1-2	Connects signal MM PIN 17 to DIR signal to drive the communication direction in RS 422 or transmitter activation of RS 485.	*
	position 2-3	Connects signal MM PIN 30 to DIR signal to drive the communication direction in RS 422 or transmitter activation of RS 485.	
	position 3-4	Connects signal MM PIN 30 to signal RD8 to drive relay output OUT D2.	*
	position 4-5	Connects signal MM PIN 16 to signal RD8 to drive relay output OUT D2.	

FIGURE 32: 5 PINS JUMPERS TABLE

3 PINS JUMPERS

JUMPER	CONNECTION	PURPOSE	DEF.
J1, J2	position 1-2	Select type NPN for optocoupled inputs of CN1 and CN2.	
	position 2-3	Select type PNP for optocoupled inputs of CN1 and CN2.	*
J5	position 1-2	Connects DIR signal to enable RS 485 communication.	
	position 2-3	Connects DIR signal to enable RS 422 communication.	*
J6	position 1-2	Connects pin 5 of connector CN6, to serial line in RS 422, RS 485 .	
	position 2-3	Connects pin 5 of connector CN6, to serial line in RS 232, TTL.	*
J7	position 1-2	Connects pin 3 of connector CN6, to serial line in RS 422, RS 485.	*
	position 2-3	Connects pin 3 of connector CN6, to serial line in RS 232, TTL.	
J8	position 1-2	Connects signal MM PIN 9 (that is serial reception signal in RS 232 or TTL of Mini Module) to RS 422, RS 485 or current loop drivers.	
	position 2-3	Connects signal MM PIN 9 (that is serial reception signal in RS 232 or TTL of Mini Module) to pin 3 of J6.	
J11	position 1-2	Connects signal MM PIN 33 directly to pin 8 of CN7, that is selects range 2.5 Vdc for analog input signal of a **grifo®** Mini Module.	*
	position 2-3	Connects signal MM PIN 33 to pin 8 of CN7 through a voltage divider, that is selects range 10 Vdc for analog input signal of a **grifo ®** Mini Module.	

FIGURE 33: 3 PINS JUMPERS TABLE

INPUTS CONFIGURATION AS NPN OR PNP

The 16 optocoupled inputs of **GMB HR168** can be configured as NPN or PNP according to the connection of jumpers J1 and J2.

Power supply of optocoupling sections is provided externally through connector CN5 (please refer to paragraph "ELECTRIC FEATURES" and to paragraph of connector CN5 for further information); such power supply is rectified by a specific circuitery that generates two voltages: +Vopto and GND opto.

Connection of jumper J1 and J2 determines which of these two voltages will be present at common pin of optocoupled inputs (pin 9 of CN1 and CN2, that is COM1 and COM2), while the other voltage will be present at all other pins of CN1 and CN2.

This allows to close an optocoupled input simply by connecting it to its common pin.

Jumpers J1 and J2 **always must be moved together at the same time**.

They can be connected **only both in position 1-2 or both in position 2-3**.

If one of the above rules is not respected, **GMB HR168** could be damaged, so it is suggested to move jumpers J1 and J2 only when power supply is off.

As already printed in table of figure 33, connecting J1 and J2 in position 1-2 configures inputs as type NPN, while connecting J1 and J2 in position 2-3 configures inputs as type PNP.

About polarity of pins COM1 and COM2: as type NPN COM1 and COM2 are connected to +Vopto, while as type PNP COM1 and COM2 are connected to GND.

BACK UP

GMB HR168 can be ordered with an optional Real Time Clock already installed (option **.RTC**). This component provides hours, minutes, seconds, dat, month and year and features a 256 bytes SRAM.

On board is installed a Lithium battery to keep the time and the content of SRAM even when power supply is off, if jumper J9 is connected. By default, jumper J9 is NOT connected.

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

ANALOG INPUT

GMB HR168 features an interface for one analog input that can accept an input voltage in a variable range according to connection of jumper J11: in position 1-2 the analog input signal is filtered, so that its stability is increased, while when J11 is in position 2-3, also a voltage divider acts on the signal, dividing its amplitude by 4.

As shown in figure 24, 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 coeffcent for successive analog signal acquisitions.

Examples developed for **grifo®** Mini Modules show some calibration techniques that the user can modify according to the application's needs.

Please refer also to figure 4, if you are using a **grifo®** Mini Modules please refer to the combination manual.
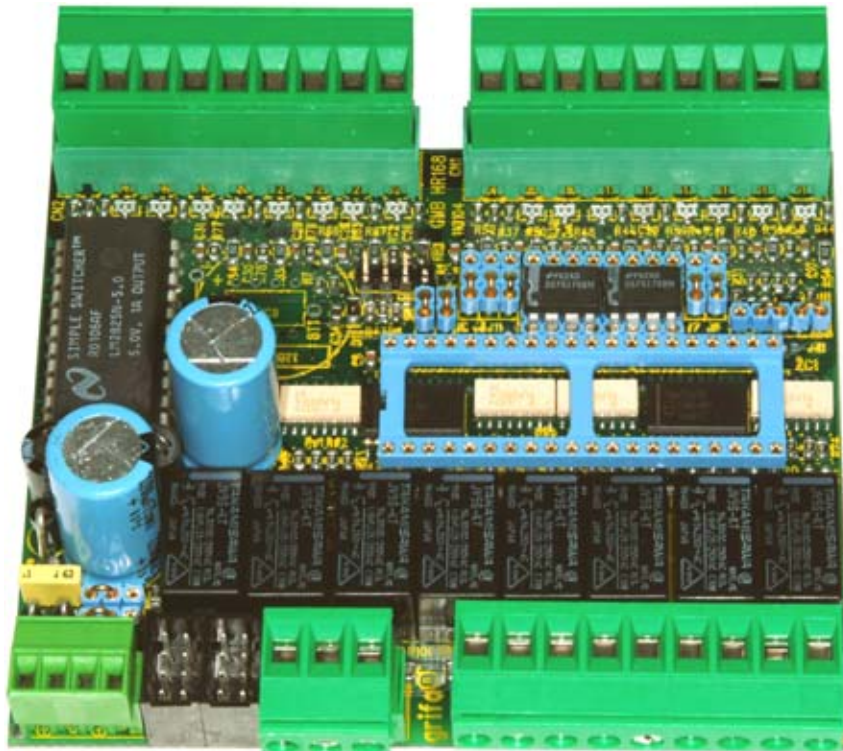
FIGURE 34: PHOTO OF GMB HR168 IN RS 422 (COD. RS422) WITHOUT OPTIONAL RTC

