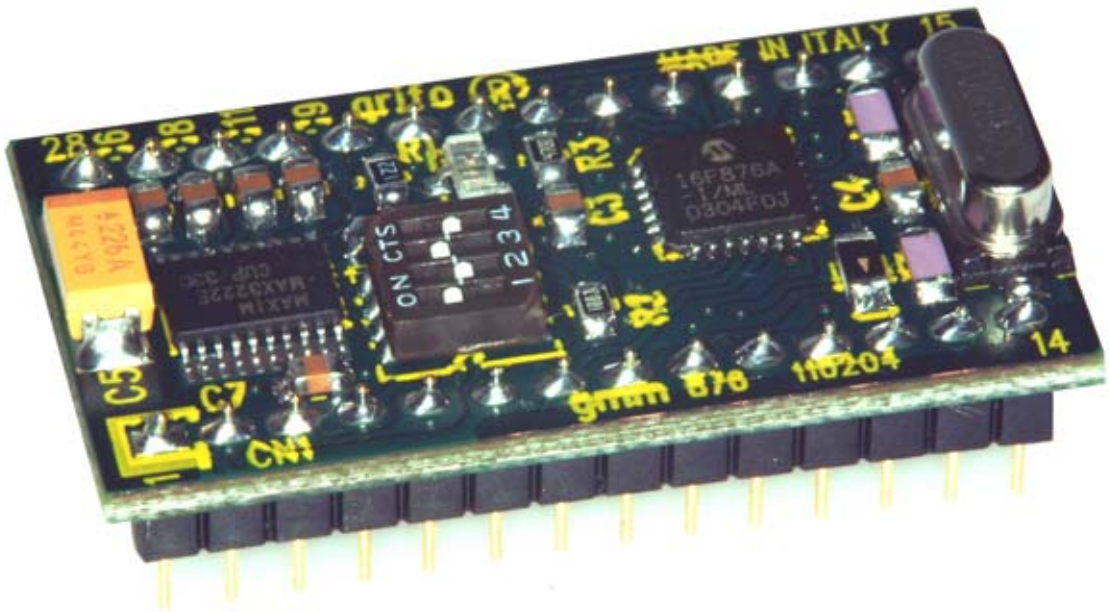
GMM 886

grifo® Mini Modulo PIC16F886

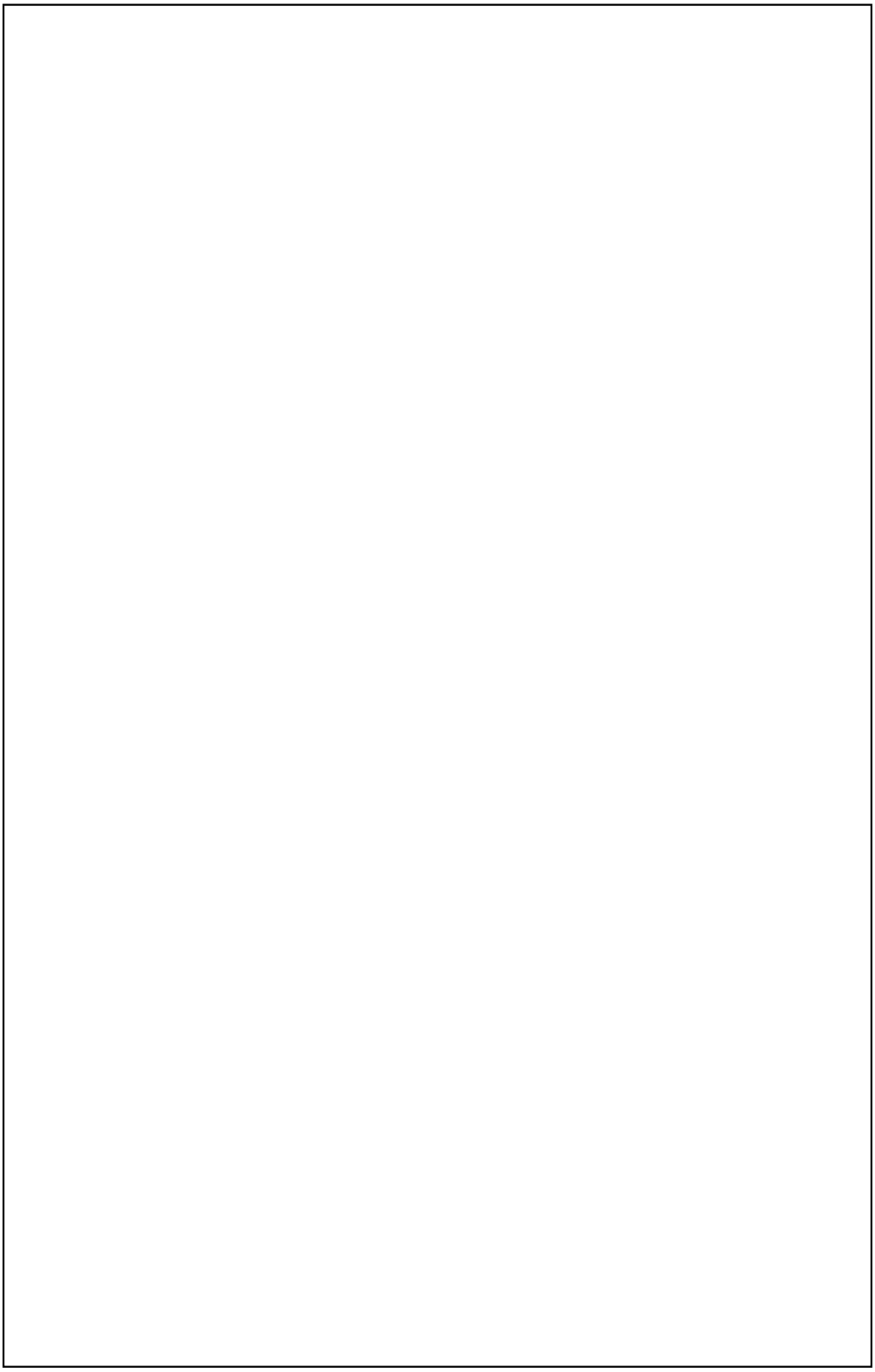
TECHNICAL MANUAL



grifo®
ITALIAN TECHNOLOGY

Via dell' Artigiano, 8/6
40016 San Giorgio di Piano
(Bologna) ITALY
E-mail: grifo@grifo.it
http://www.grifo.it http://www.grifo.com
Tel. +39 051 892.052 (a. r.) FAX: +39 051 893.661

GMM 886 Rel. 5.00 *Ed. 20 May 2011*



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Standard container with **28 pins** male socket, DIL, 100 mils pitch, 600 mils width; **very small dimension**: 20,7 x 38,7 x 12,8 mm; **4 layers** PCB to obtain **best** noisy resistance and best **EMI performance**; single power supply required 3.15 ÷ 5Vdc ± 5% 9 mA (the current consumption may vary according to module connections); availability of **idle** mode and **power down mode**; microcontroller **Microchip PIC16F886** with **20 MHz** crystal; **14.3 KBytes FLASH** for code, **368 bytes SRAM** for data, **256 Byte EEPROM** for data; **11 channels A/D converter** with **10 bit** resolution; **2 bipolar comparators** with several combinations of input and output signals; 14 **interrupt** sources; **3 Timer Counter**; **2 CCP sections** with 16 bit resolution featuring **PWM**, compare, etc.; **22 digital I/O lines** available on connector; hardware serial line with Baud Rate up to **115200 Baud**, **RS 232** buffered or at **TTL** level; **I²C BUS** hardware interface, available on connector; **SPI** hardware interface; 4 configuration **dip switches**; **1 status LED** managed by software; internal FLASH and EEPROM can be managed through **In System Programming**, or when the module is already mounted, by using I/O signals; support to **ISP** programmation to dowload the generated code, inside on board FLASH; wide range of **development tools** as: C compilers (HTC PIC); BASIC compilers (Pic Basic Pro and Standard); development environments (Micro Code Studio); etc.; long list of **demo programs** and use examples supplied under source form, duly remarked, for the available development tools.

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Tel. +39 051 892.052 (a. r.) FAX: +39 051 893.661

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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

, **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 **GMM 886** card release **110204** 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 CN1 on the solder and component side side).

