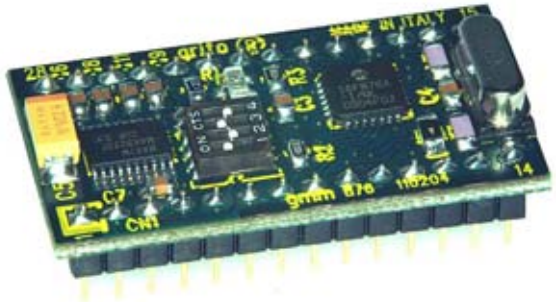
GMB HR84

Housing Relay - 8 Opto In, 4 Outputs

GMM 876

grifo® Mini Module PIC16F876A

TECHNICAL MANUAL



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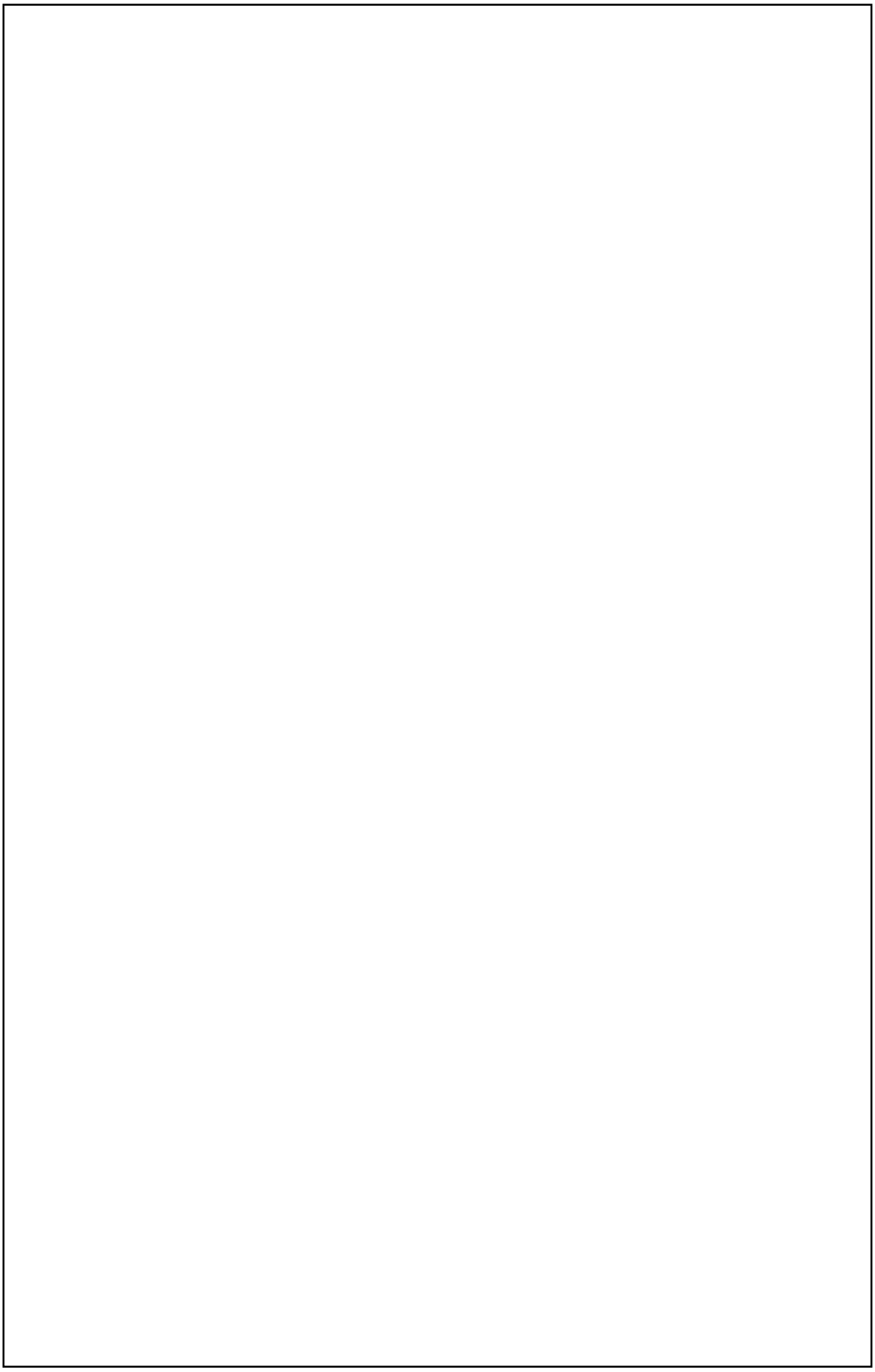
GMB HR84 & GMM 876 Rel. 5.00 *Edition 22 December 2004*



GMB HR84

Housing Relay - 8 Opto In, 4 Outputs

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TECHNICAL MANUAL

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; **GMM 876** included in delivery; **8** Optocoupled Inputs that can be both **NPN** or **PNP**; status of **8** inputs shown by **8 LEDs**; one input can pefrom **Interrupt** functions; two inputs can perform Counter functions; **4** Relay Outputs **5 A**; status of **4** outputs shown by **4 LEDs**; Serial Line in RS 232, RS 422, RS 485, current loop or **TTL**; 1 anaolog signal for **A/D** conversion with selectable full range; all signals can be connected through connectors featuring **Normalized** pin out; **4 I/O TTL** signals; **I^2C 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; possibility to manage internal FLASH and EEPROM in **In System Programming** mode; free software for **PC**, downloadable from Microchip web site, to support **ISP** programming upload the generated code into on-board FLASH memory; wide range of development software available: **C** Compilers (HI Tech C PIC); **BASIC** Compilers (mikroBasic, PIC BASIC PRO); **PASCAL** Compilers (mikroPascal); etc.; several demo programs and use examples provided as source code completely commented available for every development structure

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IMPORTANT

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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** and **GMM 876** card release **110204**. The validity of the bring informations is subordinate to the number of the card release.

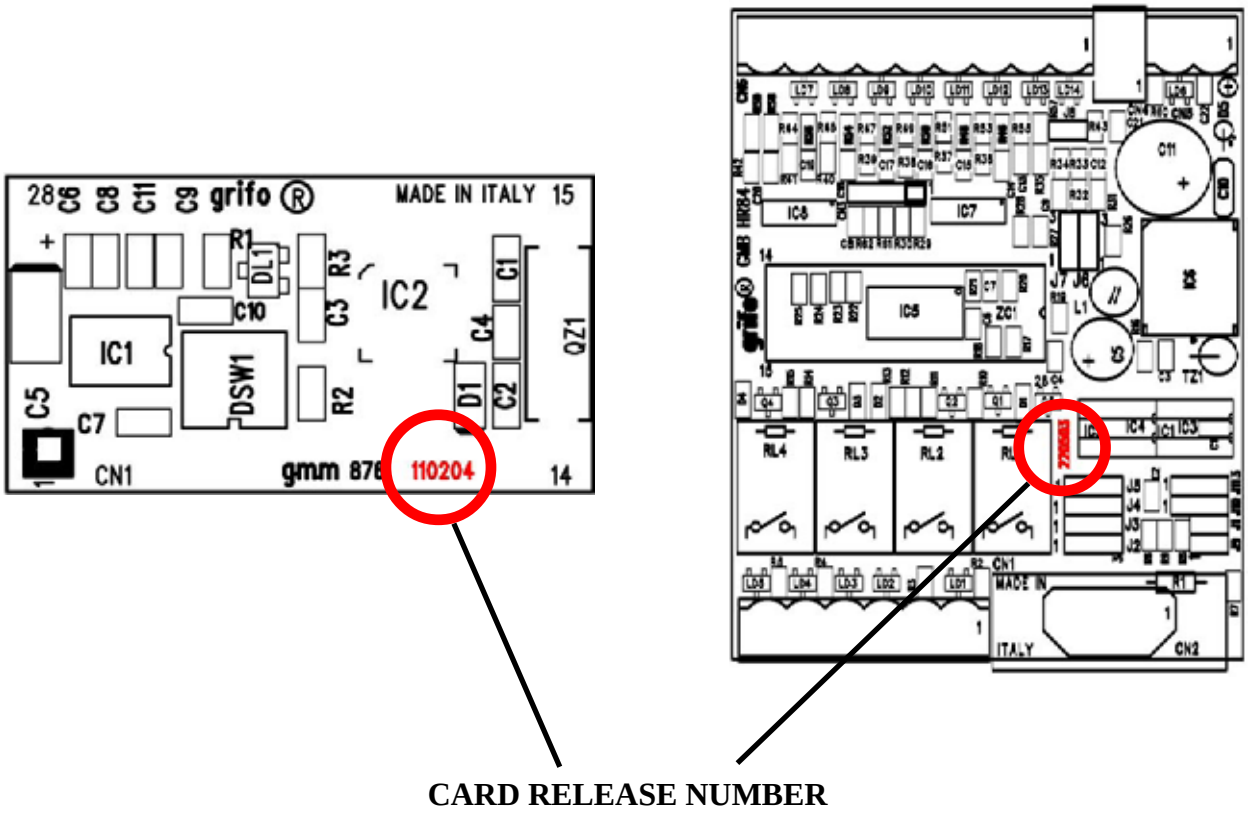


FIGURE 1: POSITION OF CARD RELEASE OF GMM 876 AND GMB HR84

GENERAL INFORMATION

GMB HR84 & GMM 876 is a module for DIN rail with a **grifo®** Mini Module CPU type **GMM 876** already 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.
The union **GMB HR84 & GMM 876** 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 **mikroBASIC** and **PIC BASIC PRO**, unexpensive and portable, C compilers **HI Tech C PIC**, or **mikroPascal**, a **PASCAL** compiler 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 union **GMB HR84 & GMM 876** 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
- **GMM 876** included in delivery
- **8 Optocoupled Inputs** that can be both **NPN** or **PNP**
- Status of **8** inputs shown by **8 LEDs**
- One input can pefrom **Interrupt** functions
- Two inputs can perform **Counter** functions
- **4 Relay** Outputs **5 A**
- Status of 4 outputs shown by **4 LEDs**
- **Serial Line** in RS 232, RS 422, RS 485, current loop or TTL
- 1 anaolog signal for **A/D** conversion with selectable full range
- All signals can be connected through connectors featuring **Normalized** pin out
- **4 I/O TTL** signals
- **I²C BUS** availabe 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
- Possibility to manage internal FLASH and EEPROM in **In System Programming** mode
- Free software for PC, downloadable from MICROCHIP web site, to support **ISP** programming upload the generated code into on-board FLASH memory
- Wide range of development software available: C compilers (**HI Tech C PIC**); BASIC compilers (**mikroBasic**, **PIC BASIC PRO**); PASCAL compilers (**mikroPascal**); etc.
- Several demo programs and use examples provided as source code completely commented available for every development structure