SERIAL COMMUNICATION SELECTION

Serial line of **GMB HR168** 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 installing the opportune hardware on socket ZC1. In the following paragraphs there are all the information 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)

J3,J4	=	not connected	Hardware ZC1	= serial line in RS 232 (#)
J5	=	indifferent	IC10	= no device
J6	=	position 2-3	IC11	= no device
J7	=	position 2-3	IC12	= no device
J8	=	position 2-3	IC8	= no device

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

J3,J4	=	not connected	Hardware ZC1	= serial line TTL (#)
J5	=	indifferent	IC10	= no device
J6	=	position 1-2	IC11	= no device
J7	=	position 1-2	IC12	= driver HP 4200
J8	=	position 1-2	IC8	= 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 13÷15. 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)

J3,J4	=	(*)	Hardware ZC1	= serial line TTL (#)
J5	=	position 2-3 (**)	IC10	= driver SN 75176 or MAX 483
J6	=	position 1-2	IC11	= driver SN 75176 or MAX 483
J7	=	position 1-2	IC12	= no device
J8	=	position 1-2	IC8	= no device

Status of signal DIR (software managed with Mini Module signal selected with J10), 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.
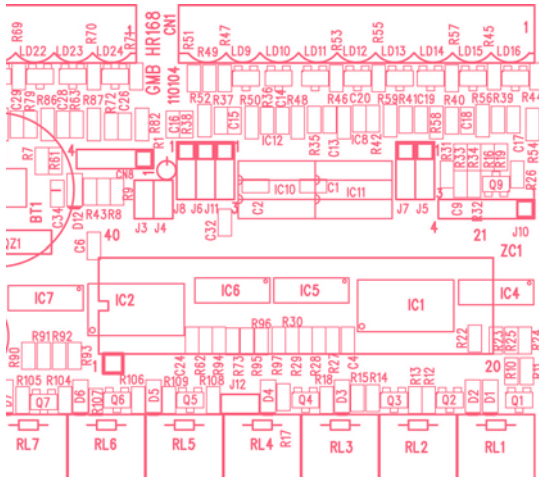
Serial in RS 232, TTL
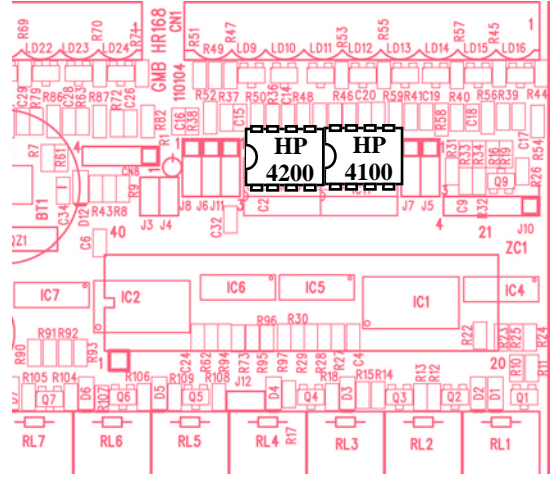
Serial in Current Loop
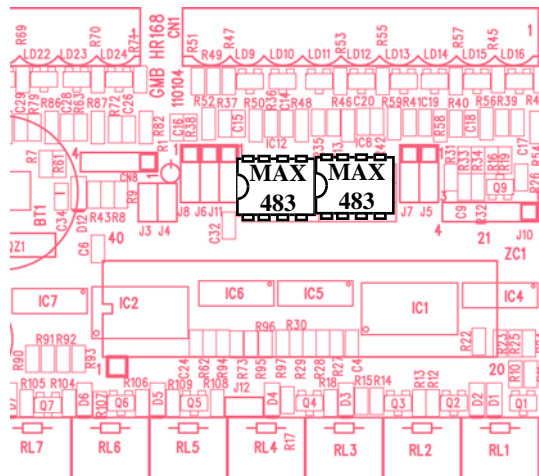
Serial in RS 422
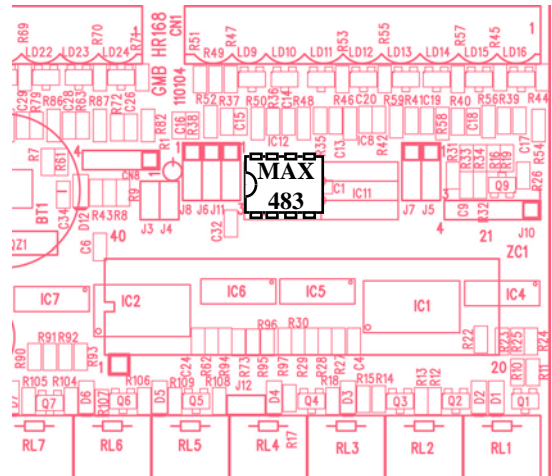
Serial in RS 485

FIGURE 35: SERIAL COMMUNICATION DRIVERS

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

J3,J4	=	(*)	Hardware ZC1	= serial in TTL (#)
J5	=	position 1-2 (**)	IC10	= driver SN 75176 or MAX 483
J6	=	position 1-2	IC11	= no device
J7	=	position 1-2	IC12	= no device
J8	=	position 1-2	IC8	= no device

In this modality the signals to use are pins 5 and 6 of connector CN6, 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

J3,J4	=	not connected	Hardware ZC1	= serial in TTL (#)
J5	=	indifferent	IC10	= no device
J6	=	position 2-3	IC11	= no device
J7	=	position 2-3	IC12	= no device
J8	=	position 2-3	IC8	= 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 jumpers J3 and J4. 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 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 connection of jumper J10:

J10 in position 1-2	->	DIR = MM PIN 17
J10 in position 2-3	->	DIR = MM PIN 30

This allows to use the resources of hardware installed on socket ZC1 the best way possible, whithout having to use and I/O signal of CN4 for serial communication.