GENERAL INFORMATION

GMM 886 (**grifo® M**ini **M**odulo con PIC16F**886**) is a module based on microcontroller **Microchip PIC16F886**, a powerful and complete system-on-a-chip provided with **CPU**, **internal memory** both for data and for code, **A/D converter**, **watch dog**, **interrupts**, TTL digital I/O lines, a hardware serial line, dedicated **timer/counter** and CCP sections, featuring capture/compare capability, **PWM**, etc. In modules' very small area some comoponents that exploit microcontrollers' performance are already mounted. In addition to this, component that completemicro's features are installed, like **MAX3222E**, that transforms TTL signals of on board UART in RS 232 signals, etc.
Possible applications of **GMM 886** Mini Modules are several.
We remark the employ as **smart intelligent nodes** with local functionalities as PID algorithms for controlling temperatures, motors, valves, etc. or as **decentralized systems** as robots, automation of production line machines, big factory automations. Finally, **teleacquisition** and **telecontrol** on medium and low distances, **home automation** (lights turning ON/OFF, heating and cooling systems control, supervision of electric devices, security and acces control systems).
Last but not least, **didactics**: **GMM 886** offers a very low cost to learn how to program a **PIC 14 bit** core CPU.
For this purpose are likewise interesting the **GMB HR84** and **GMB HR168** Mini Block modules, that allow to connect immediatly a RS 232 serial port to communicate to a PC and feature respectively 8 or 16 digital optocoupled inputs and 4 or 8 digital relay outputs.
They are also provided with standard container DIN 50022 respectively M4 HC53 or M6 HC53 that can be mounted on omega bars.
In any case, there is a short time to market: the **user can see a prototype** or even a ready product **in one week**.
Overall features are:

- Standard container with **28 pins** male socket, DIL, 100 mils pitch, 600 mils width
- **Very small dimension**: 20.7 x 38.7 x 12.8 mm
- **4 layers** PCB to obtain **best** noisy resistance and best **EMI performance**
- Single power supply required 3.15 ÷ 5Vdc ± 5% 9 mA (the current consumption may vary according to module connections)
- Availability of **idle** mode and **power down mode**
- Microcontroller **Microchip PIC16F886** with **20 MHz** crystal
- **14.3 KBytes FLASH** for code, **368 bytes SRAM** for data, **256 Byte EEPROM** for data
- **11 channels di A/D converter** with **10 bit** resolution
- **2 bipolar comparators** with several combinations of input and output signals
- 14 **interrupt** sources; **3 Timer Counter**
- **2 CCP sections** with 16 bit resolution featuring PWM, compare, etc.

- **22 digital I/O lines** available on connector; hardware serial line with Baud Rate up to **115200 Baud**, **RS 232** buffered or at **TTL** level
- **I²C BUS** hardware interface, available on connector
- **SPI** hardware interface
- 4 configuration **dip switches**
- **1 status LED** managed by software
- Internal FLASH and EEPROM can be managed through **In System Programming**, or when the module is already mounted, by using I/O signals
- Support to ISP programmation to dowload the generated code, inside on board FLASH
- Wide range of **development tools** as: C compilers (HTC PIC); BASIC compilers (Pic Basic Pro and Standard); development environments (Micro Code Studio); etc.
- Long list of **demo programs** and use examples supplied under source form, duly remarked, for the available development tools.

DIGITAL I/O LINES

The Mini Module **GMM 886** is provided with 22 digital I/O lines at TTL level, of the microprocessor Microchip PIC16F886, grouped in two 8 bit ports (RB and RC) and one 6 bit port (RA).
Port bits are RA0÷5, RB0÷7 and RC0÷7.
These lines are connected directly to 28 pins connectors with standard **grifo®** Mini Module pin out, allowing to be connected direclty to several interface cards.
By software it is possible to define and acquire the function and the status of these lines, and also to match them to peripheral devices (like Timer Counter, Interrupt, etc.), simply programming some CPU internal registers.
For further information please refer to paragraph CONNECTIONS and PERIPHERAL DEVICES SOFTWARE DESCRIPTION.

A/D CONVERTER ANALOG SIGNALS

Mini Module **GMM 886** provides 8 analog inputs of Microchip PIC16F886 internal A/D converter, that is signals AN0÷AN3 multiplexed on signals RA0÷RA3 and AN4 multiplexed on signal RA5.
Main features of this section are: resolution 10 bit; 11 analog inputs in the range defined by the pins Vref+ and Vref- or Vss÷Vdd; conversion time on a single channel 36 μsec; very easy software management; end of conversion interrupt.
A/D conversions are performed through opportune manipulation of specific microcontroller internal registers.
To easy A/D converter management, some software packages are provided with utility procedures that manage all details of this section.
For further information please refer to data sheet of appendix A of this manual or paragraph "CONNECTIONS".

WATCH DOG

Microcontroller Microchip PIC16F876A is provided with an internal hardware watch dog capable to reset the CPU if the user program cannot retrigger it in less than the selected intervent time.
Intervent time range is rather wide, it is from about 7 milliseconds to 1.7 seconds.
For further information please refer to microcontroller data sheet or appendix A of this manual.