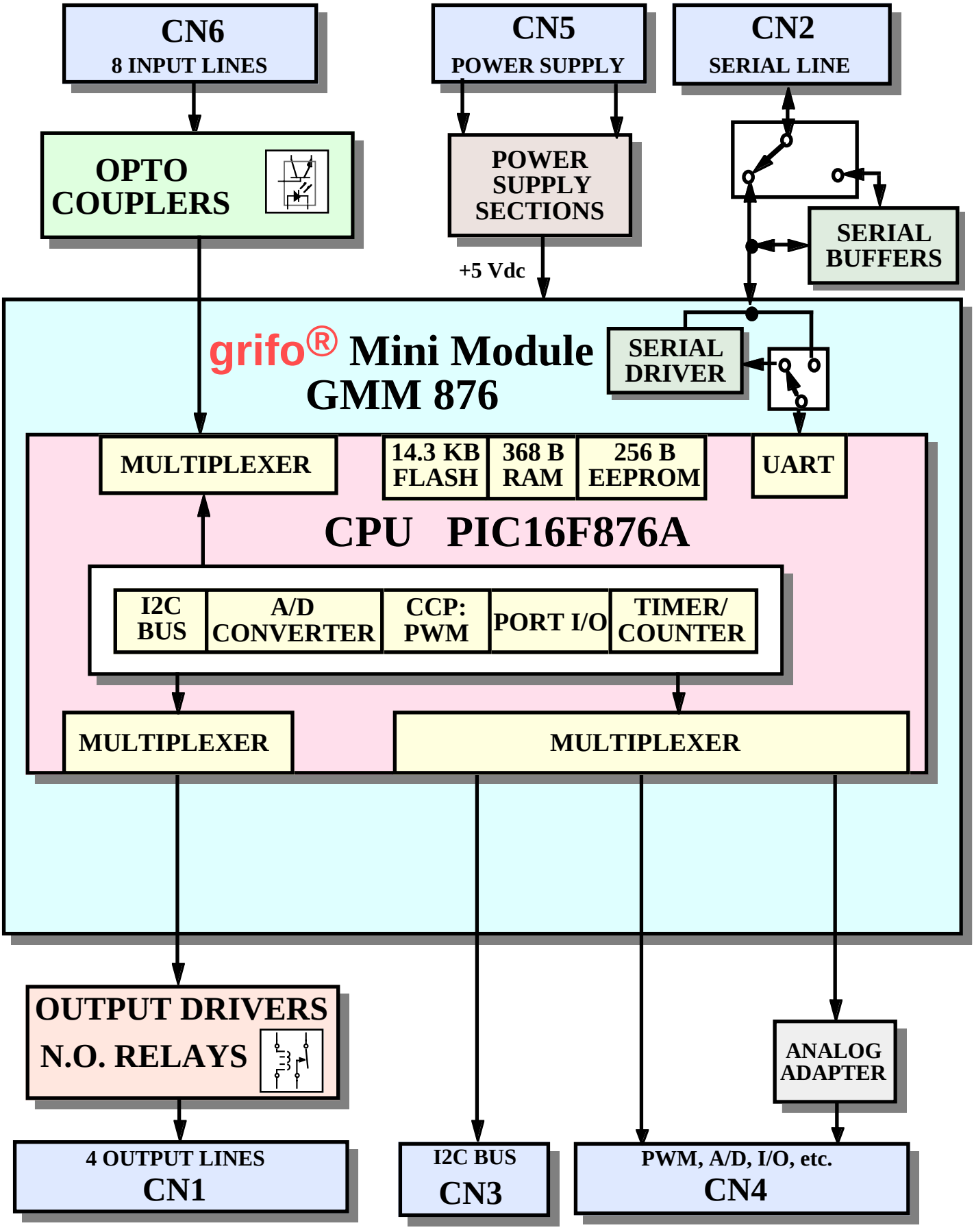


FIGURE 2: BLOCKS DIAGRAM

ANALOG INPUT

One analog input is available on pin 8 of connector CN4 (input signal AN4).
When using the analog input, voltage reference source must be the internal Vdd and Vss source.
For further information please refer to manual **GMB HR84**.

OPTOCOUPLED DIGITAL INPUT LINES

The card features 8 NPN/PNP inputs connected to two quick release screw terminal connectors and visualized by specific LEDs.
Optocoupled inputs are supplied by a specific external voltage called +Vopto that the user must provide.
For further information please refer to manual **GMB HR84**.

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 signal of **GMM 876**, buffered through a specific driver and connected to a comfortable quick release screw terminal connector to easy interface to the field signals.
For further information please refer to manuals **GMB HR84** and **GMM 876**.

I/O TTL SIGNALS

GMB HR84 features up to 4 digital I/O TTL signals of **GMM 876** connected to a specific connector (CN4).
For further information please refer to manuals **GMB HR84** and **GMM 876**.

FIGURE 3: SNAPSHOT OF GMB HR84 AND MINI MODULE GMM 876

I²C BUS LINES

GMB HR84 is provided with one connector (CN8) dedicated to I²C BUS, a hardware peripheral of the microcontroller, connected to two signals of **GMM 876** (RC.4 and RC.3), 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.
For further information please refer to manuals **GMB HR84** and **GMM 876**.

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”.

SERIAL COMMUNICATION

GMB HR84 features one AMP MODU II 2x4 P/N 280365 dedicated connector (CN6) for 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 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 signal RC.2, provided that the configuration of jumper J10 is in position 2-3.
For further information please refer to manuals **GMB HR84** and **GMM 876**.

TECHNICAL FEATURES

GENERAL FEATURES

On board resources:	8 optocoupled digital inputs NPN and PNP 1 optocoupled digital input NPN and PNP is interrupt 2 optocoupled digital inputs NPN and PNP are counters 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 eight bit PWM output Up to 4 digital I/O TTL 1 switching power supply section 14 status LEDs + 2 internal LEDs 1 internal eight pin Dip Switch
Mini Module:	**GMM 876**
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:	170 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 - 310 mA - 13 mA = 77 mA	
Relays max voltage:	35 Vdc	
Relays max non inductive current:	5 A	(resistive load)
On board battery:	3.0 Vdc; 180 mAh	
Backup current:	2.3 µA	
Optocouplers input voltage:	+V opto = 8 ÷ 30 Vdc	(*)
Power required for optocouplers:	4.4 W	
Analog input range:	0÷2.5; 0÷10 V	
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

(*) 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

Module **GMB HR84 & GMM 876** 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 17).

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.

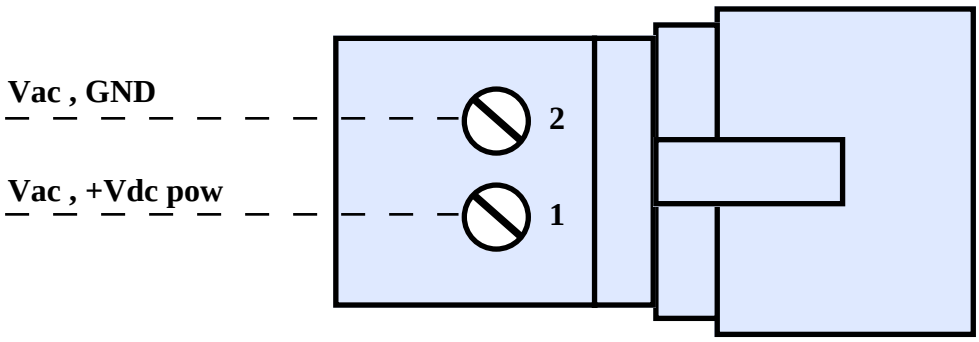


FIGURE 4: CN5 - POWER SUPPLY CONNECTOR

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.

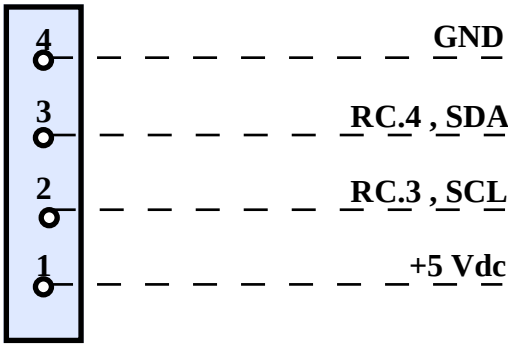


FIGURE 5: CN3 - I²C BUS LINE CONNECTOR

Signals description:

RC.4, SDA = I/O - Data signal of I²C BUS software serial line connected to RC.4.
RC.3, SCL = O - Clock signal of I²C BUS software serial line connected to RC.3.
+5 Vdc = O - Unique +5 Vdc power supply.
GND = - Ground.

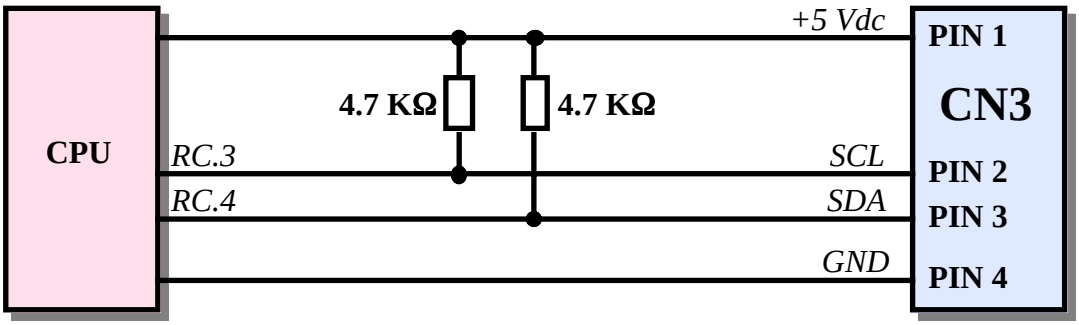


FIGURE 6: I²C BUS CONNECTION DIAGRAM

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.
For further information please refer to figure 8 or to the manuals of **GMB HR84** and **GMM 876**.

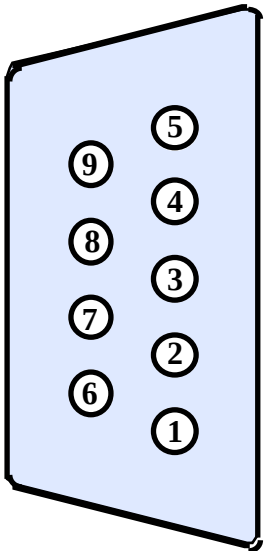


FIGURE 7: CN2 - SERIAL LINE CONNECTOR

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.

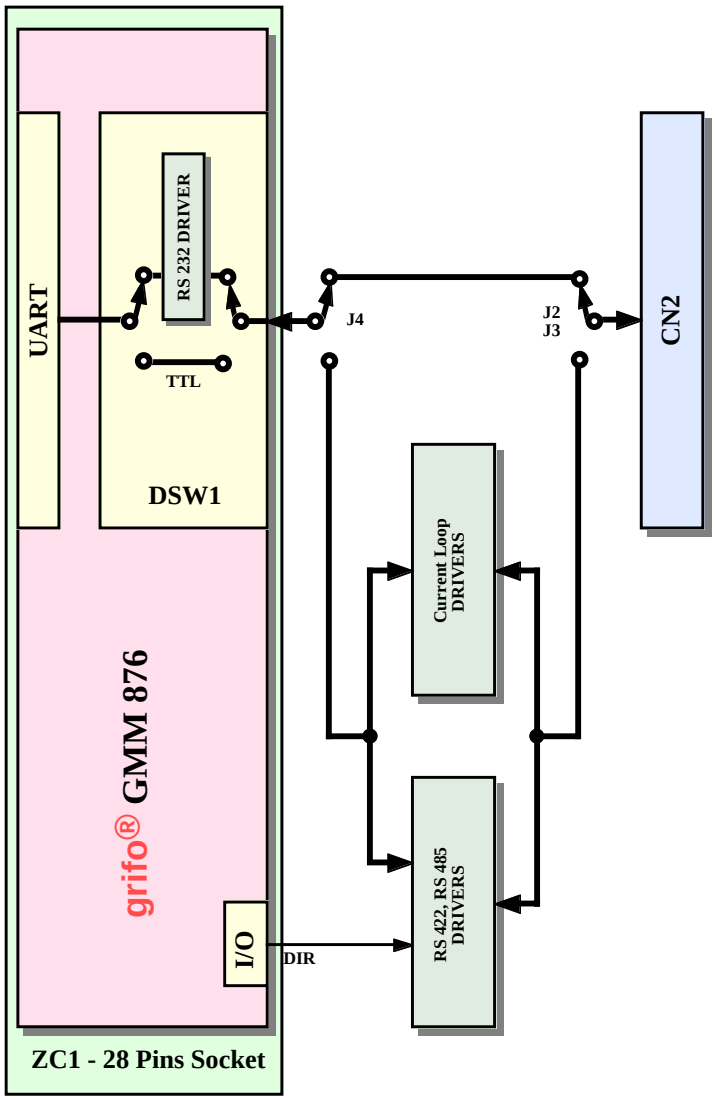


FIGURE 8: SERIAL COMMUNICATION BLOCK DIAGRAM

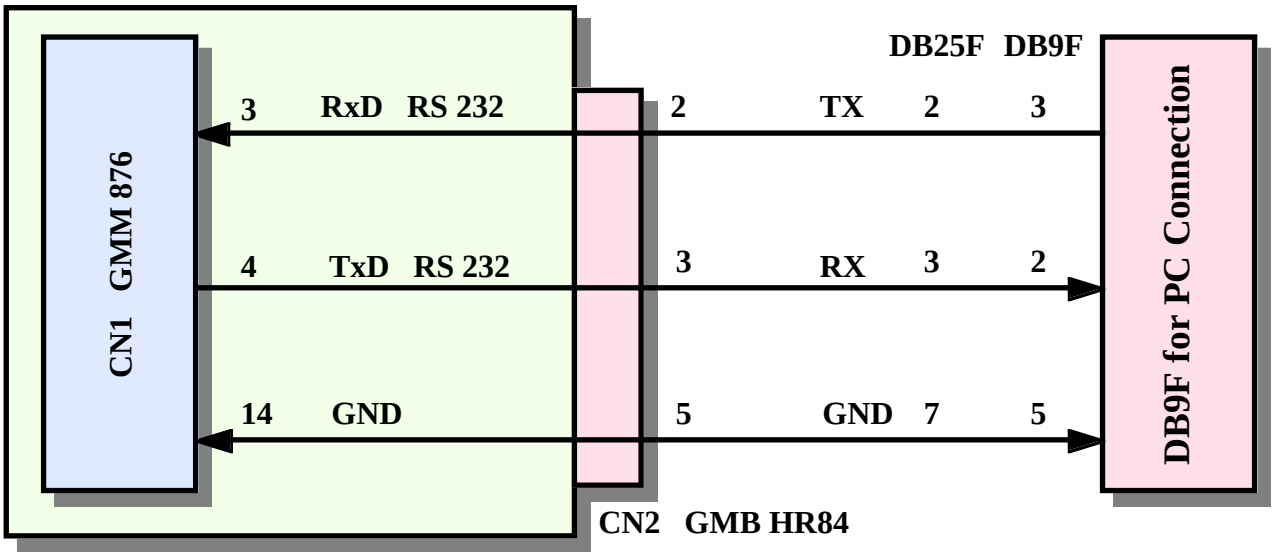


FIGURE 9: RS 232 PC POINT TO POINT CONNECTION EXAMPLE

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.
One of these **inputs** (IN3) are connected directly to **interrupt** signal, so it can generate an immediate interrupt request to the CPU.
Two more of these **inputs** (IN5 and IN6) are connected to the exernal trigger of timer/counters, so transictions on these inputs can be **counted by hardware** by CPU.
Please refer to figure 19 for further information.
Connector also features the common pin where to connect one input to close it.
These signals are software managed through **GMM 876**I/O ports have been carefully selected to take advantage of **grifo®** Mini Modules internal peripherals.
For further information please refer to manual **GMB HR84**.