(#)   Serial line of hardware installed on socket ZC1 must be designed to connect signals MM PIN 9 and MM PIN 10 respectively to RS 232 RX and TX where "serial line in RS 232" is required or TTL RX and TX (e. g., generated by a microcontroller on board UART) where "serial line in TTL" is required

For further information, refer to connection examples of figures 8÷15.
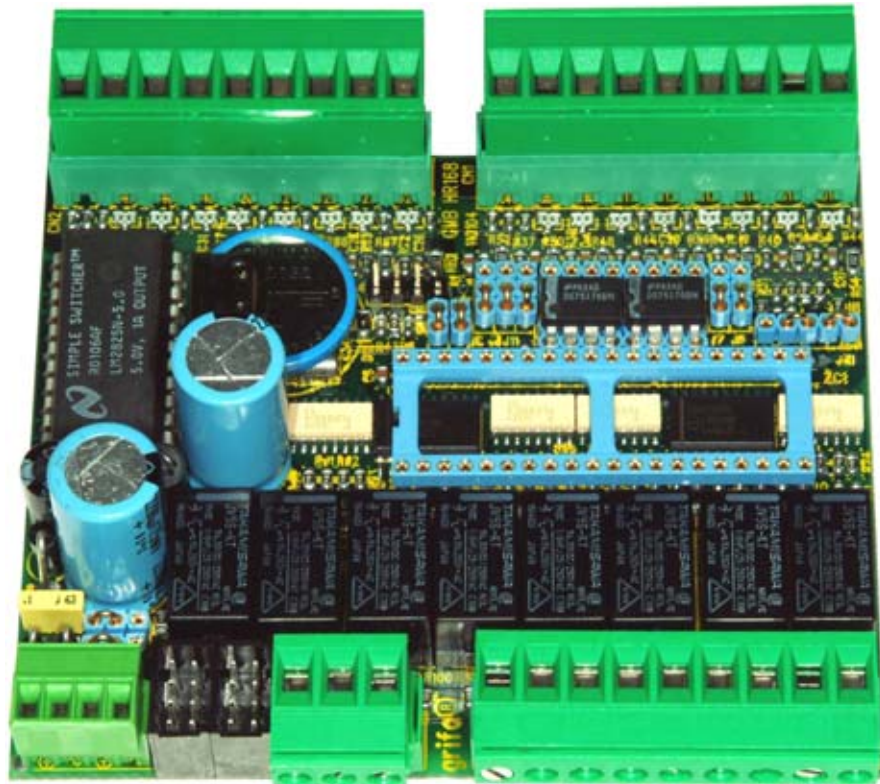
FIGURE 36: PHOTO OF GMB HR168 IN RS 422 (COD. RS422) WITH OPTIONAL RTC (COD .RTC)

PERIPHERAL DEVICES SOFTWARE DESCRIPTION

In the previous paragraphs are described the external registers addresses, while in this one there is a specific description of registers meaning and function (please refer to I/O addresses table, for the registers names and addresses values). For a more detailed description of the devices, please refer to documentation of **GMB HR168** + **grifo®** Mini Module combination. In the following paragraphs the **D7÷D0** and **.0÷7** indications denote the eight bits of the combination used in I/O operations.

RELAYS OUTPUTS

Staus of 8 digital relays outputs is set through 8 signals of 40 pin socket ZC1.
Please remark that signal driving relay OUT D2 can be connected either to signal MM PIN 16 or to signal MM PIN 30 according to the connection of jumper J10:

> J10 conncted in 3-4   ->   OUT D2 driven by MM PIN 30
> J10 connected in 4-5   ->   OUT D2 driven by MM PIN 16

When the signal of socket ZC1 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 open).
As previously said, LEDs LD1÷8 provide a visual indication of digital outputs status (LED ON = output actived).
Summarizing, the correspondance is:

MM PIN 29 , OUT A1 ->	LED LD1	MM PIN 14 , OUT C1 ->	LED LD5
MM PIN 28 , OUT A2 ->	LED LD2	MM PIN 15 , OUT C2 ->	LED LD6
MM PIN 27 , OUT B1 ->	LED LD3	MM PIN 18 , OUT D1 ->	LED LD7
MM PIN 26 , OUT B2 ->	LED LD4	(see above) , OUT D2 ->	LED LD8

SERIAL LINE

The signals used are the ones called TxD and RxD in figure 4, connected to signals MM PIN 9 and MM PIN 10 of 40 pins socket.

I²C BUS

Signals used are pin 2 of CN8 (SDA) and pin 3 of CN8 (SCL) as shown in figure 4, connected respectively to signals MM PIN 12 and MM PIN 13 of socket ZC1.
Signals SDA and SCL are also provided with 4.7 kΩ pull up resistors.
Slave address **A0H** is not usable by user if the optional Real Time Clock of **GMB HR168** (option **.RTC**) is installed or is used a **grifo®** Mini Module provided with on board Real Time Clock.

OPTOCOUPLED INPUTS

Status of 16 digital optocoupled inputs can be acquired by software by reading the status of corresponding singals of 40 pins socket, described in table of figure 4.
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 LD9÷24 give a visual indication of digital inputs status (LED ON means input actived).
In detail, green LEDs (from LD9 to LD16), visualize optocoupled inputs from IN1-1 to IN8-1 of group 1 and referring to common pin COM1, while yellow LEDs (from LD17 to LD24), visualize optocoupled inputs from IN1-2 to IN8-2 of group 2 and referring to common pin COM2.
Summarizing, the correspondance is:

```
MM PIN 32 , IN1-1   ->   LED LD16      MM PIN 1  , IN1-2   ->   LED LD24
MM PIN 31 , IN2-1   ->   LED LD15      MM PIN 2  , IN2-2   ->   LED LD23
MM PIN 25 , IN3-1   ->   LED LD14      MM PIN 3  , IN3-2   ->   LED LD22
MM PIN 24 , IN4-1   ->   LED LD13      MM PIN 4  , IN4-2   ->   LED LD21
MM PIN 23 , IN5-1   ->   LED LD12      MM PIN 35 , IN5-2   ->   LED LD20
MM PIN 22 , IN6-1   ->   LED LD11      MM PIN 36 , IN6-2   ->   LED LD19
MM PIN 21 , IN7-1   ->   LED LD10      MM PIN 37 , IN7-2   ->   LED LD18
MM PIN 19 , IN8-1   ->   LED LD9       MM PIN 38 , IN8-2   ->   LED LD17
```