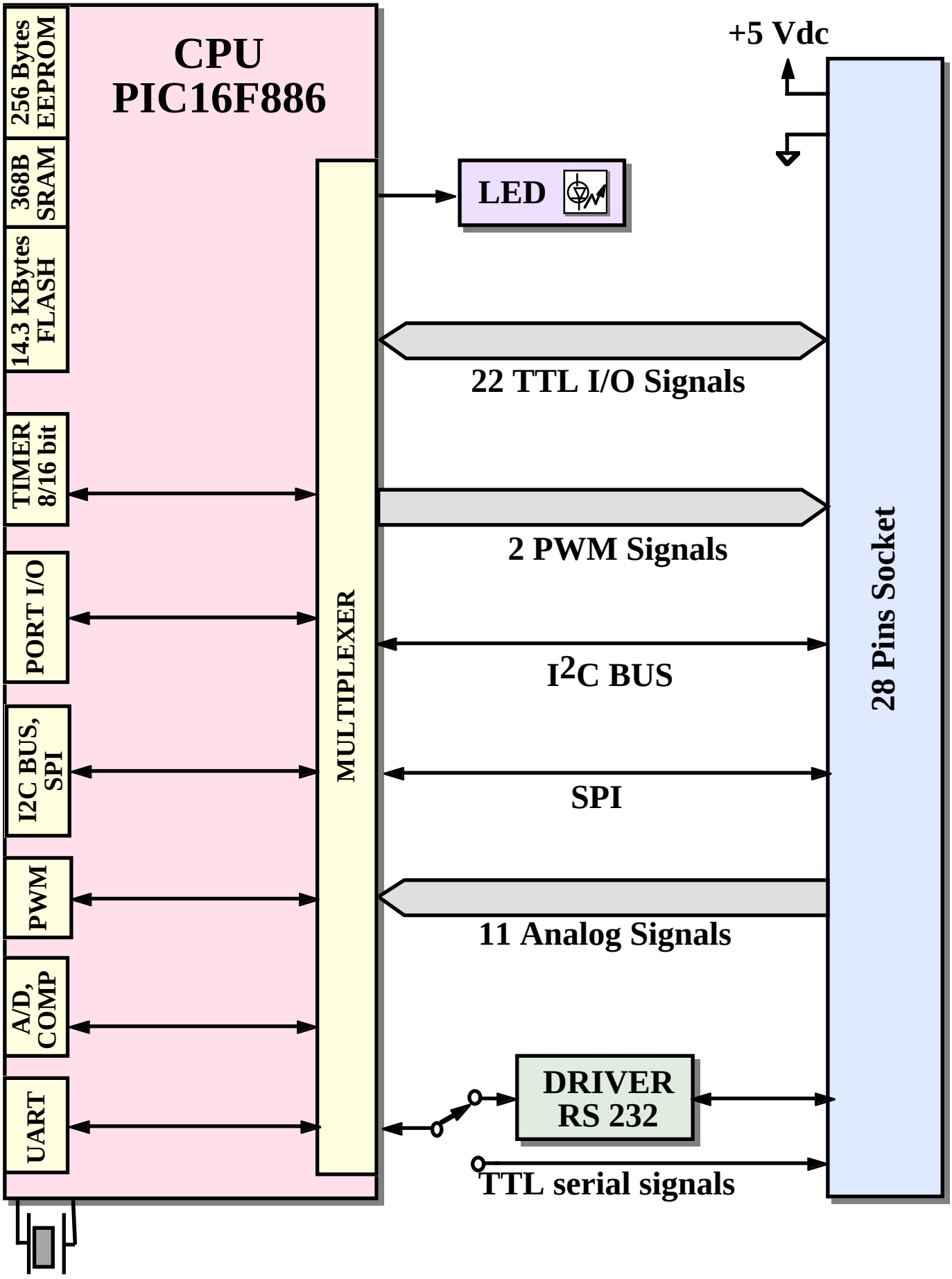


FIGURE 1: BLOCK DIAGRAM OF MINI MODULE GMM 886

MEMORY DEVICES

The card is provided of 15.2K of memory divided with a maximum of **14.3K** Bytes (8K WORD) FLASH EPROM, **368** Bytes of internal SRAM and **256** Bytes of internal EEPROM. The memory configuration must be chosen considering the application to realize or the specific requirements of the user.
Thanks to on board EEPROM there is the possibility to keep data also when power supply is failed; in this way the card is always able to maintain parameters, logged data, system status and configuration, etc. in each working conditions.
Whenever the amount of memory for data is not sufficient (i.e. for data loghin systems), it is always possible to connect external memory devices (with SRAM, EEPROM, FLASH technologies) through the comfortable and efficient I^2C BUS and SPI interfaces of the card (please see specific paragraphs).
The addressing of memory devices is controlled by microcontroller as described in the component data sheet or in APPENDIX A of this manual.

DIP SWITCH AND BOARD CONFIGURATION

GMM 886 Mini Module is provided with an on board dip switch whose purpose is to set up several electric parameters.
The switches connect or not connect signals from RS 232 buffer or microcontroller on board UART TTL signals to pins of socket CN1.
In addition the board is also provided with one signalation LED, software manageable, that can be used to signal in visual ways board status and configurations, as described in the specific paragraphs.
All the configuration resources described are completely software manageable simply programming specific registers allocated in the I/O space by the control logic.
For further information refer to paragraphs "DIP SWITCH" and "CONFIGURATION INPUTS".

SERIAL COMMUNICATION

On **GMM 886** it is always available an hardware serial line that is completely software configurable for physical protocol (baud rate, stop bits number, lenght of character, etc) by simply programming some microprocessor registers as described in the manufacturer documentation or in the appendix A of this manual.
The serial line is connected to CN1 connector at TTL or RS 232 level, thanks to some on board dip switches configuration, so when the card must be connected in a network or at long distance or with other systems that use different electric protocol, the user must provide external drivers (RS 232, RS 422, RS 485, Current loop, etc.).
Please remember that on CN1 connector in addition to standard receive and transmit signals are also available other I/O signals that can be driven by software; these signals can be used to define the RS 485 line direction, to enable the RS 422 transmit drive or to generate an RS 232 handshake.
For example the **MSI 01** module that converts a TTL serial line in any other electric standards in a pratical and inexpensive way can be used.
Please read "SERIAL COMMUNICATION SELECTION" paragraph of this manual or contact directly grifo® technician for further explanation or any other necessary information.

CLOCK

On **GMM 886** module there is a clock circuitery that generates the clock signals for the microcontroller at a frequency of 20 MHz.
Please remark that the CPU architecture is high performance RISC, which allows to execute intructions at **5 MIPS** with the above mentioned quartz.
Working frequency of the several peripherals can be set by software acting on the specific internal registers, and so the clock source selection; this latter can be performed through specific configuration registers.
For further information please refer to component data sheet or appendix A of this manual.

I²C BUS INTERFACE

Standard pin out of 28 pins **grifo®** Mini Module connector reserves two pins, 6 and 7, to I²C BUS interface; some Mini Modules are provided with hardware interface, others emulate it by software.
In special case of **GMM 886** I²C BUS is hardware and is managed through microcontroller inernal registers.
Mini Module is delivered with a demo program that explaing how to use the peripheral by a complete and well commented code.
For further information please refer to component data sheet or appendix A of this manual.

SPI INTERFACE

Mini Module **grifo®** **GMM 886** is provided with a SPI serial inteface featured through a specific hardware section of the microcontroller.
Signals SCK, SDI and SDO of SPI interface are available respectively on pins 6, 7 and 13 of connector CN1.
All interface parameters are managed through microcontroller inernal registers.
Mini Module is delivered with a demo program that explaing how to use the peripheral by a complete and well commented code.
For further information please refer to component data sheet or appendix A of this manual.

TECHNICAL FEATURES

GENERAL FEATURES

Devices:	22 digital TTL I/O signals 11 A/D converter analog inputs 2 analog comparators 2 CCP sections 1 Watch Dog section 3 Programmable Timer/Counter 14 interrupt sources 1 RS 232 serial line 1 four pins dip switch 1 status LED	
Memories:	14.3 KByte (8K Word) FLASH 368 Bytes EEPROM 256 Bytes SRAM	user program user data user data
CPU:	Microchip PIC16F886	
Clock frequency:	20 MHz	
A/D resolution:	10 bit	
A/D conversion time:	36 μsec	
Watch Dog intervent time:	programmable from about 7 msec to 1.7 sec	

PHYSICAL FEATURES

Size:	20.7 x 38.7 x 12.8 mm	
Weight:	9.8 g	
Connectors:	CN1	28 pins male socket DIL
Temperature range:	0÷50 °C	
Relative humidity:	20%÷90%	(without condense)

ELECTRIC FEATURES

Power supply voltage:	3.15 ÷ 5Vdc ± 5%	
Current consumption:	2 ma	(power down mode)
	8 ma	(normal)
	13 ma	(highest)
Analog inputs voltage range:	0 ÷ 5 Vdc	
Analog signals impedance:	maximum 2.5 kΩ	
Power failure theshold:	typical 4 Vdc	
Brown out time:	4.7 KΩ	

INSTALLATION

In this chapter there are the information for a right installation and correct use of **GMM 886** card. In detail there are the locations and functions of each connector, of the dip switches, LED, and so on.

VISUAL SIGNALATIONS

GMM 886 features the LED described in the following table:

LED	COLOUR	PURPOSE
DL1	Red	Visulizes the status of signal RB4 of Mini Module, it can be used as activity LED because it can be driven by software.

FIGURE 2: LED TABLE

The main function of LED is to inform the user about card status, with a simple visual indication and in addition to this, LED makes easier the debug and test operations of the complete system.
To recognize the LEDs location on the card, please refer to figure 7. while for further information please refer to paragraph ACTIVITY LED.

CONNECTIONS

The **GMM 886** module has 1 connector that can be linkeded to other devices or directly to the field, according to system requirements.
In this paragraph there are connector pin out, a short signals description (including the signals direction) and connectors location (see figure 7) that simplify and speed the installation phase. Some additional figures shows the pins functionalities and some of the most frequently used connections.

CN1 - EXTERNAL MINI MODULE SIGNALS CONNECTOR

CN1 is a 28 pins, male, dual in line, socket connector with 100 mils pitch and 600 mils width.
On CN1 are available all the interfacement signals of the Mini Module as the power supply, the I/O lines, the asynchronous communication lines, the on board peripheral devices signals, the operating mode selection lines, etc.
Some pins of this connector have multiple purposes, in fact they can be multiplexed by programming some software registers with several CPU internal devices and the following figure lists all these possible functionalities.
So the signals available on CN1 have different types as described in the following CONNECTOR SIGNALS INTERFACEMENT paragraph and they follow grifo® Mini Module standard pin out.

To avoid problems in pin counting and numbers the figure 3 shows the signals directly on the top view of the **GMM 886**; moreover the serigraph reports the pins number on the four corner of the card both on bottom (solder) and top (component) side.