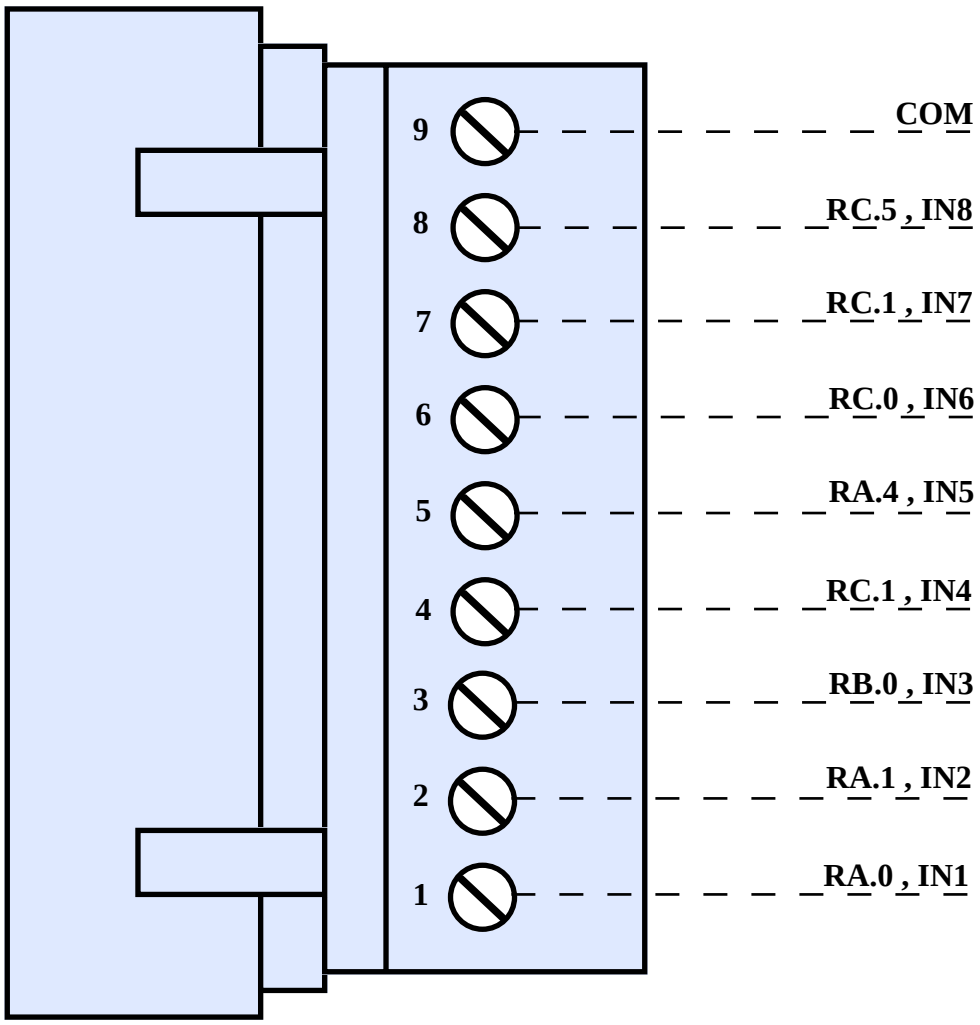


FIGURE 10: CN6 - OPTOCOUPLED DIGITAL INPUTS CONNECTOR

Signals description:

Rx.y, INn	=	I - n-th optocoupled input type NPN or PNP, connected to indicated port.
COM	=	- Common pin where an input must be connected to close it.

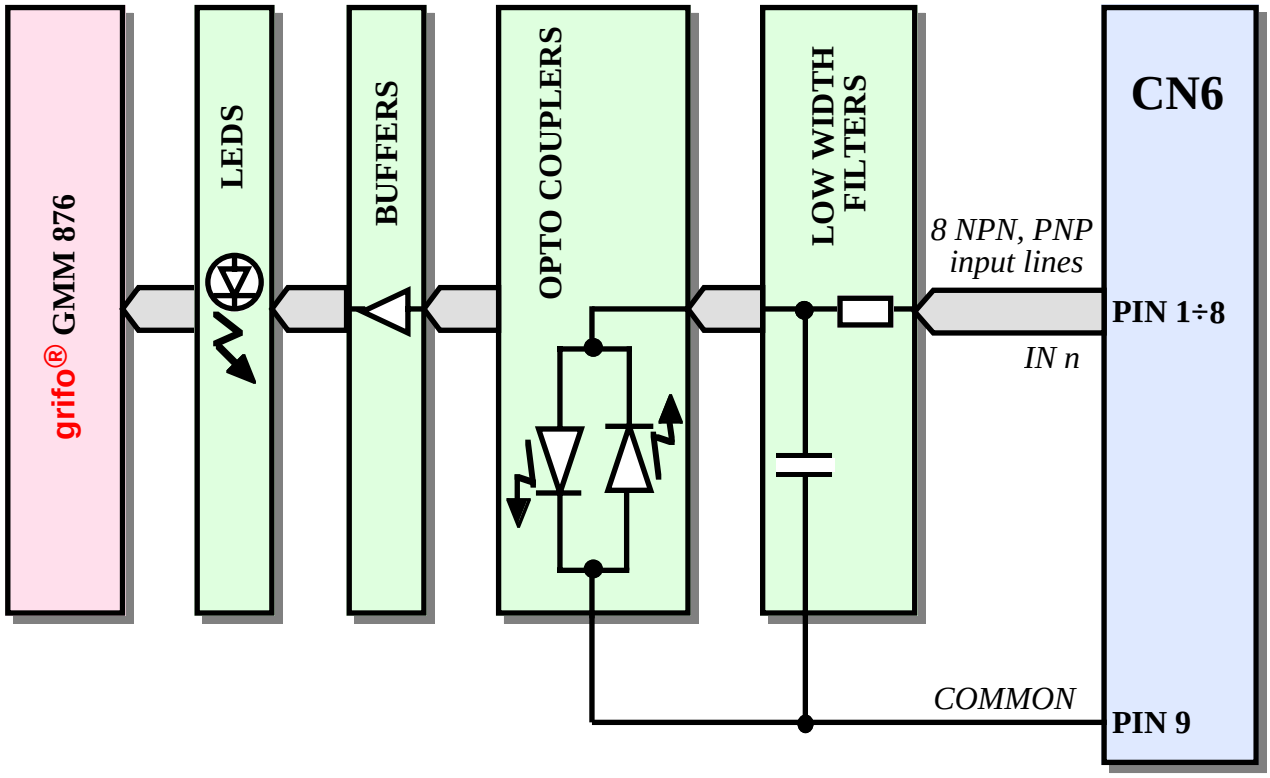


FIGURE 11: OPTOCOUPLED INPUTS BLOCK DIAGRAM

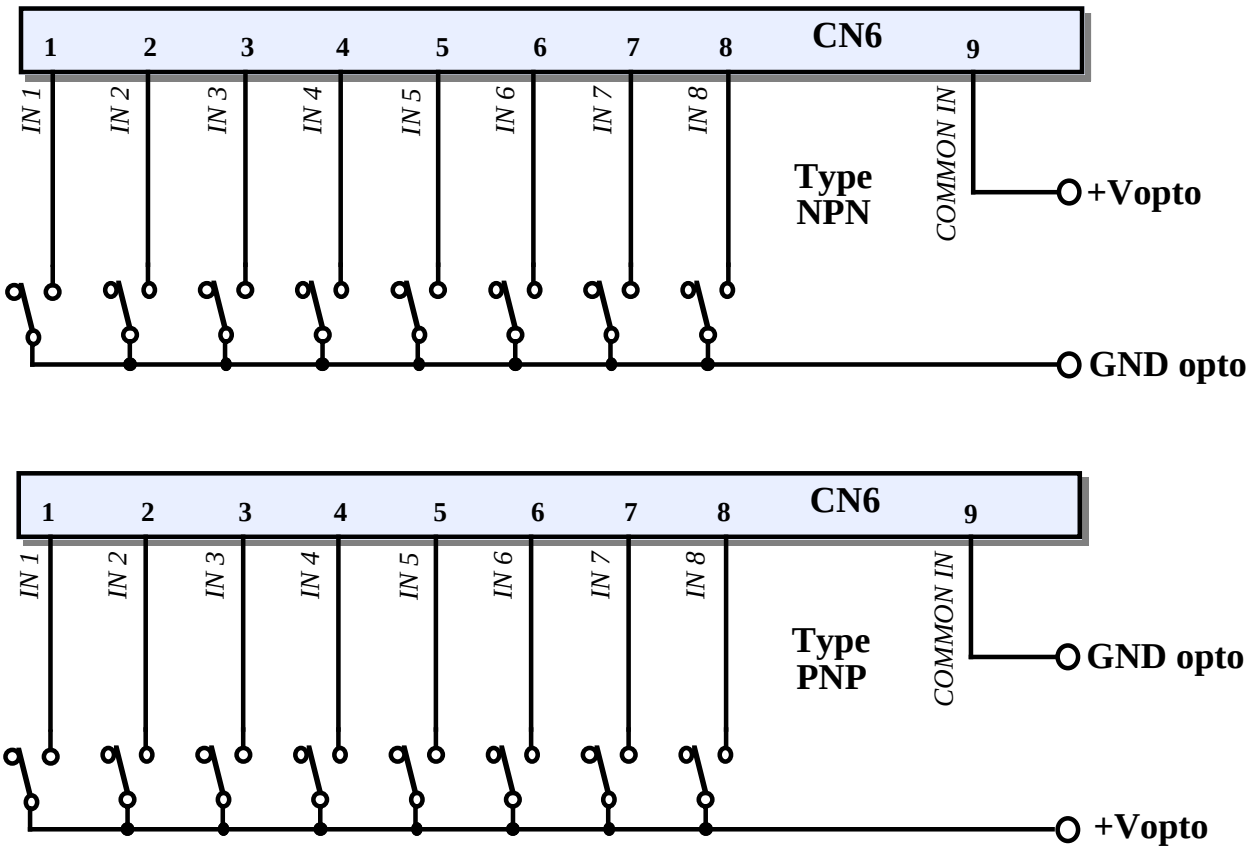


FIGURE 12: OPTOCOUPLED INPUTS CONNECTION DIAGRAM

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 **GMM 876** I/O ports, opportunely buffered, and selected carefully to easy management (plese refer to chapter "PERIPHERAL DEVICES SFOTWARE DESCRIPTION").
For further information please refer to manual **GMB HR84**.