DIGITAL TTL I/O

They are pins 2, 3, 4 and 6 of connector CN7, connected respectively to signals MM PIN 5, MM PIN 6, MM PIN 11 and MM PIN 30.
Pin 8 of CN7 can also be used as digital I/O connected to signal MM PIN 33 (if J11 is connected in position 1-2), but remembering that it is always connected to a 4.7 kΩ pull-down.
In addition, pin 4 is connected to a yellow LED (LD28) that visualizes its status; in case an optional Real Time Clock is installed this signal is connected to its open collector output /INTRTC and cannot be used as user digital I/O.

RTC + SRAM

GMB HR168 can be ordered with an optional Real Time Clock + SRAM module already installed (option **.RTC**).

The SRAM module, is provided with 256 bytes and the Real Time Clock which manages time (hours, minutes, seconds) and date (day, month, year, day of the week).

Option is delivered with on board Lithium battery installed.

RTC section can also generate periodic interrupts whose period can be programmed by the user, so it can be used to awaken CPU from low consumption working modes.

For software management of serial SRAM+RTC module, please refer to specific documentation or to demo programs supplied with the card.

The user must realize a serial communication with I²C bus standard protocol, through two ZC1 zoket signals.

The only necessary information is the electric connection:

DATA line (**SDA**) -> **MM PIN 12** P2.1 (input/output)
CLOCK line (**SCL**) -> **MM PIN 13** P2.0 (output)

Please remark that A0 of this component's slave address is bound to logic 0, so its slave address is hexadecimal **A0H**.

Logic state 0 of line corresponds to low level logic state (= 0 V), while logic state 1 correspons to high level logic state (= 5 V).

We also would want to remark that SDA and SCL lines are connected to a 4.7 KΩ pull-up resistor.

NOTE:

When using a **GMB HR168** provided with optional Real Time Clock, it is not possible to install a **grifo®** Mini Module with its own Real Time Clock on board, because they use the same slave address and would conflict.

EXTERNAL CARDS

GMB HR168 can be connected to all 28 pins and 40 pins Mini Modules and operator interface system produced by **grifo®**. The on board resources can be expanded with a simple connection to the numerous peripheral **grifo®** boards.

Connection to the field is easy because performed through standard connectors, that allow a prompt replacements with different models, also superior.

As an example, here follows a short list of peripheral **grifo®** boards with description and overall features, for further information please contact **grifo®** directly.

GMM AC2
grifo® Mini Module with Atmel T89C51AC2

This **grifo®** Mini Module has a 40 pin connector and it is based on Atmel T89C51AC2 CPU with 32K FLASH; 256 Byte RAM;1K ERAM; 2K FLASH for Bootloader; 2K EEPROM; 3 Timers Counters and 5 Programmable Counter Array channels (for PWM, watch dog, compare, capture); 32 TTL I/O lines; 8 A/D 10 bits; RS 232 or TTL serial line; I2C BUS; 2 status LEDs; configuration Dip switch; etc.

GMM AM32
grifo® Mini Module with Atmel ATmega32

This **grifo®** Mini Module has a 40 pin connector and it is based on Atmel ATmega32L CPU with 32K FLASH; 2K SRAM; 1K EEPROM; 3 Timer Counter eand 2 Programmable Counter Array channels; 4 PWM; 8 A/D; 1 Comparator; RTC + 240 Bytes SRAM, backed by Lithium battery; I2C BUS; Master/Slave SPI Serial Interface; JTAG Interface; 32 TTL I/O lines; RS 232 or TTL serial line; 2 status LEDs; configuration Dip switch; etc.

GMM 4620
grifo® Mini Modulo PIC 18F4620

This **grifo®** Mini Module has a 40 pin connector and it is based on CPU Microchip PIC 18F4620 with 64K FLASH; 4K SRAM; 1K EEPROM; 3 Timer Counter; 2 PWM; RTC + 240 Bytes SRAM, backed by Lithium battery; 13 A/D; 1 Comparator; I^2C BUS; Master/Slave SPI; 33 signals I/O TTL; RS 232 or TTL; 2 status LEDs; etc.

EXPS-2
EXternal Power Supply 2 tensioni

Mains power supply 75x55x90 mm with plastic container. Input voltage: 230 Vac, 50 Hz. Output voltages: 20 Vdc, 200 mA e 15 Vac, 300 mA galvanically isolated. Standard wall plug for input power supply.

QTP G28
Quick Terminal Panel - LCD Graphic, 16 LEDs, 28 keys

LCD display 240x128 pixels, CFC backlit; Optocoupled RS 232 line and additional RS 232/422/485/ C. L. line; CAN line controller; E^2 for set up; RTC and RAM lithium backed; primary graphic object; possibility of re-naming keys, LEDs and panel name; 28 keys and 16 LEDs with blinking attribute and buzzer manageable by software; Buzzer; built-in power supply; reader of magnetic badge and relay option.

QTP 22
Quick Terminal Panel, 22 LEDs, 22 keys

Intelligent user panel equipped with Fluorescent or LCD display, LEDs backlit, 40x2 or 40x4 characters; RS 232, RS 422, RS 485 or Current Loop serial line; serial E2 for set up and message. Pssibility of re-naming keys, LEDs and panel name by inserting label with new name into the proper slot; 22 Keys and 22 LEDs with blinking attribute and buzzer manageable by software; built in power supply; RTC option, reader of magnetic badge and relay.