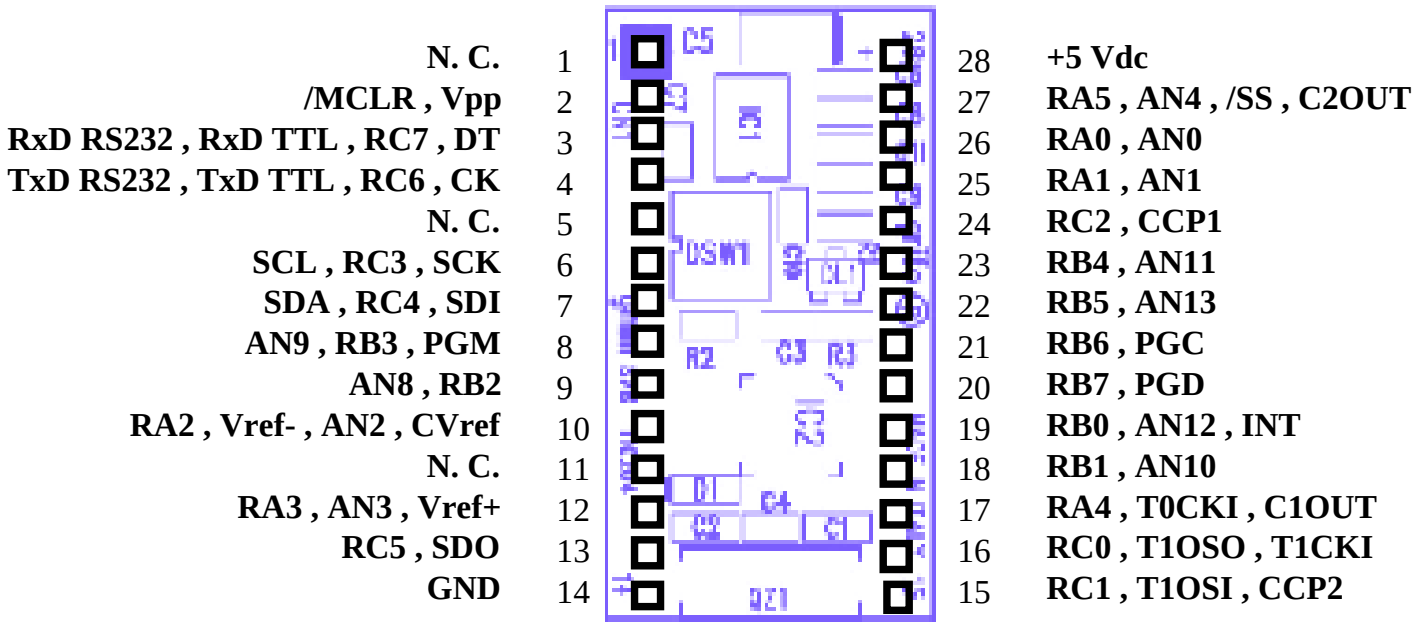


FIGURE 3: SOCKET AND MINI MODULE SIGNALS

Signals description:

+5 Vdc	= I - +5 Vdc power supply
GND	= - Ground
/MCLR , Vpp	= I - Reset (active low) and programming voltage input
SCK , SDI , SDO	= I/O - SPI interface signals
RxD RS232 , TTL	= I - Receive Data in RS 232 or TTL
TxD RS232 , TTL	= O - Transmit Data RS 232 or TTL
Vref+	= I - A/D converter positive reference voltage
Vref-	= I - A/D converter negative reference voltage
CVref	= I - Analog comparators reference voltage
INT	= I - Interrupt
CCPn	= I/O - Capture inputs compare outputs or PWM output of n-th CCP section
TnCKI	= I - External inputs for counters of timer 0 and 1
T1OSI	= I - External clock input for Timer 1
T1OSO	= O - External clock output for Timer 1
SCL	= O - I^2C Bus clock signal
SDA	= I/O - I^2C Bus reception and transmission signal
Rx0÷7	= I/O - CPU I/O TTL signals RA, RB and RC
AN0÷13	= I - Analog inputs
CnOUT	= O - Analog comparators outputs
N. C.	= - No connection

CONNECTOR SIGNALS INTERFACEMENT

To prevent possible connecting problems between **GMM 886** and the external systems, the user has to read carefully the previous paragraph information and he must follow these instrunctions:

- For RS 232 signals the user must follow the standard specifications of this protocol, defined by CCITT normative.

- All TTL signals must follow the rules of this electric standard. The connected digital signals must be always referred to card ground (GND) and then the 0V level corresponds to logic status 0, while the 5V level corrisponds to logic status 1. The connection of these lines to devices of the controlled system (encoders, switches, proximity, electric valves, power relays, etc.) must be performed through proper power interfaces; it is preferible to adopt opto coupled interfaces that ensure an electric insulation between Mini Module electronic and external noisy, typically generated by power electronic.

- The inputs for A/D converter and analog comparators must be connected to low impedance signals in the range from 0 to 5.0 V, to assure greater stability and precision.

- PWM signals generated by CCP sections are TTL type so they must be buffered to interface the power circuitery. Typical interfaces can be current driver (if PWM signal is still required) or an intergrator circuit if analog voltage is required.

- Also I^2C BUS and SPI signals are at TTL level, as defined by the same standards; for completeness it is remarked that in a network with several devices and rather long it is better to study the connection lay out and to set properly the output stage, the best operational modes and the programmable bit rate: all these conditions allow communications in any condition.

INTERRUPTS MANAGEMENT

One of the most important **GMM 886** features is the powerful interrupts management. Here is a short description of how the board's hardware interrupt signals can be managed; a more complete description of the hardware interrupts can be found in the microprocessor data sheets or in appendix A of this manual.

- Pin 19 of CN1 -> Generates INT to the CPU.
- CPU inside devices -> Can generate an internal interrupt. Possible sources of internal interrupt events are: timer 0÷2, CCP1÷2, UART, SPI, I^2C BUS, A/D converter, analog comparators, EEPROM operations.

The microprocessor features a programmable priority structure that manages the case of contemporary interrupts.
The addresses of the interrupt response subroutines can be software programmed by the user placing them on the proper code areas while the interrupts priority level and activation are sofware programmable through internal CPU registers. So the user program has always the possibility to react promptly to every external event, deciding also the priority of interrupts.