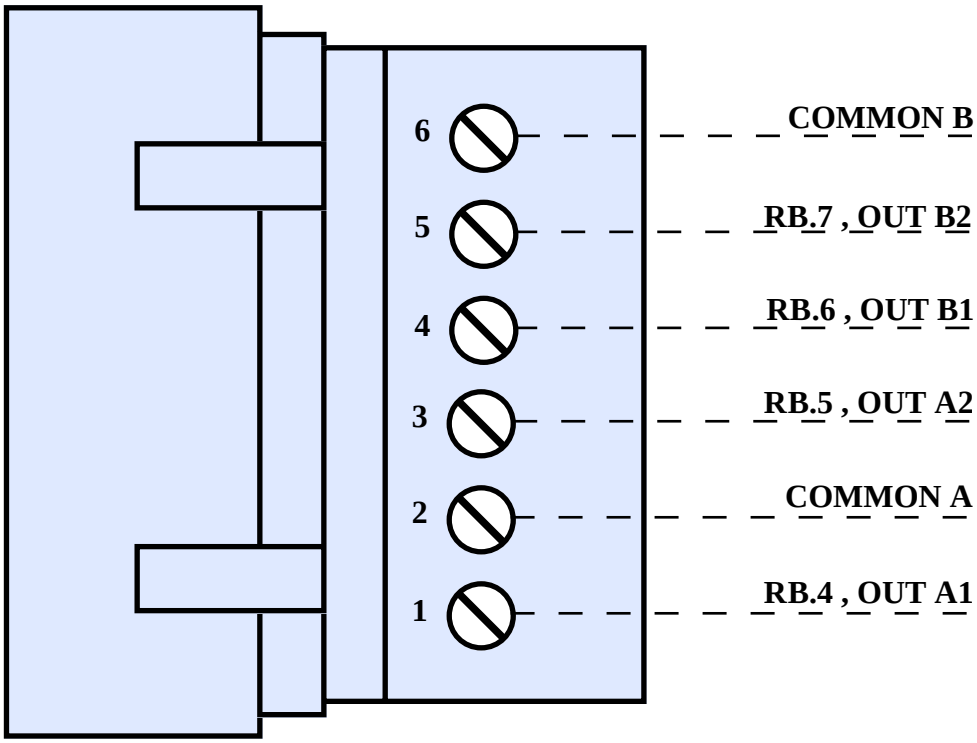


FIGURE 13: CN1 - RELAYS OUTPUTS CONNECTOR GROUPS A AND B

Signals description:

RB.x, OUT Yn = O - Normally open contact for n-th relay of group A or B, connected to RB.x.
COMMON A = - Common contact for relays of group A.
COMMON B = - Common contact for relays of group B.

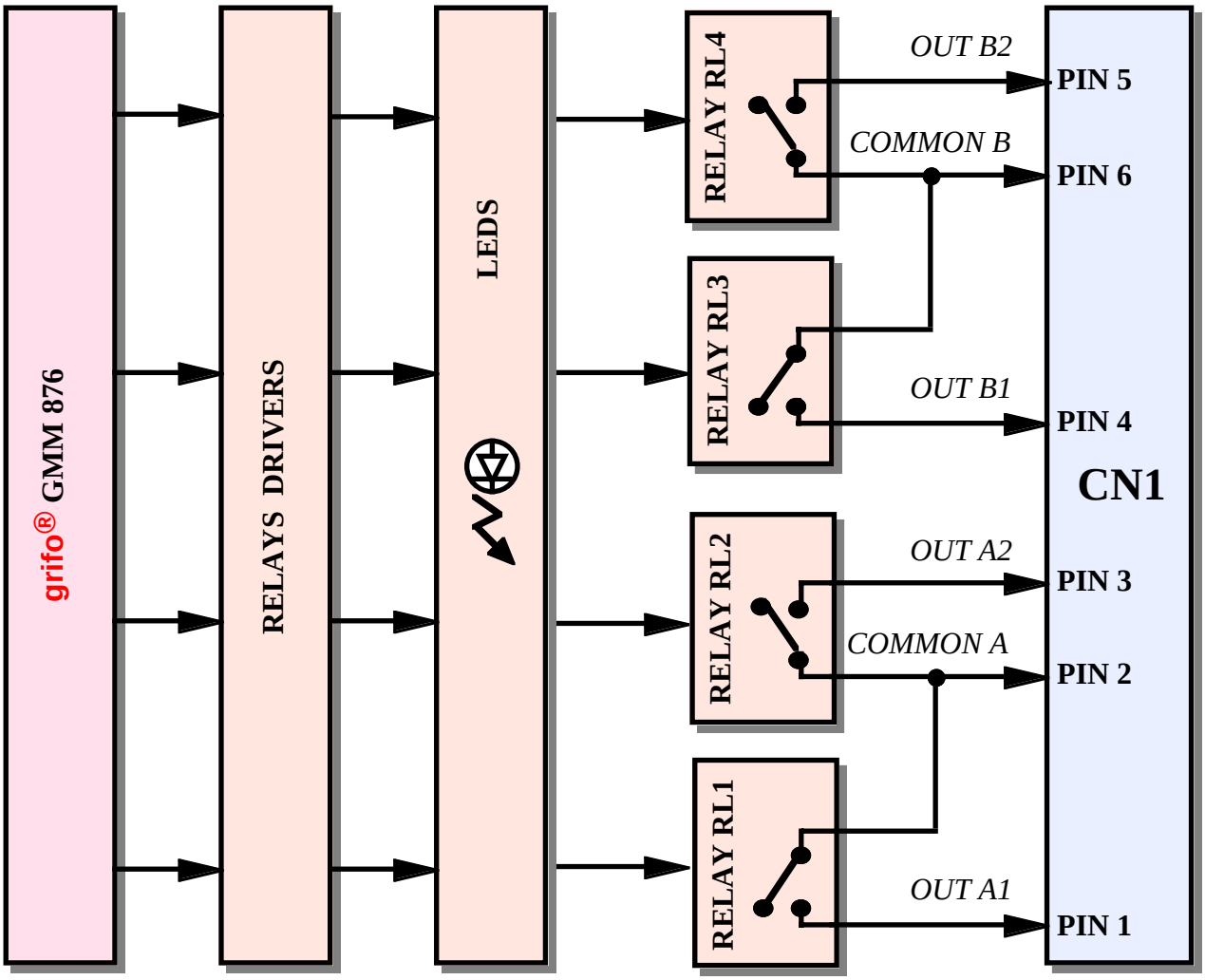


FIGURE 14: RELAY OUTPUTS A AND B BLOCK DIAGRAM

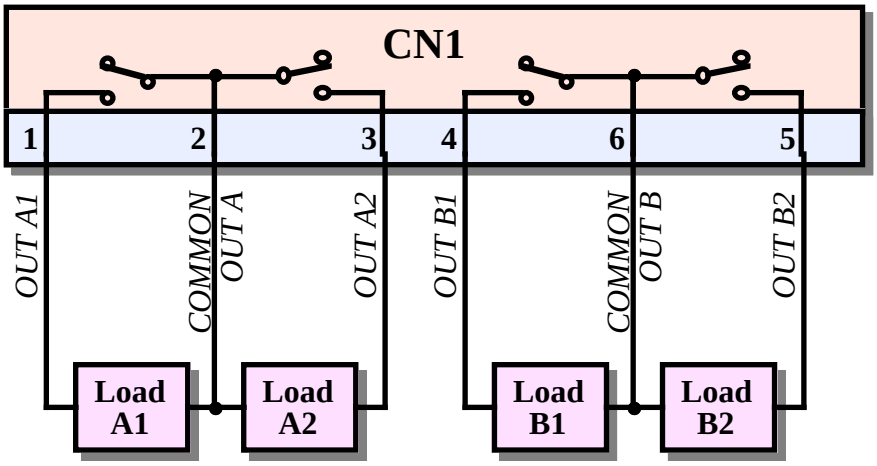


FIGURE 15: RELAY OUTPUTS A AND B CONNECTION DIAGRAM

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**).
For further information please refer to the manual of **GMB HR84**.

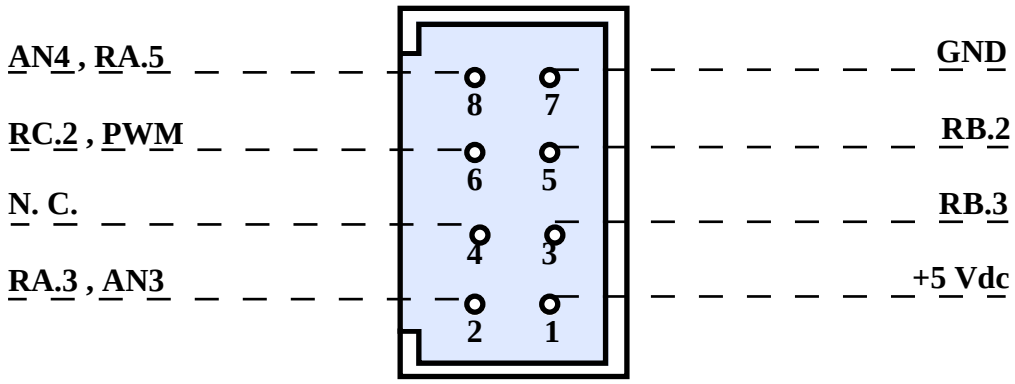


FIGURE 16: CN4 - TTL I/O, A/D, ETC. CONNECTOR

Signals description:

Rx.y	= I/O	- TTL digital I/O signal, connected to port Rx.y of microcontroller
AN4	= I	- Analog input for A/D converter section connected to signal AN4
AN3	= I	- Analog input AN3 of microcontroller
PWM	= O	- Pulse Width Modulation TTL output of Mini Module
+5 Vdc	= O	- Positive terminal of +5 Vdc power supply.
GND	=	- Ground signal.
N. C.	=	- No connection.

INTERRUPTS

Possible interrupt sources are:

- Input IN3 of CN1 -> Generates an external interrupt called INT.
- CPU internal peripherals -> Generate internal interrupts. In detail interrupt sources can be: Timer 0, Timer 1, Timer 2, I²C BUS, UART, A/D converter, analog comparator, SPI, EEPROM, CCP.

Please refer to **GMM 876** manual for further information.

I/O CONNECTION

To prevent possible connecting problems between **GMB HR84 & GMM 876** 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 I²C BUS signals 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, at maximum: 0÷20 Vdc according to card configuration. Inputs feature high impedance, anyway an eventual interfacing circuitery should provide low impedance to assure greater stability and precision. Microcontroller registers configuration must connect internally Vref+ to Vdd and Vref- to Vss. 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.

- 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.

POWER SUPPLY

GMB HR84 & GMM 876 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 & GMM 876**, 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

in this case:

400 mA - 310 mA - 13 mA = 77 mA

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

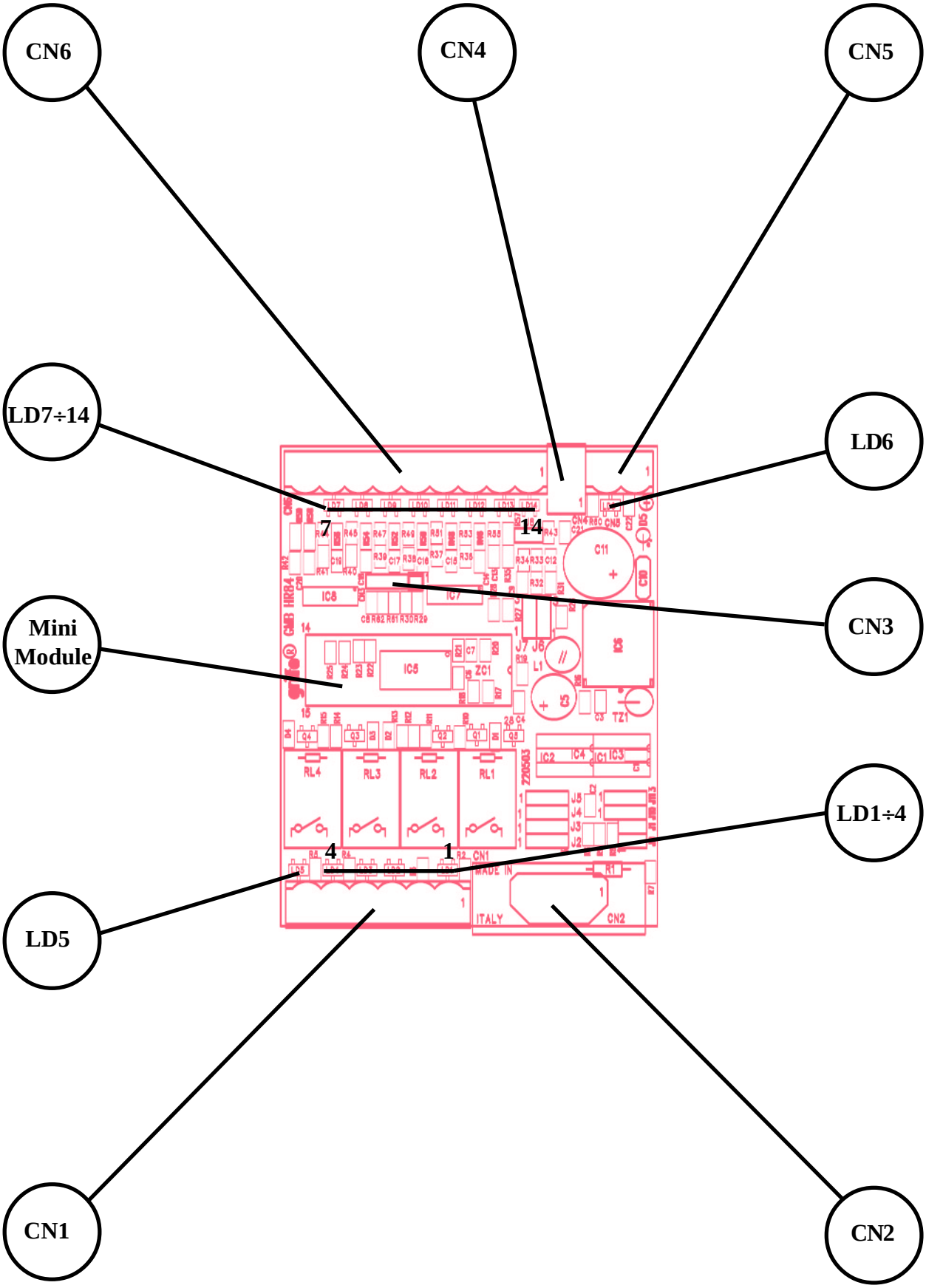


FIGURE 17: LEDS, CONNECTORS, ETC. LOCATION

ANALOG INPUT

GMB HR84 & GMM 876 features an interface for one analog input that can accept an input voltage in a variable range according to connection of jumper J6.
Internal configuration of microcontroller must connect Vref+ to Vdd and Vref- to Vss.
As Vdd is 5 Vdc and Vss is 0 V, normal input range (J6 connected in position 1-2) for A/D conversion is 0÷5 V and extended input range (J6 connected in position 2-3) is 0÷20 V.
For further information please refer to manual of **GMB HR84**.

CORRESPONDANCE OF SIGNALS

All hardware resources of **GMB HR84 & GMM 876** are managed by **GMM 876** through signals and peripherals of local microcontroller, Microchip PIC16F876A.
To have the complete control of such resources, it is enough to refer to the table in the near page, which indicates the signal and/or peripheral that drives a specific resource.

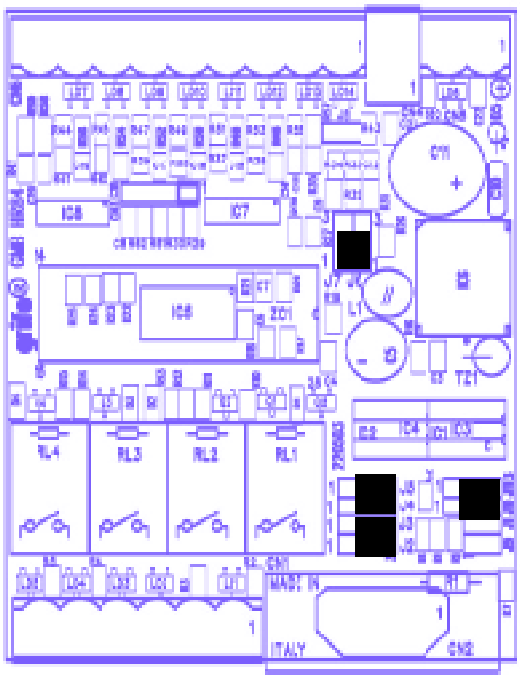


FIGURE 18: JUMPERS CONNECTION

Connector GMB HR84	PIN	Signal GMB HR84	PURPOSE	PIN CN1 GMM 876	Signal GMM 876
OPTO INPUTS	1	Input 1	Optocoupled input n° 1.	pin 26	RA.0
	2	Input 2	Optocoupled input n° 2.	pin 25	RA.1
	3	Input 3	Optocoupled input n° 3 or Interrupt.	pin 19	RB.0, INT
	4	Input 4	Optocoupled input n° 4.	pin 18	RC.1
	5	Input 5	Optocoupled input n° 5 or counter Timer 0.	pin 17	RA.4, T0CKI
	6	Input 6	Optocoupled input n° 6 or counter Timer 1.	pin 16	RC.0, T1CKI
	7	Input 7	Optocoupled input n° 7.	pin 15	RC.1
	8	Input 8	Optocoupled input n° 8.	pin 13	RC.5
	9	Common pin of optocoupled inputs			
RELAY OUTPUTs	A1	Output 1	Relay output 5 A n° 1.	pin 23	RB.4
	A	Common pin of buffered relay outputs of group A on connector CN3			
	A2	Output 2	Relay output 5 A n° 2.	pin 22	RB.5
	B1	Output 3	Relay output 5 A n° 3.	pin 21	RB.6
	B	Common pin of buffered relay outputs of group B			
	B2	Output 4	Relay output 5 A n° 4.	pin 20	RB.7
AMP 8 I/O	pin 1	+5 Vdc	Power supply +5 Vdc.	pin 28	+5 Vdc
	pin 2	I/O TTL	I/O TTL.	pin 12	RA.3
	pin 3	CAN L	I/O TTL.	pin 8	RB.3
	pin 5	CAN H	I/O TTL.	pin 9	RB.2
	pin 6	D/A	PWM of CCP1 or I/O TTL.	pin 24	RC.2
	pin 7	GND	Ground of Mini Block.	pin 14	GND
	pin 8	A/D	Input AN4.	pin 27	AN4

FIGURE 19: TABLE OF CORRESPONDANCE BETWEEN SIGNALS AND RESOURCES

HOW TO START

One of the most important features is the possibility to program the microprocessor Microchip PIC16F876A internal FLASH through specific tools made by **grifo®** and Microchip or using only a RS 232 connection of a PC and **grifo® GMM PIC-PR**.

A) FLASH REPROGRAMMING:

A1) Find on CD **grifo®** and save to a comfortable position on your hard drive the demo program"gmbiob.hex". It can be found starting from main page following the path: English | Examples tables | Mini Modules and Mini Block examples | GMB HR84 (please refer to figure 20).

A2) Perform FLASH programming. FLASH programming can be done using three different set of tools:

I) Microchip MP LAB® ICD 2 and **grifo® GMM PIC-PR**
II) **grifo®** MP PIK+ and **grifo® GMM PIC-PR**
III) **grifo® GMM PIC-PR**

As this operation is remarkably different according to the tools used, here follows a detailed explanation.

I) Using Microchip MP LAB® ICD 2 and grifo® GMM PIC-PR.

Do not supply **grifo® GMM PIC-PR**: it is supplyed by MP LAB®

Ia) Download from Microchip website, if it has not already been done, the latest version of MP LAB® IDE.

Ib) Please refer to Microchip documentation to correctly install MP LAB® IDE.

Ic) Please refer to Microchip MP LAB® ICD 2 documentation to correctly install it.

Id) Select PIC16F876A from MP LAB® IDE using menu Configuration | Select device.

PROGRAMMI PER MINI MODULI E MINI BLOCK

TIPO DI SCHEDA	GET	ASM	Ladder	Abaco® Link BUS	BASIC CBZ80	BASIC BASCOM 8051	BASIC BASCOM AVR	PIC BASIC	BASIC VARI	MCS® Basic 52	C	PASCAL	TIPO DI CPU / BLOCK
VARI	-	-	-	-	-	●	-	-	-	-	-	-	-
CAN GM0	●	-	-	-	-	●	-	-	-	-	●	-	Atmel T89C51cc03 - 8051 Code
CAN GM1	●	-	-	-	-	●	-	-	-	-	●	-	Atmel T89C51cc01 - 8051 Code
CAN GM2	●	-	-	-	-	●	-	-	-	-	●	-	Atmel T89C51cc02 - 8051 Code
GMM 5115	●	-	-	-	-	●	-	-	-	-	●	-	Atmel T89C5115 - 8051 Code
GMM 876	●	-	-	-	-	-	-	●	-	-	-	-	Microchip PIC16F876A - PIC 14 Code
GMM 932	●	-	-	-	-	●	-	-	-	-	-	-	PHILIPS P89LPC932 - 8051 Code
GMM AC2	●	-	-	-	-	●	-	-	-	-	●	-	Atmel T89C51AC2 - 8051 Code
GMM AM08	●	-	-	-	-	-	●	-	-	-	-	-	Atmel ATMega08 - AVR Code
GMM AM32	●	-	-	-	-	-	●	-	-	-	-	-	Atmel ATMega32 - AVR Code
GMB HR84	●	-	-	-	-	●	●	●	-	-	●	-	Mini Block 8 input opto 4 output relè
GMB HR168	●	-	-	-	-	●	-	-	-	-	●	-	Mini Block 16 input opto 8 output relè

FIGURE 20: EXAMPLES TABLES

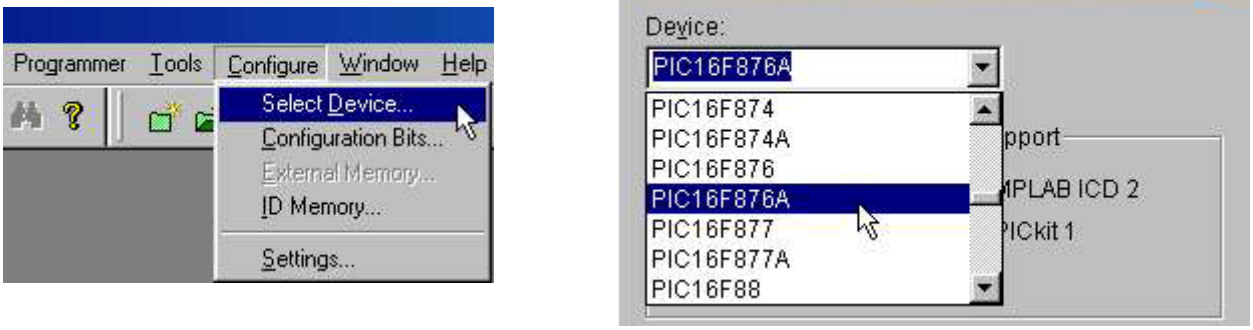
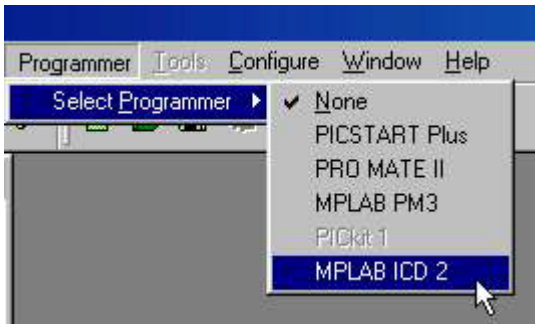


FIGURE 21: DEVICE SELECTION WITH MP LAB® ICD 2

Ie) Insert Mini Module in socket ZC1 of **grifo® GMM PIC-PR**; connect MP LAB® ICD 2 to connector CN3 of **grifo® GMM PIC-PR** using the specific plug cable provided with the hardware; enable ICD 2 using the menu Programmer | Select Programmer | MP LAB® ICD 2; enter menu Programmer | Settings | Power and check the checkbox "Power target from MP LAB® ICD 2 (5V Vdd)"; connect with MP LAB® ICD 2 using menu Programmer | Connect.



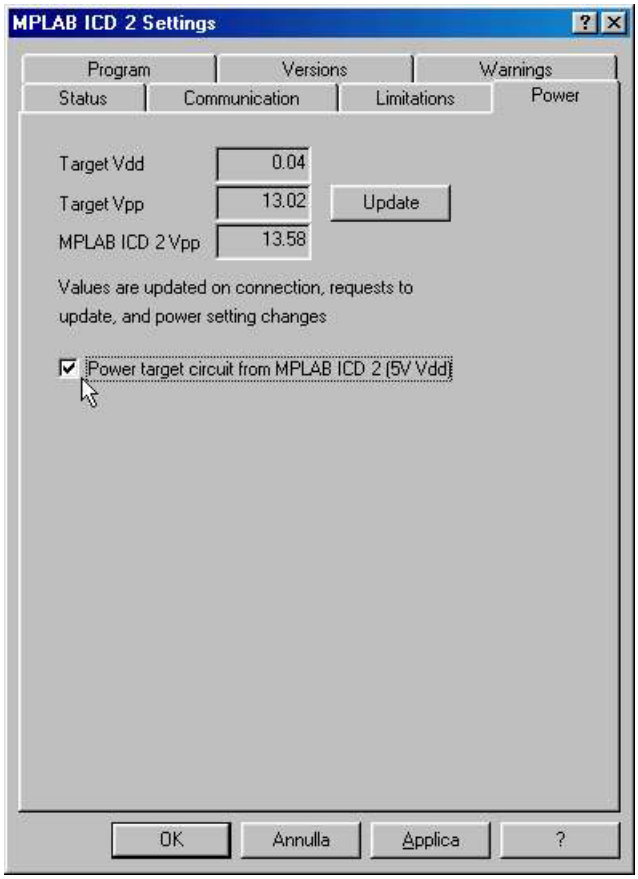


FIGURE 22: CONNECTION TO MP LAB® ICD 2

If) Load file gmbiob.hex using menu File | Import.