QTP 24
Quick Terminal Panel, 16 LEDs, 24 keys

Intelligent user panel equipped with Fluorescent or LCD display, LEDs backlit, 20x2 or 20x4 characters; RS 232, RS 422, RS 485 or Current Loop serial line; serial E2 for set up and message. Pssibility of re-naming keys, LEDs and panel name by inserting label with new name into the proper slot; 24 Keys and 16 LEDs with blinking attribute and buzzer manageable by software; built in power supply; RTC option, reader of magnetic badge and relay.

QTP 03
Quick Terminal Panel, 3 keys max.

Operator interface provded with alphanumeric display 20x2, 20x4, 20x4 BIG, 40x1 and 40x2 characters both LCD and fluorescent; display LCD backlit by LED; interfacce for tastiera three keys external keyboard; serial interface in RS 232 or TTL; setup in EEPROM ; buzzer. Management firmware featuring terminal functions with primitives to control visualization.

QTP 4x6
Quick Terminal Panel, 24 keys max.

Operator interface provded with alphanumeric display 20x2, 20x4, 20x4 BIG, 40x1 and 40x2 characters both LCD and fluorescent; display LCD backlit by LED; interfacce for tastiera three keys external keyboard; RS 232, RS 422, RS 485 or Current Loop serial line; setup in EEPROM ; buzzer. Management firmware featuring terminal functions with primitives to control visualization.

QTP 12
Quick Terminal Panel, 1 LED, 1 LEDs, 12 keys + CAN

Intelligent user panel equipped with Fluorescent or LCD display, LEDs backlit, 20x2 characters; graphic Fluorescente display 140x16 pixel; interface for 12 keys keyboard; serial interface can be buffered in RS 232, RS 422, RS 485 or Current Loop; CAN interface; set up parameters on EEPROM; buzzer. Control firmware performing terminal functions with video management commands.

QTP 16
Quick Terminal Panel, 1 LED, 16 keys

Intelligent user panel equipped with Fluorescent or LCD display, LEDs backlit, 20x2, 20x4 characters; interface for 16 keys keyboard; serial interface can be buffered in RS 232, RS 422, RS 485 or Current Loop; set up parameters on EEPROM; buzzer; 4 opto-input redable for serial lines. Control firmware performing terminal functions with video management commands.
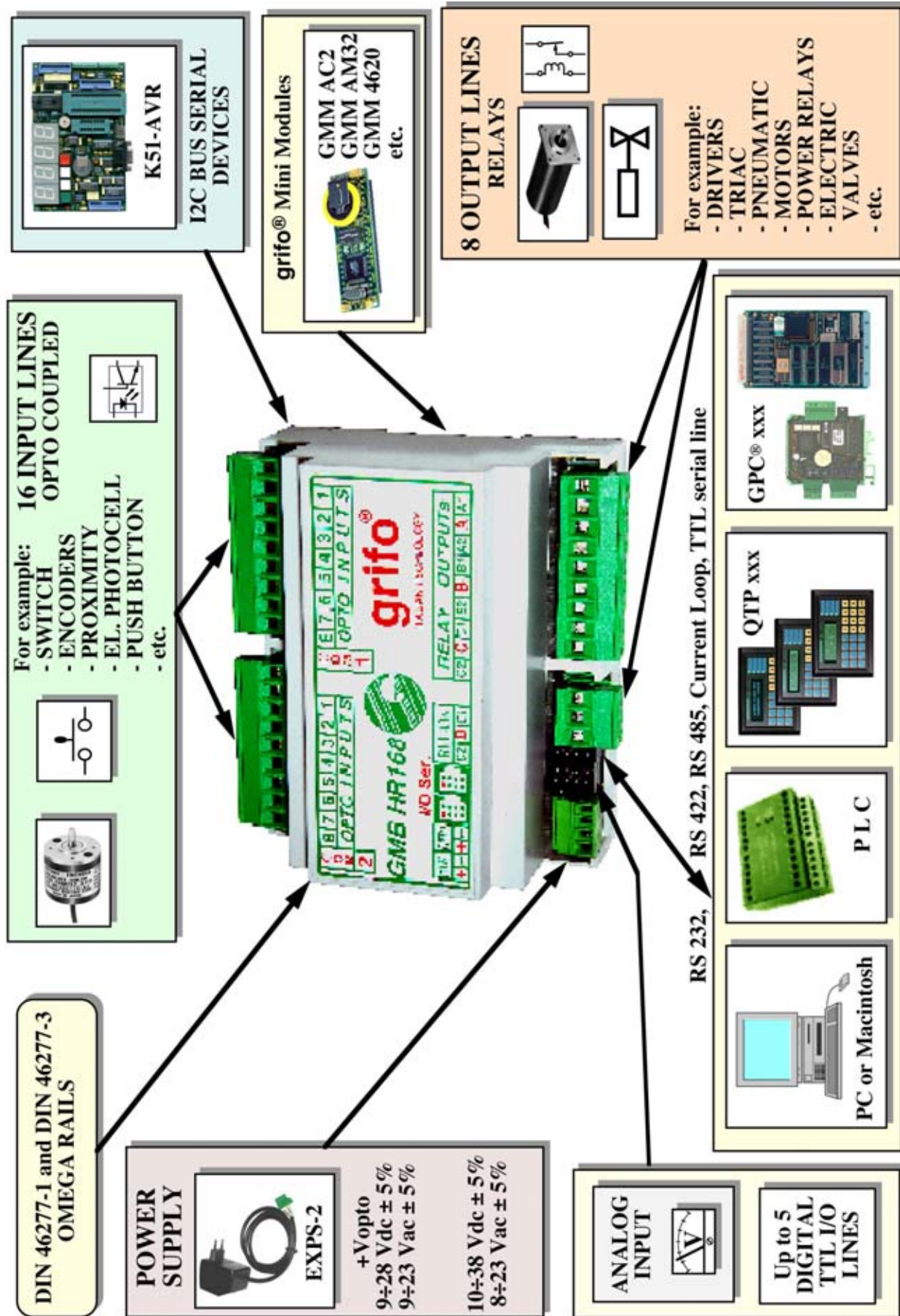
FIGURE 37: POSSIBLE CONNECTIONS DIAGRAM

BIBLIOGRAPHY

In this chapter there is a complete list of technical books, where the user can find all the necessary documentations on the components mounted on **GMB HR168**.