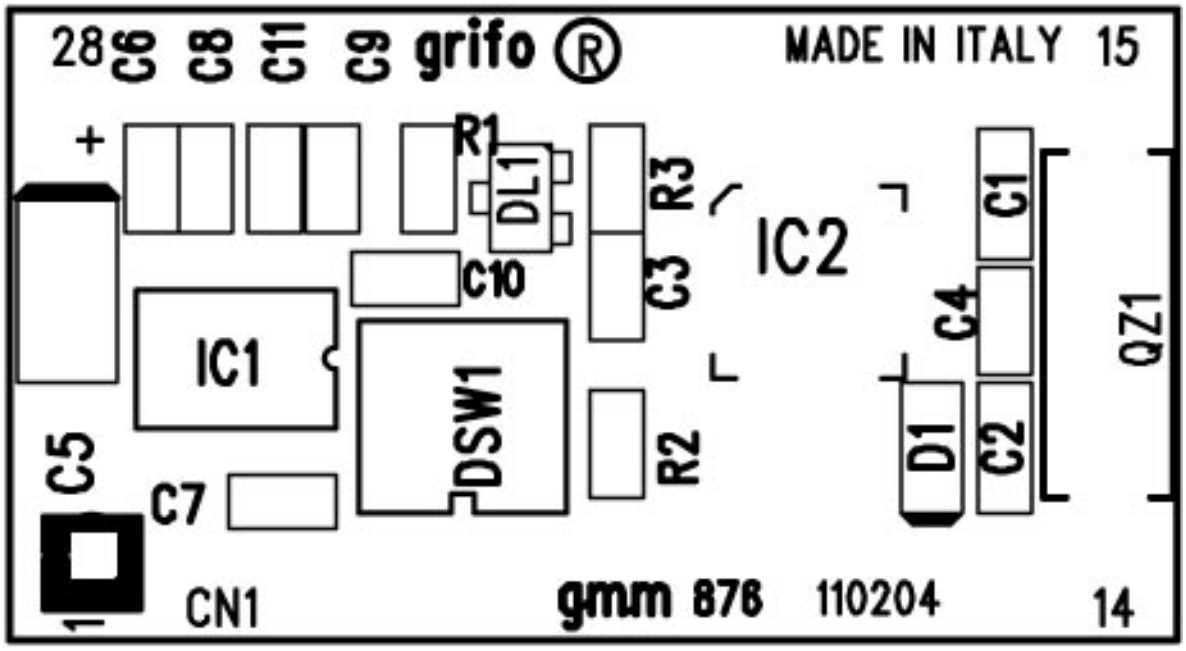


FIGURE 4: COMPONENTS MAP - COMPONENTS SIDE

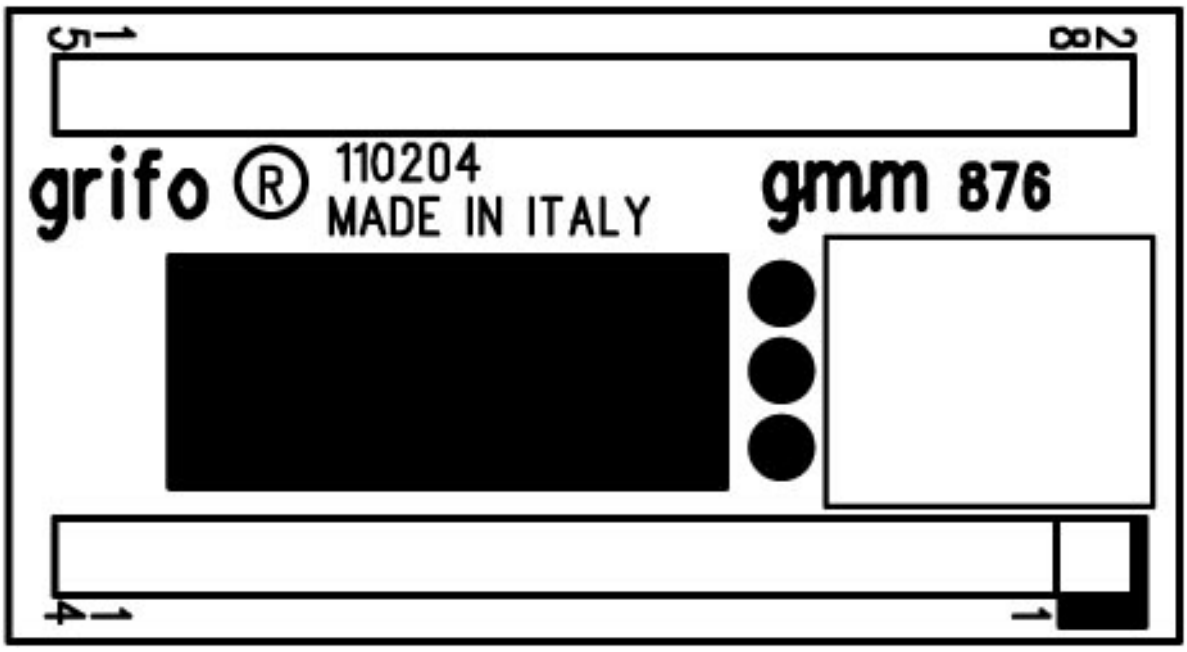


FIGURE 5: COMPONENTS MAP - SOLDER SIDE

DIP SWITCH

A 4 pins dip switch is installed on **GMM 886** Mini Module. It allows to perform selection regarding the module's working way.
Figure 6 shows a list of swithces connection and purpose, in the table * (asterisk) means default connection, that is the configuration of the board after test in our laboratories.
To locate the dip switch, please refer to figure 7.

SWITCH	POSITION	PURPOSE	DEF.
1	ON	Connects signal TxD RS 232 , TxD TTL , RC6 , CK of CN1 to serial driver. DSW1.3 must be OFF to avoid conflicts. Used in conjuncion with switch DSW1.3.	*
	OFF	Does not connect signal TxD RS 232 , TxD TTL , RC6 , CK of CN1 to serial driver, allowing direct connection to CPU.	
2	ON	Connects signal RxD RS 232 , RxD TTL , RC7 , DT of CN1 to serial driver. DSW1.4 must be OFF to avoid conflicts. Used in conjuncion with switch DSW1.4.	*
	OFF	Does not connect signal RxD RS 232 , RxD TTL , RC7 , DT of CN1 to serial driver, allowing direct connection to CPU.	
3	ON	Connects signal TxD RS 232 , TxD TTL , RC6 , CK of CN1 directly to CPU. DSW1.1 must be OFF to avoid conflicts. Used in conjuncion with switch DSW1.1	
	OFF	Does not connect to CPU signal TxD RS 232 , TxD TTL , RC6 , CK of CN1, allowing direct connection to serial driver.	*
4	ON	Connects signal RxD RS 232 , RxD TTL , RC7 , DT of CN1 directly to CPU. DSW1.2 must be OFF to avoid conflicts. Used in conjuncion with switch DSW1.2.	
	OFF	Does not connect signal RxD RS 232 , RxD TTL , RC7 , DT of CN1 to CPU, allowing direct connection to serial driver.	*