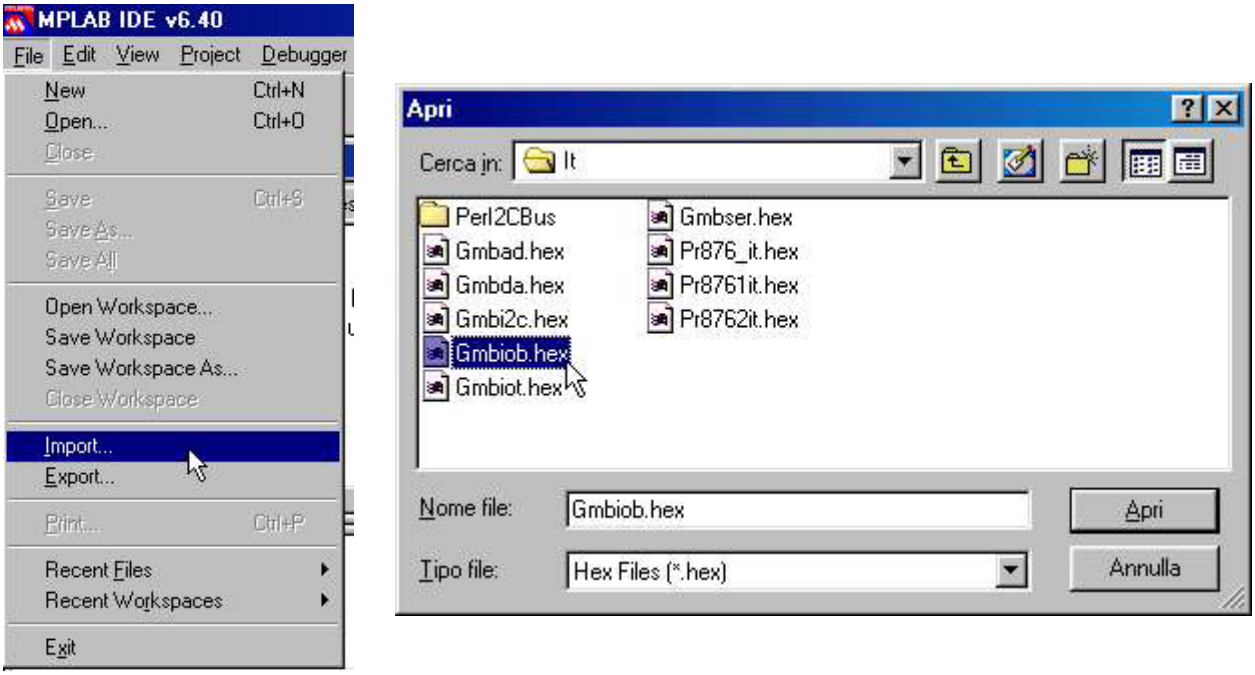


FIGURE 23: LOADING FILE TO PROGRAM WITH MP LAB® ICD 2

Ig) In menu Configuration | Configuration Bits configure "Oscillator" as "HS" and "WatchDog" as "Off".

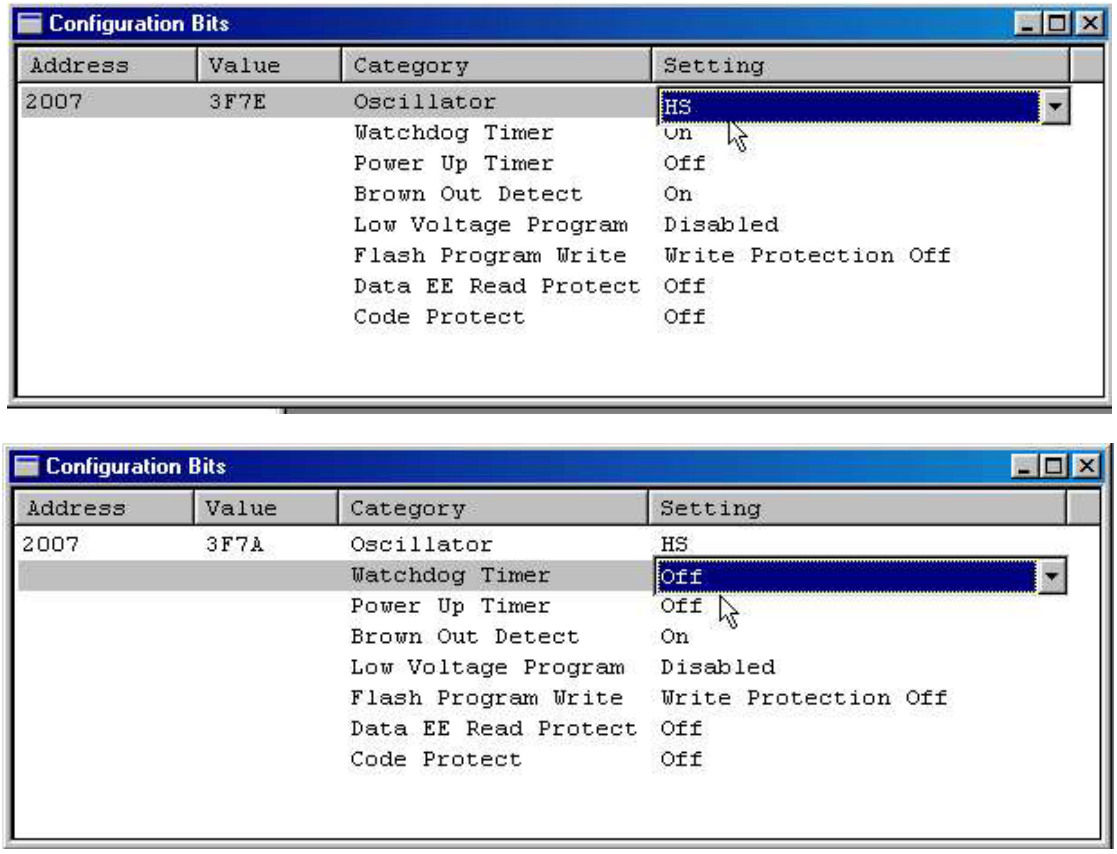


FIGURE 24: CONFIGURATION OF MP LAB® ICD 2

Ih) Give the command to program (menu Programmer | Program).

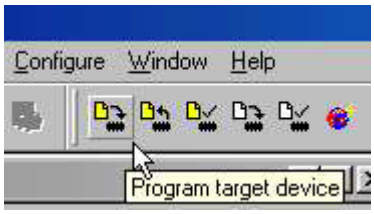


FIGURE 25: FLASH MEMORY PROGRAMMING WITH MP LAB® ICD 2

II) *Using grifo® MP PIK+ and grifo® GMM PIC-PR.*

Do not supply **grifo®** **GMM PIC-PR**: it is supplyed by MP PIK+

IIa) Download from **grifo®** website (www.grifo.it) the latest version PG4UW and install it clicking twice the file Pg4uarc.exe in the folder you want.

IIb) Connect the programmer and start the communication to the PC following the instructions of the manual on the Mini CD.

IIc) Connect MP PIK+ to connector CN4 of **grifo® GMM PIC-PR** using the specific cable provided with the programmer and insert the Mini Module in socket ZC1.

IId) Select PIC16F876A (ISP) using menu Device| Select device as shown in figure 26.

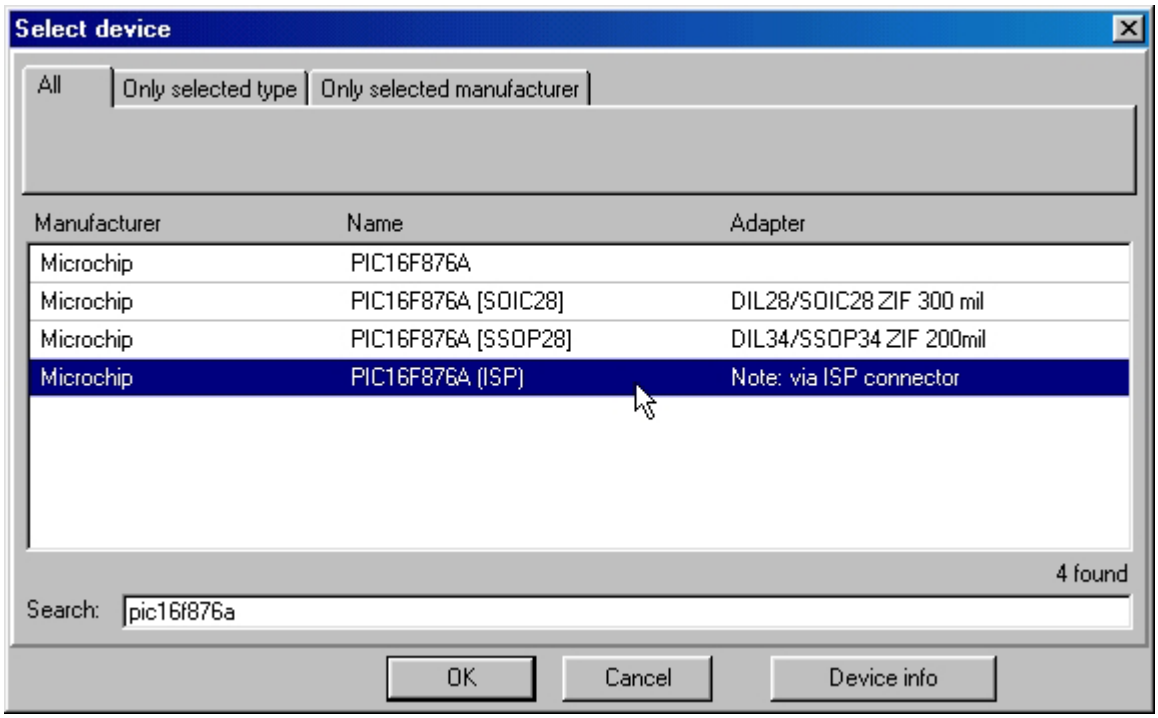


FIGURE 26: DEVICE SELECTION WITH MP PIK+

IIe) Open the programming options window (pressing ALT and letter "o") and uncheck the box "Low voltage programming" as shown in figure 27.

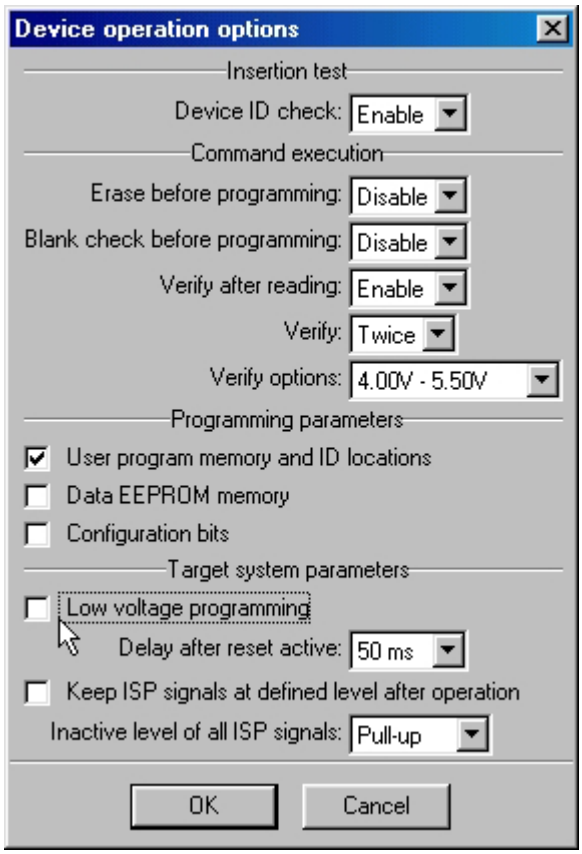


FIGURE 27: CONFIGURATION OF PROGRAMMER MP PIK+

IIf) Load the file gmbiob.hex using the menu File | Load File as shown in figure.