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

Manual PHILIPS: *I²C-bus compatible ICs*

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

Manual TAKAMISAWA: *Relays index Book*

Manual NATIONAL SEMICONDUCTOR: *Linear Databook - Volume 1*

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: DATA SHEET

grifo® provides a completely free technical documentation service to make available data sheets of on board components, through its web site. In this chapter the user found the complete and ready to use links and URLs to these information, together with the first pages of the same documents. To use our technical documentation service just connect to our site www.grifo.com and click its icon.

PCF 8583

Link: Home | Technical documentation Service | Philips | Data-Sheet PCF 8583
URL: http://www.grifo.com/PRESS/DOC/Philips/PCF8583.pdf

Philips Semiconductors   Product specification

Clock/calendar with 240 × 8-bit RAM   PCF8583

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7 FUNCTIONAL DESCRIPTION

The PCF8583 contains a 256 by 8-bit RAM with an 8-bit auto-increment address register, an on-chip 32.768 kHz oscillator circuit, a frequency divider, a serial two-line bidirectional I²C-bus interface and a power-on reset circuit.

The first 16 bytes of the RAM (memory addresses 00 to 0F) are designed as addressable 8-bit parallel special function registers. The first register (memory address 00) is used as a control/status register. The memory addresses 01 to 07 are used as counters for the clock function. The memory addresses 08 to 0F may be programmed as alarm registers or used as free RAM locations, when the alarm is disabled.

7.1   Counter function modes

When the control/status register is programmed, a 32.768 kHz clock mode, a 50 Hz clock mode or an event-counter mode can be selected.

In the clock modes the hundredths of a second, seconds, minutes, hours, date, month (four year calendar) and weekday are stored in a BCD format. The timer register stores up to 99 days. The event counter mode is used to count pulses applied to the oscillator input (OSCO left open-circuit). The event counter stores up to 6 digits of data.

When one of the counters is read (memory locations 01 to 07), the contents of all counters are strobed into capture latches at the beginning of a read cycle. Therefore, faulty reading of the count during a carry condition is prevented.

When a counter is written, other counters are not affected.

7.2   Alarm function modes

By setting the alarm enable bit of the control/status register the alarm control register (address 08) is activated.

By setting the alarm control register a dated alarm, a daily alarm, a weekday alarm or a timer alarm may be programmed. In the clock modes, the timer register (address 07) may be programmed to count hundredths of a second, seconds, minutes, hours or days. Days are counted when an alarm is not programmed.

Whenever an alarm event occurs the alarm flag of the control/status register is set. A timer alarm event will set the alarm flag and an overflow condition of the timer will set the timer flag. The open drain interrupt output is switched on (active LOW) when the alarm or timer flag is set (enabled). The flags remain set until directly reset by a write operation.

When the alarm is disabled (Bit 2 of control/status register = 0) the alarm registers at addresses 08 to 0F may be used as free RAM.

7.3   Control/status register

The control/status register is defined as the memory location 00 with free access for reading and writing via the I²C-bus. All functions and options are controlled by the contents of the control/status register (see Fig.3).

7.4   Counter registers

In the clock modes 24 h or 12 h format can be selected by setting the most significant bit of the hours counter register. The format of the hours counter is shown in Fig.5.

The year and date are packed into memory location 05 (see Fig.6). The weekdays and months are packed into memory location 06 (see Fig.7). When reading these memory locations the year and weekdays are masked out when the mask flag of the control/status register is set. This allows the user to read the date and month count directly.

In the event-counter mode events are stored in BCD format. D5 is the most significant and D0 the least significant digit. The divider is by-passed.

In the different modes the counter registers are programmed and arranged as shown in Fig.4. Counter cycles are listed in Table 1.

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Fig.3 Control/status register.

MSB / LSB bits: 7 6 5 4 3 2 1 0

memory location 00
reset state: 0000 0000

timer flag (50% duty factor
seconds flag if alarm
enable bit is 0)

alarm flag (50% duty factor
minutes flag if alarm
enable bit is 0)

alarm enable bit:
0 alarm disabled: flags toggle
   alarm control register disabled
   (memory locations 08 to 0F
   are free RAM space)
1 enable alarm control register
   (memory location 08 is the
   alarm control register)

mask flag:
0 read locations 05 to 06
   unmasked
1 read date and month count
   directly

function mode :
00 clock mode 32.768 kHz
01 clock mode 50 Hz
10 event-counter mode
11 test modes

hold last count flag :
0 count
1 store and hold last count in
   capture latches

stop counting flag :
0 count pulses
1 stop counting, reset divider

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Fig.4 Register arrangement.

CLOCK MODES

control/status		
hundredth of a second	1/10 s	1/100 s
seconds		1 s
10 s		1 s
minutes		1 min
10 min		1 min
hours		1 h
10 h		1 h
year/date		1 day
10 day		1 day
weekday/month		1 month
10 month		1 month
timer		
10 day		1 day
alarm control		
hundredth of a second	1/10 s	1/100 s
alarm seconds		
alarm minutes		
alarm hours		
alarm date		
alarm month		
alarm timer		
free RAM		

EVENT COUNTER

control/status		
00	D1	D0
01	D3	D2
02	D5	D4
03	free	
04	free	
05	free	
06	timer	
07	T1	T0
08	alarm control	
09	alarm D1	alarm D0
0A	D3	D2
0B	D5	D4
0C	free	
0D	free	
0E	free	
0F	alarm timer	
	free RAM	

MRB015

Product specification

Clock/calendar with 240 × 8-bit RAM

PCF8583

Table 1   Cycle length of the time counters, clock modes

UNIT	COUNTING CYCLE	CARRY TO NEXT UNIT	CONTENTS OF THE MONTH COUNTER
Hundredths of a second	00 to 99	99 to 00	-
Seconds	00 to 59	59 to 00	-
Minutes	00 to 59	59 to 00	-
Hours (24 h)	00 to 23	23 to 00	-
Hours (12 h)	12 AM	-	-
	01 AM to 11 AM	-	-
	12 PM	-	-
	01 PM to 11 PM	11 PM to 12 AM	-
Date	01 to 31	31 to 01	1, 3, 5, 7, 8, 10 and 12
	01 to 30	30 to 01	4, 6, 9 and 11
	01 to 29	29 to 01	2, year = 0
	01 to 28	28 to 01	2, year = 1, 2 and 3
Months	01 to 12	12 to 01	-
Year	0 to 3	-	-
Weekdays	0 to 6	6 to 0	-
Timer	00 to 99	no carry	-

7.5   Alarm control register

When the alarm enable bit of the control/status register is set (address 00, bit 2) the alarm control register (address 08) is activated. All alarm, timer, and interrupt output functions are controlled by the contents of the alarm control register (see Fig.8).