FIGURE 6: DIP SWITCH TABLE

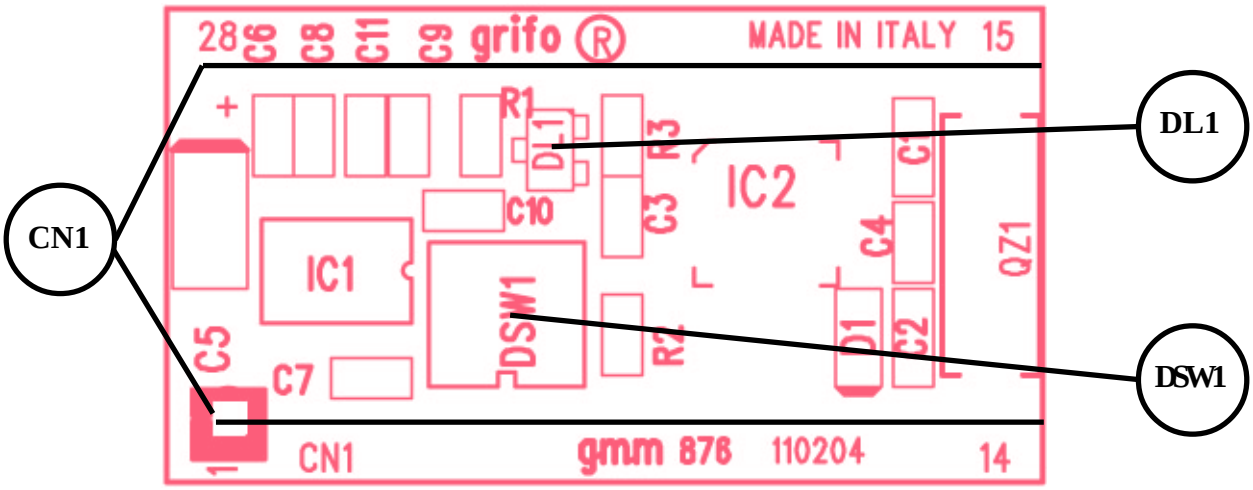


FIGURE 7: LED, DIP SWITCH, CONNETTOR, ETC. LOCATION

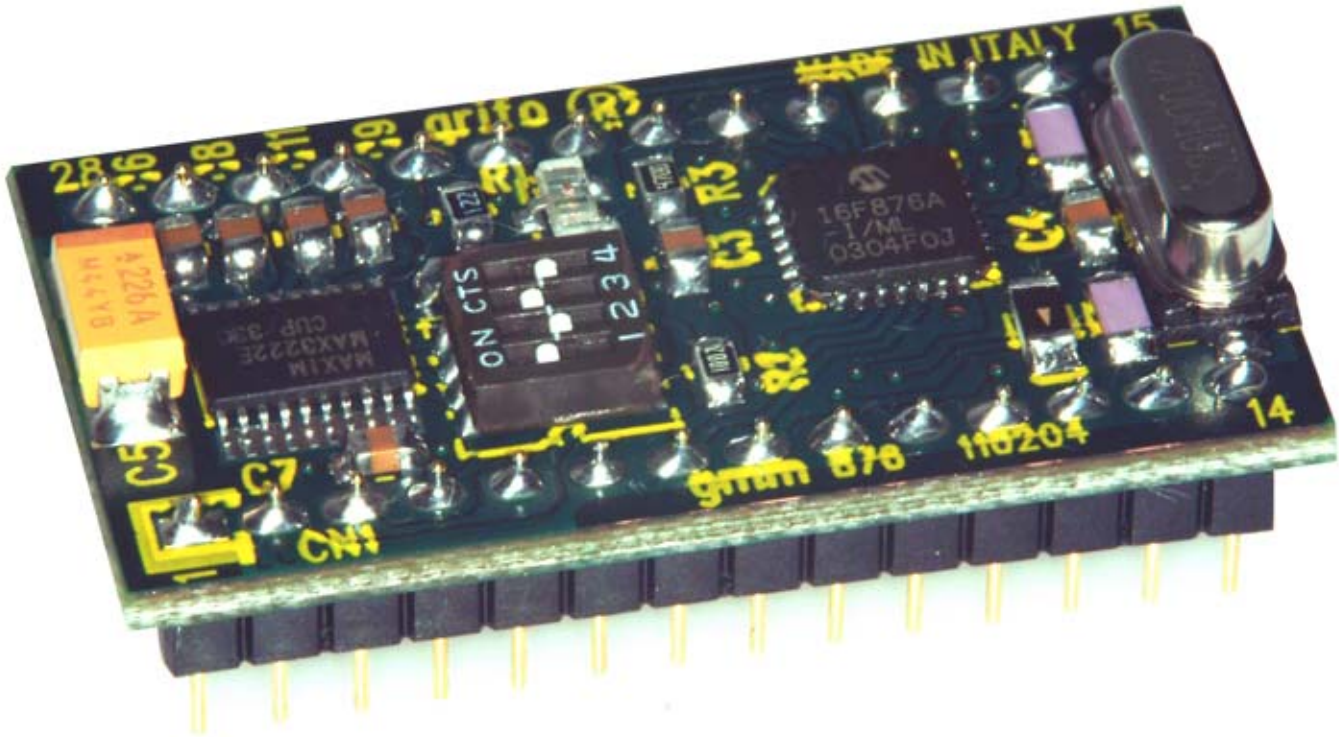


FIGURE 8: MINI MODULE GMM 886

CONFIGURTATION FOR SUPPORT CARDS

GMM 886 Mini Module can be used as a macro components for some support cards either developed by the user or directly chosen from the **grifo®** boards. In the following paragraphs are reported the suggested configuration of the most interesting support cards.

USE WITH GMB HR84 MODULE

Amongst **grifo®** cards, **GMB HR84** module is the one designed specifically to provide to 28 pins Mini Modules many interesting features as: 8 optocoupled inputs, 4 relay outputs, mechanical mounting on omega rails and a comfortable wiring through screw terminal connectors. The complete description of the product is available in the relative data sheet and technical manual while in this paragraph are listed the advantages obtained by using this pair of cards:

FIGURE 9: MODULE GMB HR 84 OPEN WITH GMM 886 INSTALLED

The **GMB HR84** allows easily to:

- supply the Mini Module through on board wide range AC, DC power supply;
- have eight I/O signals of microcontroller ports optocoupled NPN and PNP at the same time and visualized through green LEDs; I/O signals are multiplexed with internal peripheral devices, so high level functions as counters, status recognition, etc.,are immediatly available;
- have other four I/O signals of microcontroller ports on bufferd relays and visualized through red LEDs; I/O signals are multiplexed with internal peripheral devices, so high level functions like sqare waves, time based signals, etc., are immediatly available;
- connect I^2C BUS and +5 Vdc power supply on a dedicated connector

- to connect immediatly RS 232 - TTL serial line through a comfortable 9 pins D type connector
- to buffer easily TTL UART signals from microprocessor in RS 422, RS 485 or current loop
- to have more I/O signals for A/D converter, PWM functions, etc. on AMP connector

In detail, the correspondance between Mini Module CPU internal devices signals and **GMB HR84** external interfaces are:

Connettore GMB HR84	PIN	Segnale GMB HR84	FUNZIONE	PIN CN1 GMM 886	Segnale GMM 886
OPTO INPUTS	1	Input 1	Ingresso optoisolato.	pin 26	RA0
	2	Input 2	Ingresso optoisolato.	pin 25	RA1
	3	Input 3	Ingresso optoisolato oppure Ingresso dell'Interrupt.	pin 19	RB0, /INT
	4	Input 4	Ingresso optoisolato.	pin 18	RB1
	5	Input 5	Ingresso optoisolato oppure Timer 0 contatore.	pin 17	RA4, T0CKI
	6	Input 6	Ingresso optoisolato oppure Timer 1 contatore.	pin 16	RC0, T1CKI
	7	Input 7	Ingresso optoisolato.	pin 15	RC1
	8	Input 8	Ingresso optoisolato.	pin 13	RC5
RELAYS	A1	Output 1	Uscita a rele' 5 A.	pin 23	RB4
	A2	Output 2	Uscita a rele' 5 A.	pin 22	RB5
	B1	Output 3	Uscita a rele' 5 A.	pin 21	RB6
	B2	Output 4	Uscita a rele' 5 A.	pin 20	RB7
AMP 8	pin 8	A/D	Ingresso Analogico AN4 oppure I/O TTL.	pin 27	AN4
	pin 3	I/O	I/O TTL.	pin 8	RB3
	pin 5	I/O	I/O TTL.	pin 9	RB2
	pin 6	D/A	PWM oppure I/O TTL.	pin 24	CCP1
	pin 2	I/O	Ingresso Analogico AN3 oppure I/O TTL.	pin 12	RA3
	pin 1	+5 Vdc	Alimentazione +5 Vdc.	pin 28	+5 Vdc
	pin 7	GND	Massa del Mini Block.	pin 14	GND

FIGURE 10: FUNCTIONS OF CONNECTORS OF GMB HR 84 + GMM 886

FIGURE 11: IMAGE OF MODULE GMB HR 84 IN ITS CONTAINER

The following configuration is suggested to use the couple **GMB HR84** + **GMM 886** in their base version, that is RUN mode with serial line buffered in RS 232:

***GMM 886** configuration*

DSW1.1	=	ON
DSW1.2	=	ON
DSW1.3	=	OFF
DSW1.4	=	OFF

***GMB HR84** configuration*

J1	=	not connected
J2	=	2-3
J3	=	2-3
J4	=	2-3
J5	=	don't care
J6	=	1-2
J7	=	1-2
J8	=	not connected
J9	=	not connected
J10	=	2-3
J11	=	2-3

The serial connection cable with development P.C. is the CCR 9+9 R (or in other words an extension reversed cable provided of D9 Female and D9 Male connectors).

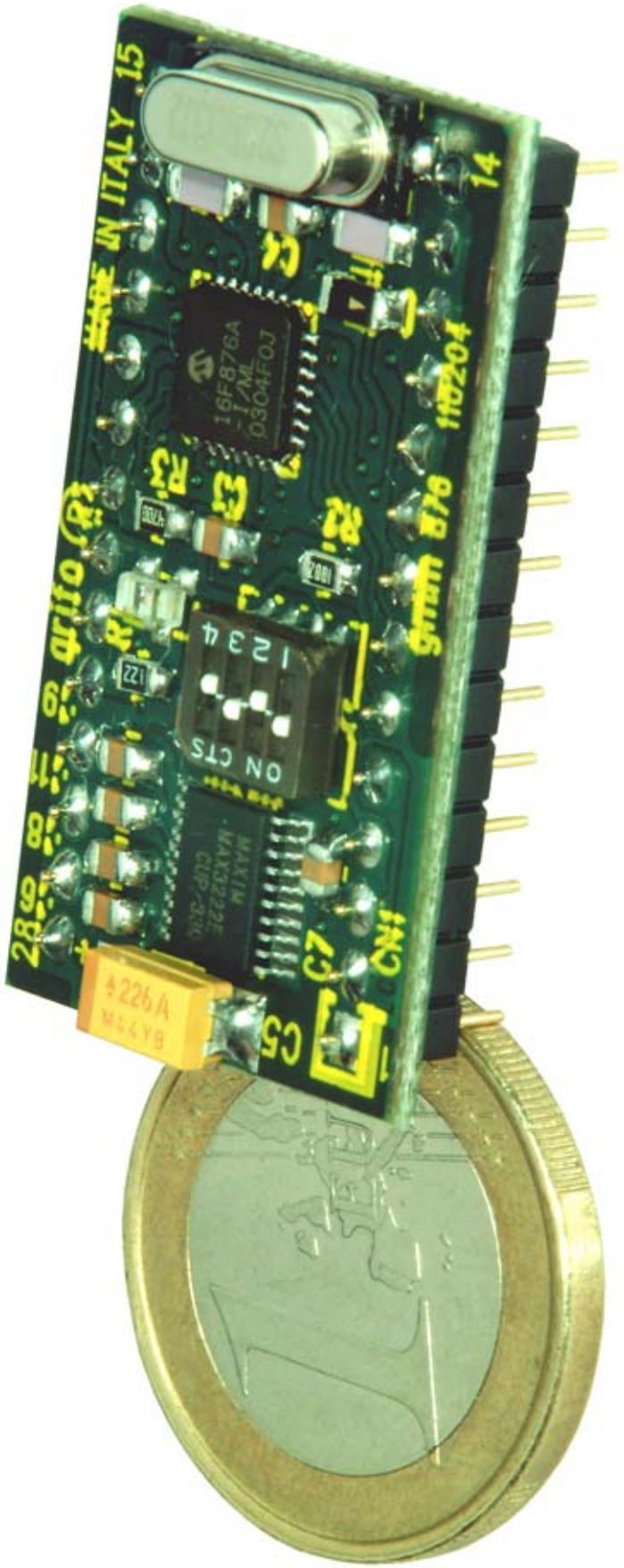


FIGURE 12: MINI MODULE GMM 886 NEAR A 1 EURO COIN

USE WITH GMB HR168 MODULE

Amongst **grifo®** cards, **GMB HR168** module is the one designed specifically to provide up to 16 optocoupled inputs and up to 8 relay outputs to 28 or 40 pins Mini Modules, in addition to the comfortable cabling by quick release connecters and the possibility to install on omega rails.
Complete features description is available in its specific technical sheet and manul, while in this paragraph are listed the features of the matching with Mini Module **GMM 886**.