FIGURE 28: LOADING FILE TO PROGRAM WITH MP PIK+

IIg) Open the "Edit config." window (pressing key ALT and letter "s") then set "Oscillator" as "HS" and "Watchdog" as "Disable" like shown in figure.

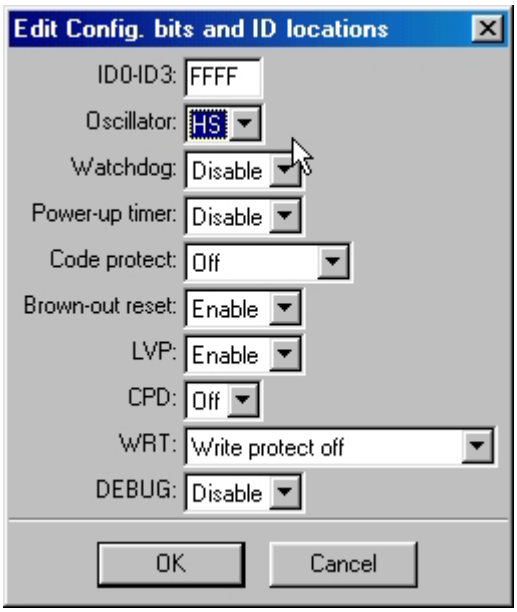


FIGURE 29: CONFIGURATION OF DEVICE WITH MP PIK+

IIh) Give the programming command.

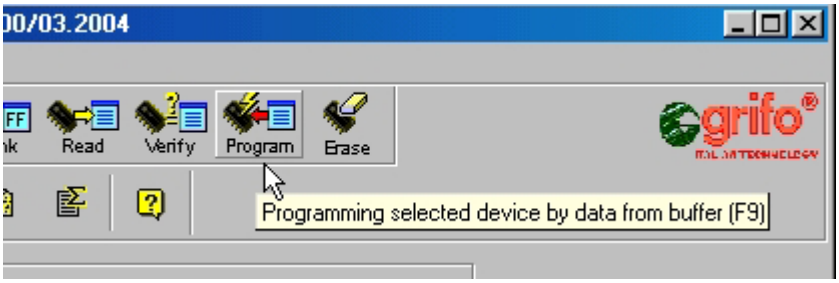


FIGURE 30: PROGRAMMING OF PIC16F876A WITH MP PIK+

III) *Using PONYPROG and grifo® GMM PIC-PR.*

Supply for **grifo® GMM PIC-PR** must be provided through and external power supply.

IIIa) Download latest version of PonyProg from website www.lancos.com and follow the instructions for software installation.

IIIb) Connect connector CN2 of **grifo® GMM PIC-PR** to a free serial port of the PC and supply with a direct tension between 15 V and 20 V, please refer to manual of **grifo® GMM PIC-PR** for further information.

IIIc) Perform calibration (menu Setup | Calibration) and select libraries SI Prog API (menu Setup | Interface setup).

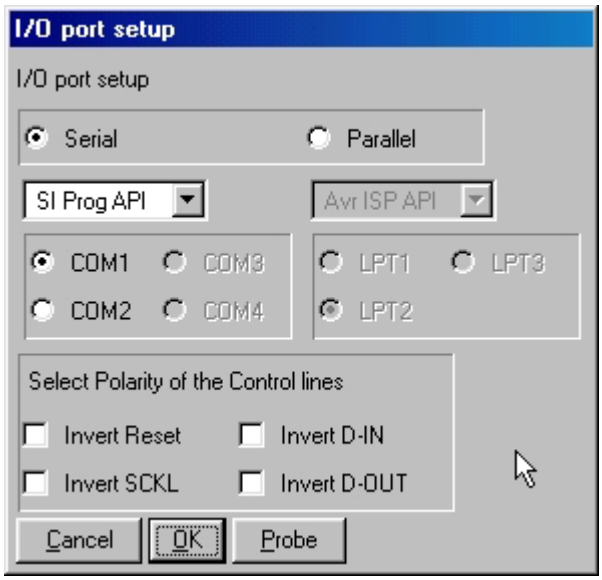


FIGURE 31: SELECTING PROGRAMMING INTERFACE OF PONYPROG

IIId) Insert the Mini Module in socket ZC1 of **grifo® GMM PIC-PR** and select the device PIC 16 model PIC16F876A from the specific text box.

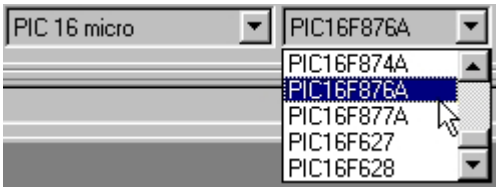


FIGURE 32: DEVICE SELECTION WITH PONYPROG

IIIe) Load file gmbiob.hex as shown in the following figure.

FIGURE 33: LOADING FILE TO PROGRAM WITH PONYPROG

IIIf) Open the window with menu Command | Security and configuration bits, uncheck the checkbox FOSC1 and check the checkbox FOSC0 and WDTEN, as shown in the following figure, then press OK.

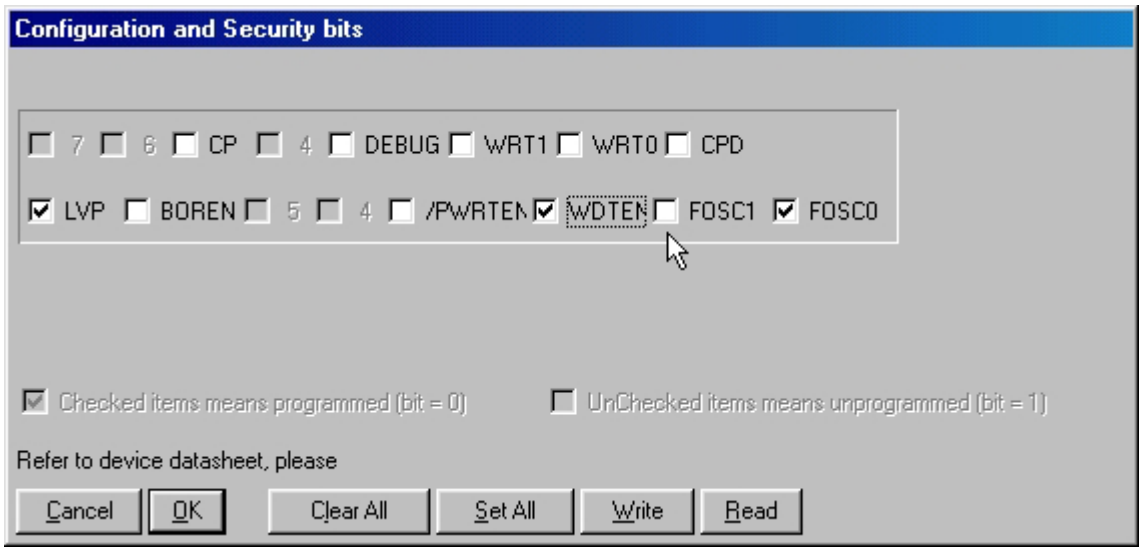


FIGURE 34: CONFIGURATION OF DEVICE WITH PONYPROG

IIIg) Program FLASH of PIC16F876A, as shown in the following figure.

FIGURE 35: PROGRAMMING THE DEVICE WITH PONYPROG

A3) Follow instructions of steps B to connect Mini Module to terminal emulator on PC and supply it, in the terminal emulator window the starting screen of demo appears.

B) SERIAL CONNECTION TO THE PC:

B1) First of all, open the container of **GMB HR84** to install Mini Module **GMM 876** on socket ZC1.

. B2) To supply **GMB HR84**, power supply **EXPS-2** can be used. It can provide two galvanically isolated tensions, required for the correct working of **GMB HR84 & GMM 876**. Also any other power supply capable to generated the two required voltages can be used.

.

FIGURE 36: PICTURE OF POWER SUPPLY EXPS-2

B3) Make the connection described in figure 9.

B4) After performing the connection described at point B3, run a terminal emulatore on the PC, configure it to use the serial port conneted to the Mini Module with 19200 baud, 8 data bit, 1 stop bit, no parity.

B5) Supply the boards. If programming worked fine, the starting screen of demo program appears in the terminal emulator window. If this does not happen, please control the correct making of cable described at point B3 or repeat the programming procedure described at points A.

C) GENERATING DEMO EXECUTABLE CODE:

C1) Install on the hard disk of the development P.C. the software environment selected to develop the application program. There are many different software tools that satisfy any customers requirements but here we remind only the most diffused like Microcode Studio + PIC BASIC, mikroBasic, mikroPascal, HI TECH C PIC + MP LAB IDE, etc. Please refer to software manuals for further information like installation guide.

C2) On **grifo®** CD in addition to file with the executable code of the demo program, described at point A1, there are also the source file of the same. These have an extension that identifies the used software development tools (for example gmbiob.bas for Microcode Studio + PIC BASIC, gmbiob.c for HI Tech C PIC, gmbiob.pbas for mikroBasic, gmbiob.ppas for mikroPascal) and they are properly organized inside demo programs tables available on CD, together with possible definition file (gmbiob.mcw for HI Tech C PIC+MP LAB® ICD 2, gmbiob.pbp for mikroBasic, gmbiob.ppp for mikroPascal). Once these files have been located they must be copied in a comfortable folder on the hard disk of development P.C.

C3) Compile the source file by using the selected software tools: the file gmbiob.hex must be obtained equal to those available on **grifo®** CD and already used at steps A. This operation is very different according to the programming environment selected, so here follws the details:

I) Ricompilation using Micocode Studio + PIC BASIC.

Ia) When in Microcode Studio IDE, select the target CPU from the specific list box. Target CPU for the source recompilation must be PIC16F876A, as shown in figure :

FIGURE 37: SELECTIN TARGET PROCESSOR WITH MICROCODE STUDIO + PIC BASIC

Ib) Load file gmbiob.bas , containing the source code to be recompiled, using the menu File | Open, as shown:

FIGURE 38: LOADING SOURCE FILE WITH MICROCODE STUDIO + PIC BASIC

Ic) Compile the source file by pressing the button on the right of the list box that selects target CPU:

FIGURE 39: COMPILING THE PROGRAM WITH MICROCODE STUDIO + PIC BASIC

II) *Ricompilation with mikroBasic.*

IIa) After starting mikroBasic IDE, open the project file with menu Project | Open Project...:

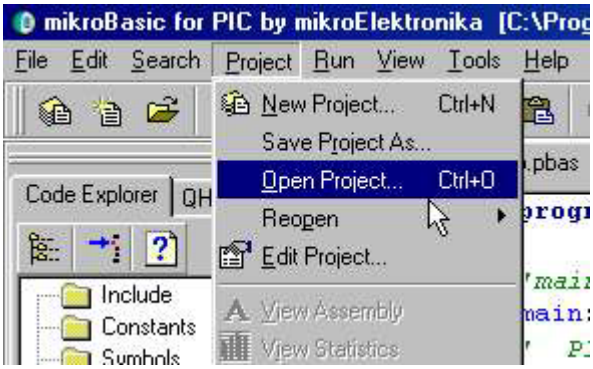


FIGURE 40: LOADING PROJECT FILE WITH MIKROBASIC

IIb) Compile the project pressing the button near the list box that indicates the target processor. All the information required for compiling (for example: target processor, frequency of the oscillator, value of configuration words, etc.) are contained in the project file, so there is no need to specify them.

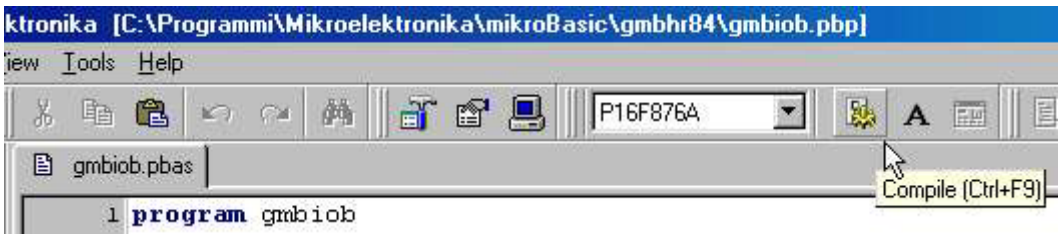


FIGURE 41: COMPILING WITH MIKROBASIC

III) *Ricompilation with mikroPascal.*

IIa) After starting mikroPascal IDE, open the project file with menu Project | Open Project...:

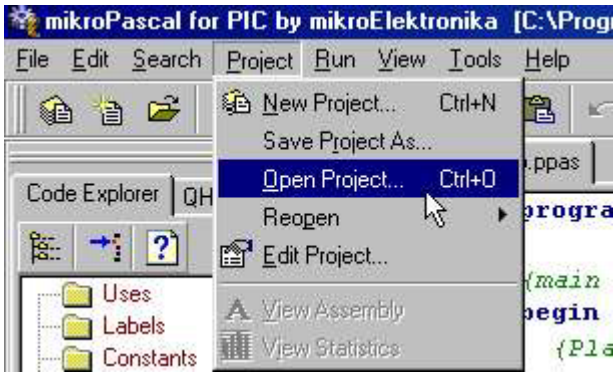


FIGURE 42: LOADING PROJECT FILE WITH MIKROPASCAL

IIb) Compile the project pressing the button near the list box that indicates the target processor. All the information required for compiling (for example: target processor, etc.) are contained in the project file, so there is no need to specify them.