7.6   Alarm registers

All alarm registers are allocated with a constant address offset of hexadecimal 08 to the corresponding counter registers (see Fig.4, Register arrangement).

An alarm signal is generated when the contents of the alarm registers matches bit-by-bit the contents of the involved counter registers. The year and weekday bits are ignored in a dated alarm. A daily alarm ignores the month and date bits. When a weekday alarm is selected, the contents of the alarm weekday/month register will select the weekdays on which an alarm is activated (see Fig.9).

Remark: In the 12 h mode, bits 6 and 7 of the alarm hours register must be the same as the hours counter.

Product specification

Clock/calendar with 240 × 8-bit RAM

PCF8583

memory location 04 (hours counter)
reset state : 0000 0000

unit hours BCD

ten hours (0 to 2 binary)

AM/PM flag:
0   AM
1   PM

format :
0   24 h format, AM/PM flag
    remains unchanged
1   12 h format, AM/PM flag
    will be updated

Fig.5 Format of the hours counter.

memory location 05 (year/date)
reset state : 0000 0001

unit days BCD

ten days (0 to 3 binary)

year (0 to 3 binary, read as 0 if
the mask flag is set)

Fig.6 Format of the year/date counter.

memory location 06 (weekdays/months)
reset state: 0000 0001

unit months BCD

ten months

weekdays (0 to 6 binary, read as 0 if
the mask flag is set)

Fig.7 Format of the weekdays/month counter.

Fig.8 Alarm control register; clock mode.

memory location 08
reset state: 0000 0000

timer function :
000 no timer
001 hundredths of a second
010 seconds
011 minutes
100 hours
101 days
110 not used
111 test mode, all counters in parallel (factory use only)

timer interrupt enable :
0 timer flag, no interrupt
1 timer flag, interrupt

clock alarm function :
00 no clock alarm
01 daily alarm
10 weekday alarm
11 dated alarm

timer alarm enable :
0 no timer alarm
1 timer alarm

alarm interrupt enable :
(valid only when 'alarm enable' in control / status register is set)
0 alarm flag, no interrupt
1 alarm flag, interrupt

Fig.9 Selection of alarm weekdays.

memory location 0E (alarm weekday / month)
weekday 0 enabled when set
weekday 1 enabled when set
weekday 2 enabled when set
weekday 3 enabled when set
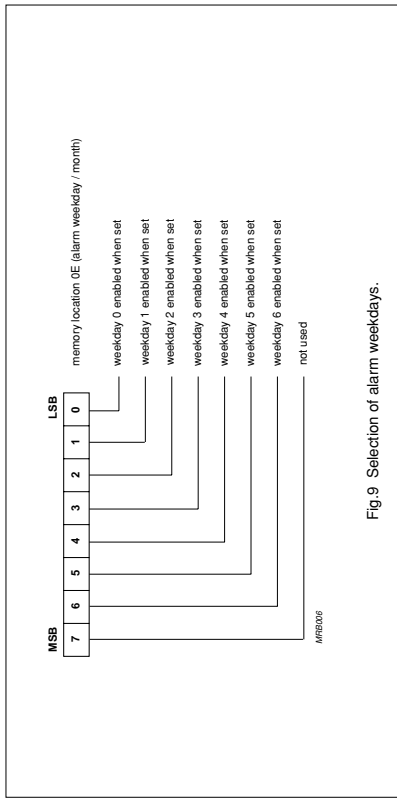weekday 4 enabled when set
weekday 5 enabled when set
weekday 6 enabled when set
not used

7.7 Timer

The timer (location 07) is enabled by setting the control/status register = XX0X X1XX. The timer counts up from 0 (or a programmed value) to 99. On overflow, the timer resets to 0. The timer flag (LSB of control/status register) is set on overflow of the timer. This flag must be reset by software. The inverted value of this flag can be transferred to the external interrupt by setting bit 3 of the alarm control register.

Additionally, a timer alarm can be programmed by setting the timer alarm enable (bit 6 of the alarm control register). When the value of the timer equals a pre-programmed value in the alarm timer register (location 0F), the alarm flag is set (bit 1 of the control/status register). The inverted value of the alarm flag can be transferred to the external interrupt by enabling the alarm interrupt (bit 6 of the alarm control register).

Resolution of the timer is programmed via the 3 LSBs of the alarm control register (see Fig.11, Alarm and timer Interrupt logic diagram).

7.8 Event counter mode

Event counter mode is selected by bits 4 and 5 which are logic 1, 0 in the control/status register. The event counter mode is used to count pulses externally applied to the oscillator input (OSCO left open-circuit).

The event counter stores up to 6 digits of data, which are stored as 6 hexadecimal values located in locations 1, 2, and 3. Thus, up to 1 million events may be recorded.

An event counter alarm occurs when the event counter registers match the value programmed in locations 9, A, and B, and the event alarm is enabled (bits 4 and 5 which are logic 0, 1 in the alarm control register). In this event, the alarm flag (bit 1 of the control/status register) is set. The inverted value of this flag can be transferred to the interrupt pin (pin 7) by setting the alarm interrupt enable in the alarm control register. In this mode, the timer (location 07) increments once for every one, one-hundred, ten thousand, or 1 million events, depending on the value programmed in bits 0, 1 and 2 of the alarm control register. In all other events, the timer functions are as in the clock mode.