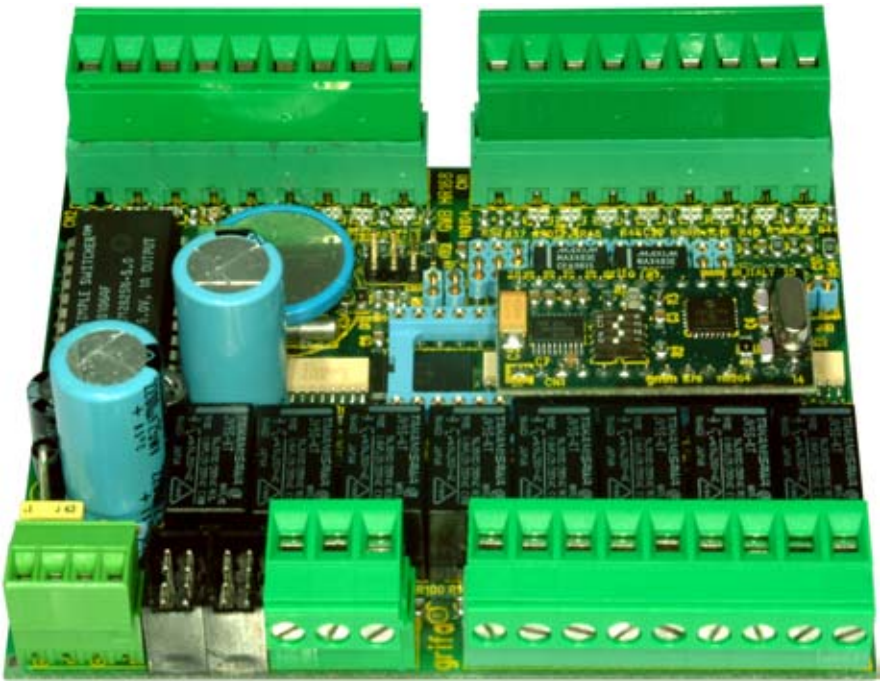


FIGURE 13: IMAGE OF MODULE GMB HR 168, WITH OPTIONAL RTC, AND A GMM 886 INSTALLED

FIGURE 14: IMAGE OF MODULE GMB HR 168 IN ITS CONTAINER

GMB HR168 allows easily to:

- to supply the Mini Module through on board power supply;
- to have sixteen TTL I/O signals of microprocessor ports optocoupled NPN and PNP at the same time and visualized through LEDs (green for the first byte and yellow for the second byte); I/O signals are multiplexed with timer inputs, so developed functions like counters are immediatly available;
- to have other eight TTL I/O signals of microprocessor ports on bufferd relays driving and visualized through red LEDs;
- to connect on **I²C Bus** and +5 Vdc power supply on a dedicated connector;
- to connect immediatly RS 232 - TTL serial line through a comfortable 8 pins standard AMP type connector;
- to buffer easily TTL UART signals from microprocessor in RS 422, RS 485 or current loop;
- to have an optional Real Time Clock (code **.RTC**) installed on board featuring date and time, periodic interrupt generation, 256 Bytes SRAM and Lithium batterty backup;

Connettore GMB HR168	PIN	Segnale GMB HR168	FUNZIONE	PIN CN1 GMM 886	Segnale GMM 886
OPTO INPUTS COM 1	1	Input 1	Ingresso optoisolato.	pin 26	RA0
	2	Input 2	Ingresso optoisolato.	pin 25	RA1
	3	Input 3	Ingresso optoisolato oppure Ingresso dell'Interrupt.	pin 19	RB0, /INT
	4	Input 4	Ingresso optoisolato.	pin 18	RB1
	5	Input 5	Ingresso optoisolato oppure Timer 0 contatore.	pin 17	RA4, T0CKI
	6	Input 6	Ingresso optoisolato oppure Timer 1 contatore.	pin 16	RC0, T1CKI
	7	Input 7	Ingresso optoisolato.	pin 15	RC1
	8	Input 8	Ingresso optoisolato.	pin 13	RC5
RELAY OUTPUTs	A1	Output 1	Uscita a rele' 5 A.	pin 23	RB4
	A2	Output 2	Uscita a rele' 5 A.	pin 22	RB5
	B1	Output 3	Uscita a rele' 5 A.	pin 21	RB6
	B2	Output 4	Uscita a rele' 5 A.	pin 20	RB7
	C1	Output 5	Uscita a rele' 5 A.	pin 8	RB3
	C2	Output 6	Uscita a rele' 5 A.	pin 9	RB2
RELAYs	D1	Output 7	Uscita a rele' 5 A.	pin 12	RA3
	D2	Output 8	Uscita a rele' 5 A oppure PWM.	pin 24	RC2 (se J10 è in 3-4)
			Uscita a rele' 5 A.	pin 10	RA2 (se J10 è in 4-5)
AMP 8 I/O	pin 8	A/D	Ingresso Analogico AN4 oppure I/O TTL.	pin 27	AN4
	pin 6	D/A	PWM oppure I/O TTL.	pin 24	CCP1
	pin 1	+5 Vdc	Alimentazione +5 Vdc.	pin 28	+5 Vdc
	pin 7	GND	Massa del Mini Block.	pin 14	GND

FIGURE 15: FUNCTIONS OF CONNECTORS OF GMB HR 168 AND GMM 886

USE WITH GMM TST 2 BOARD

Amongst **grifo®** cards, **GMM TST 2** is the one designed specifically to be the prototyping board supporting **GMM xxx** Mini Modules featurung 28 or 40 pins.
GMM TST 2 allows easily:

- to supply the Mini Module through on board power supply
- to have I/O port and A/D converter signals on a comfortable low profile connector compiant to standard **I/O ABACO®**
- to connect immediatly RS 232 - TTL signals through a comfortable D type connector
- to set and visualize the status of up to 2 microcontroller I/O signals through coloured push buttons and LEDs excludible by jumpers
- to generate sound feedback using the autoscillating on board buzzer
- to develop quickly and comfortably user interface application taking advantage of on-board LCD backlit 20x2 display and the 4x4 matrix keyboard

Following configuration allows to use the match **GMM TST 2** + **GMM 886** in their basic version and in RS 232:

*Configuration **GMM 886***

DSW1.1	=	ON
DSW1.2	=	ON
DSW1.3	=	OFF
DSW1.4	=	OFF

*Configuration **GMM TST 2***

J1	=	1-2
J2	=	2-3
J3	=	1-2
J4	=	2-3
J5	=	2-3
J6	=	2-3
J7	=	2-3

The serial connection cable with development P.C. is the CCR 9+9 (or in other words an extension cable provided of D9 Female and D9 Male connectors).