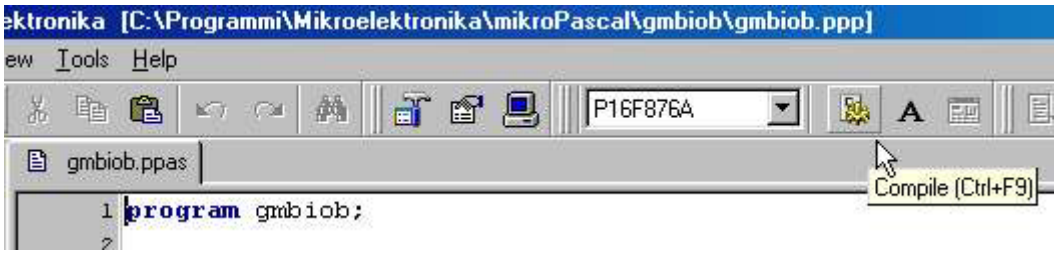


FIGURE 43: COMPILING WITH MIKROBASIC

IV) *Ricompilation with HI Tech C PIC + MP LAB® IDE.*

IVa) First of all, HI Tech C PIC and MP LAB® IDE must be integrated. Instruction for integration are beyond the purpose of this manual, please refer to the information published on HI Tech Soft web site (www.htsoft.com). It is suggested also to connect to Microchip web site (www.microchip.com) and to download the latest version of free development environment MP LAB® IDE.

IVb) Open the project file gmbiob.mcp using the menu Project | Open Project or pressing the button shown in the following figure:

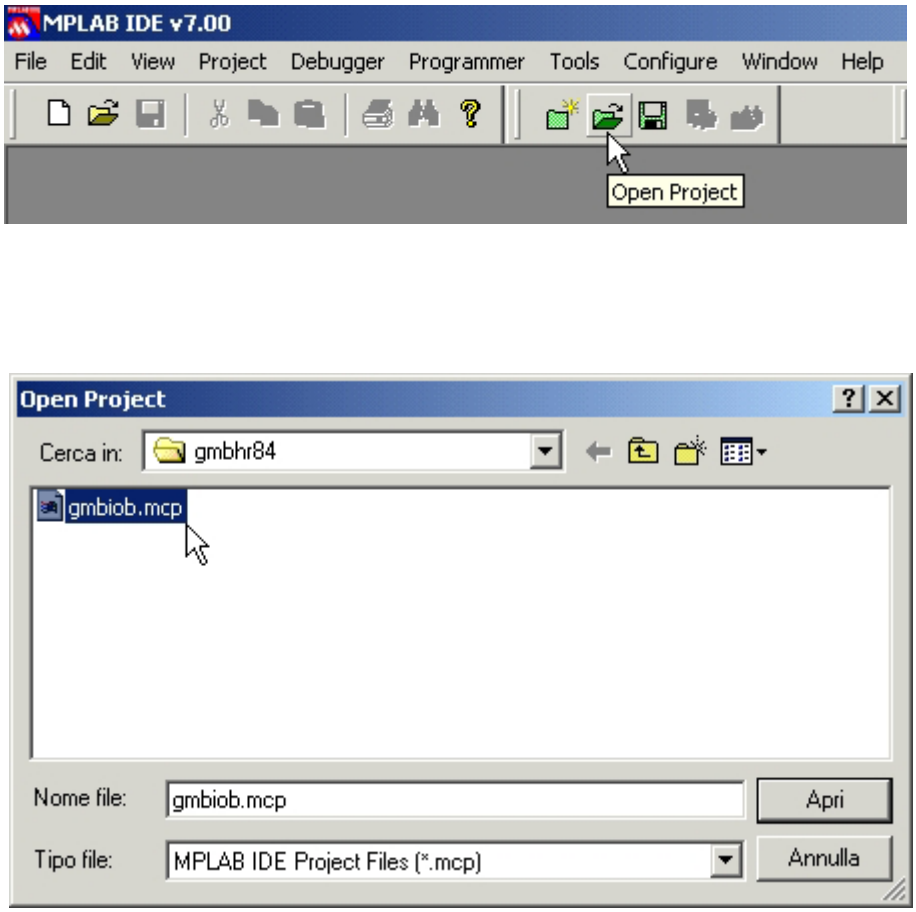


FIGURE 44: LOADING PROJECT FILE WITH HI TECH C PIC + MP LAB® IDE

IIb) Compile the project using the menu Project | Make or pressing the button shown in figure. All the information required for compiling (for example: target processor, etc.) are contained in the project file, so there is no need to specify them.

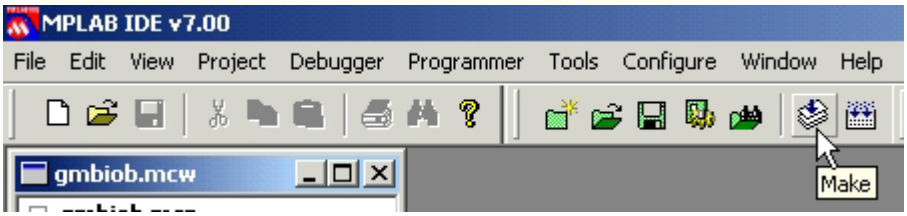


FIGURE 45: COMPILING WITH HI TECH C PIC + MP LAB® IDE

C4) Reperform the programmation of the obtained HEX file in the Mini Module FLASH, by executing again the points from A2.

Should during the execution of the steps above described a problem or a malfunction be found, we suggest to read and repeat again all the steps carefully and if malfunction persists please contact directly **grifo®** technician.
Instead when execution of all the steps above described is right, the user has realized his first application program that coincides with demo of **GMM 876 & GMB HR84**.
At this point it is possible to modify the source of the demo/s program according to application requirements and test the obtained program with the steps above listed (from A2 to C4) in cyclic mode, until the developed application program is completely well running.
When this focus is reached the developmnet P.C. can be eliminated, by obtaining a self running card, as below described:

D) *PREPARAZIONE DEFINITIVA DELL'APPLICAZIONE*

D1) Install **GMM 876** in **GMB HR8**4 and close it.

PERIPHERAL DEVICES SOFTWARE DESCRIPTION

In the previous paragraphs are described the peripheral connections to the field, 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 HR84** and **GMM 876**.
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 4 digital relays outputs is set through 4 signals of 28 pin socket ZC1, which means I/O TTL signals of **GMM 876**.
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÷4 provide a visual indication of digital outputs status (LED ON = output actived).
Summarizing, the correspondance is:

RB.4 , OUT A1 -> LED LD1
RB.5 , OUT A2 -> LED LD2
RB.6 , OUT B1 -> LED LD3
RB.7 , OUT B2 -> LED LD4

SERIAL LINE

The **GMM 876** signals used are the ones called TD and RD.

I²C BUS

Signals used are pin 3 of CN3 (SDA) and pin 2 of CN3 (SCL).
Please remark that **GMM AM08** is provided with an hardware I²C BUS interface, so this must be used by sofware managing the microprocessor internal registers through the high level instructions of the development language or the functions that can be found in the demo programs.
For further information please refer to the component data sheet.
Connector CN3 of **GMB HR84** provides signals SDA and SCL with 4.7 kΩ pull up resistors.

OPTOCOUPLED INPUTS

Status of 8 digital optocoupled inputs can be acquired by software reading the status of corresponding **GMM 876**.
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 LD7÷14 give a visual indication of digital inputs status (LED ON means input actived).
Summarizing, the correspondance is:

RA.0 , IN1 ->	LED LD14
RA.1 , IN2 ->	LED LD13
RB.0 , IN3 ->	LED LD12
RC.1 , IN4 ->	LED LD11
RA.4 , IN5 ->	LED LD10
RC.0 , IN6 ->	LED LD9
RC.1 , IN7 ->	LED LD8
RC.5 , IN8 ->	LED LD7

DIGITAL TTL I/O

They are pins 2, 3, 5 and 6 of connector CN4, connected respectively to microprocessor ports RA.3, RB.3, RB.2 and RC.2.

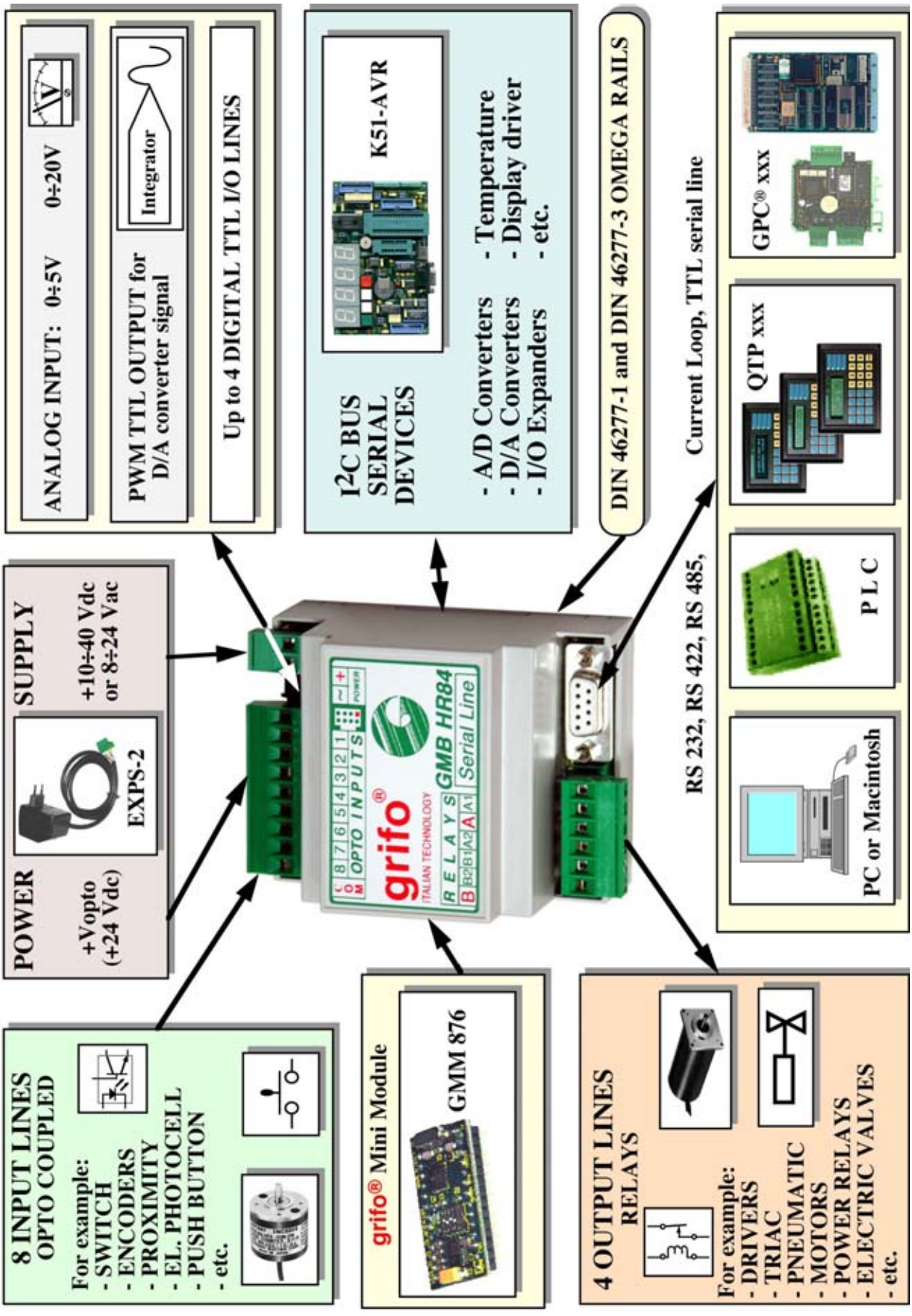


FIGURE 46: CONNECTIONS EXAMPLE

APPENDIX A: ALPHABETICAL INDEX