7.9 Interrupt output

The conditions for activating the open-drain n-channel interrupt output INT (active LOW) are determined by appropriate programming of the alarm control register. These conditions are clock alarm, timer alarm, timer overflow, and event counter alarm. An interrupt occurs when the alarm flag or the timer flag is set, and the corresponding interrupt is enabled. In all events, the interrupt is cleared only by software resetting of the flag which initiated the interrupt.
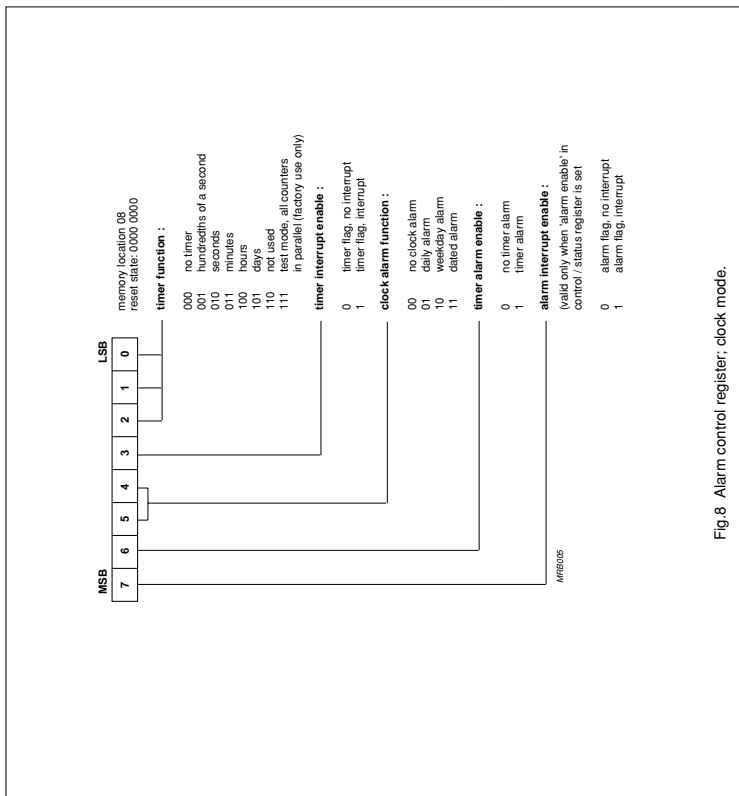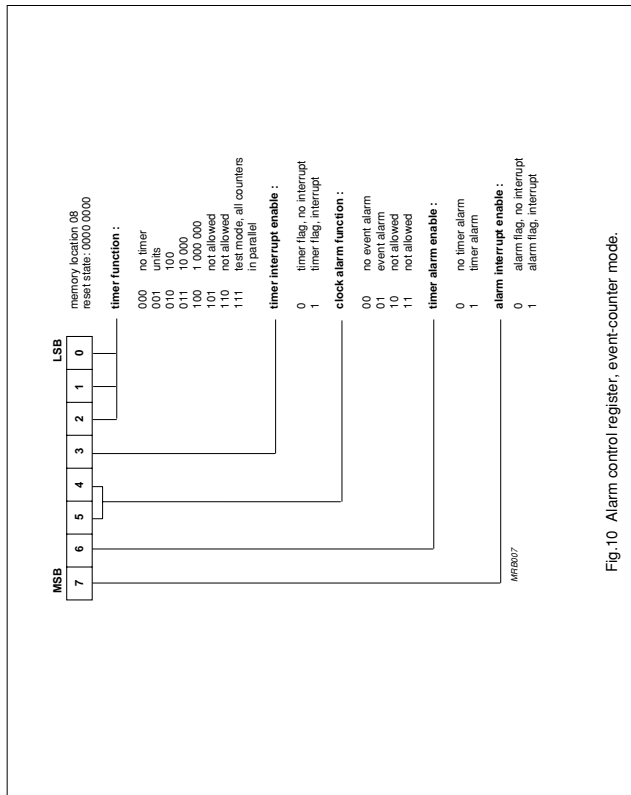
Philips Semiconductors

Product specification

Clock/calendar with 240 × 8-bit RAM

PCF8583

MSB 7 6 5 4 3 2 1 **LSB** 0

memory location 08
reset state : 0000 0000

timer function :

000   no timer
001   units
010   100
011   10 000
100   1 000 000
101   not allowed
110   not allowed
111   test mode, all counters
      in parallel

timer interrupt enable :

0   timer flag, no interrupt
1   timer flag, interrupt

clock alarm function :

00   no event alarm
01   event alarm
10   not allowed
11   not allowed

timer alarm enable :

0   no timer alarm
1   timer alarm

alarm interrupt enable :

0   alarm flag, no interrupt
1   alarm flag, interrupt

MFB007

Fig.10 Alarm control register, event-counter mode.

In the clock mode, if the alarm enable is not activated (alarm enable bit of control/status register is logic 0), the interrupt output toggles at 1 Hz with a 50% duty cycle (may be used for calibration). This is the default power-on state of the device. The OFF voltage of the interrupt output may exceed the supply voltage, up to a maximum of 6.0 V.
A logic diagram of the interrupt output is shown in Fig.11.

7.10 Oscillator and divider

A 32.768 kHz quartz crystal has to be connected to OSCI (pin 1) and OSCO (pin 2). A trimmer capacitor between OSCI and V_{DD} is used for tuning the oscillator (see quartz frequency adjustment). A 100 Hz clock signal is derived from the quartz oscillator for the clock counters.

In the 50 Hz clock mode or event-counter mode the oscillator is disabled and the oscillator input is switched to a high impedance state.

This allows the user to feed the 50 Hz reference frequency or an external high speed event signal into the input OSCI.

7.11 Initialization

When power-up occurs the I²C-bus interface, the control/status register and all clock counters are reset. The device starts time-keeping in the 32.768 kHz clock mode with the 24 h format on the first of January at 0.00.00: 00. A 1 Hz square wave with 50% duty cycle appears at the interrupt output pin (starts HIGH).

It is recommended to set the stop counting flag of the control/status register before loading the actual time into the counters. Loading of illegal states may lead to a temporary clock malfunction.

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1997 Jul 15

APPENDIX B: ALPHABETICAL INDEX