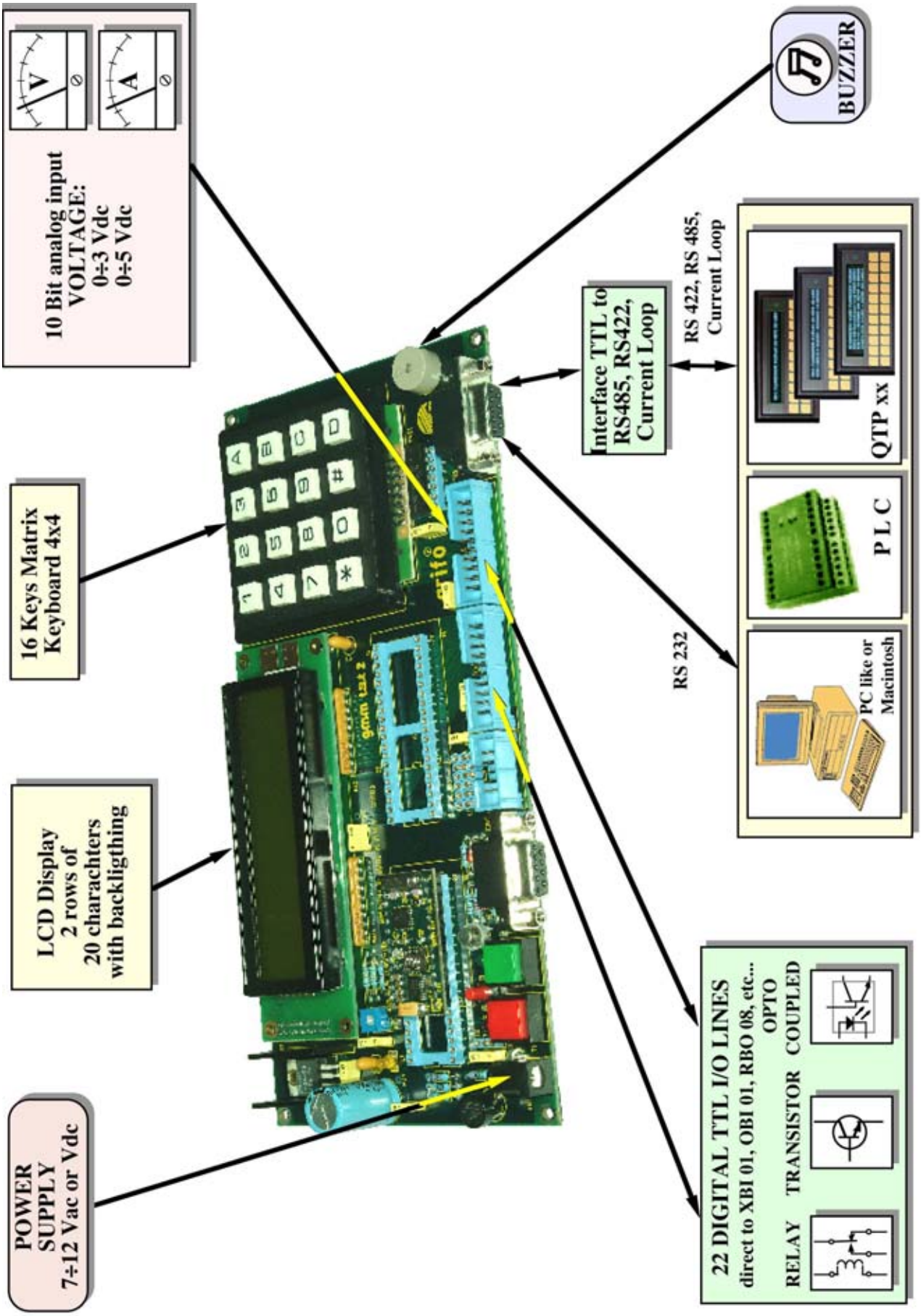


FIGURE 16: DEVELOPMENT BOARD GMM TST 2 WITH A GMM 886 INSTALLED

HOW TO START

One of the most important features of **GMM 886** Mini Module is the possibility to program the microprocessor Microchip PIC16F886 internal FLASH through **grifo® GMM PIC-PR** and a wide range of hardware and software tools.
The three best systems are:

Hardware	Software
Microchip MPLAB® ICD 2 and **grifo® GMM PIC-PR**	MPLAB® IDE Rel. 6.00 or greater
grifo® MP PIK+ and **grifo® GMM PIC-PR**	**grifo®** PG4UW 2.00 or greater
grifo® GMM PIC-PR	PonyProg 2.06c or greater

A PC with a free RS 232 serial port is required.

grifo® GMM PIC-PR board has been designed exclusively to program Mini Modules featuring both 28 and 40 pin, with PIC family microcontroller on board.
To be able to develop application programs also an opportune software development tools is required. For this, it is possible to use specific programming languager like Assembler, BASIC, C, PASCAL, etc.
The previous chapters already introduced three **grifo®** boards suitable both for development and for production: **GMM TST 2**, **GMB HR84** and **GMB HR168**.
Below are listed the sequence of operations that must be performed by the user to develop completely a generic applcation using **grifo®** cards both for programming and for debugging.
All references and examples are designed for use with **GMM TST 2** debuggin and development card.

A) ***MAKE SERIAL CONNECION BETWEEN HARDWARE AND PC:***

A1) Make the connection described in figure 17 or install Mini Module on a **GMM TST 2**, a **GMB HR84** or a **GMB HR168** referring to the manuale of those cards.

.

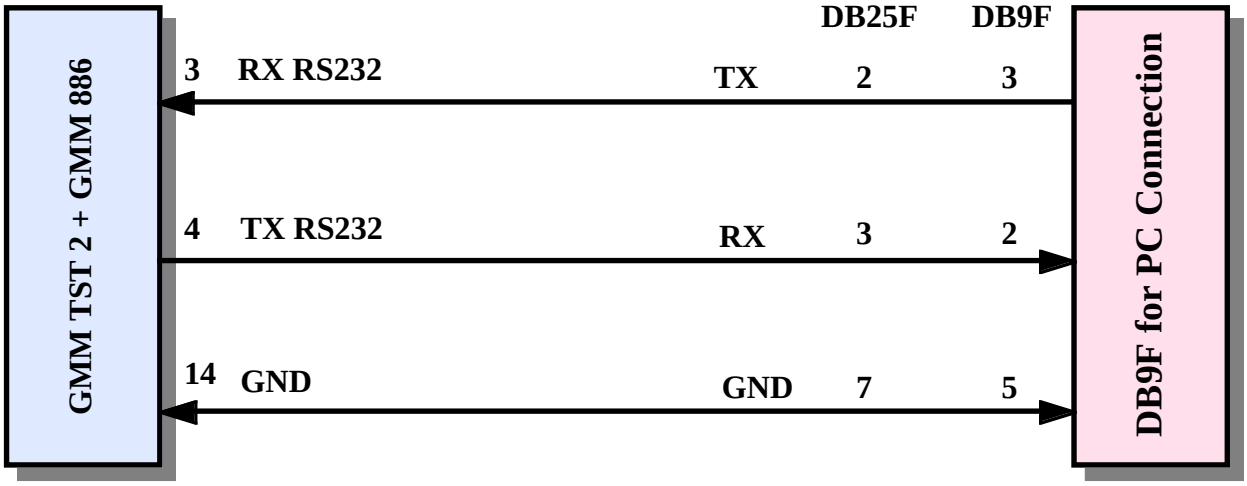


FIGURE 17: POINT TO POINT CONNECTION IN RS 232 BETWEEN A GMM TST 2 AND A PC

A2) Start 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.

A3) Supply **GMM TST 2** where the **GMM 886** has been installed; each Mini Module is delivered with its demo program already programmed in internal FLASH and configured to make it start when Module is supplied, if you don't see the starting screen of demo on terminal emulator, check serial connection.

B) ***FLASH REPROGRAMMING:***

B1) The file containing the demo already programmed in internal FLASH, called "pr886_it.hex", is available on **grifo®** CD, locate and save to a comfortable position on PC hard drive.

FLASH programming can be done in three possible different ways:
I) Using Microchip MPLAB® ICD 2 and **grifo® GMM PIC-PR**
II) Using **grifo®** MP PIK+ and **grifo® GMM PIC-PR**
III) Using **grifo® GMM PIC-PR** alone

I) USING MICROCHIP **MPLAB® ICD 2** AND **grifo® GMM PIC-PR**:

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

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

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

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

Id) Select PIC16F886 from MPLAB® IDE using menu Configuration | Select device.

Ie) Insert Mini Module in socket ZC1 of **grifo® GMM PIC-PR**; connect MPLAB® 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 | MPLAB® ICD 2; enter menu Programmer | Settings | Power and check the checkbox "Power target from MPLAB® ICD 2 (5V Vdd)"; connect with MPLAB® ICD 2 using menu Programmer | Connect.

If) Load file pr886_it.hex using menu File | Import.

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

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

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 PIC16F886 (ISP) using menu Device| Select device as shown in figure 20.

IIe) Open the programming options window (pressing ALT and letter "o") and uncheck the box "Low voltage programming" as shown in figure 21.

IIf) Load the file pr876_it.hex using the menu File | Load File as shown in figure.

FIGURE 18: LOAD THE FILE TO PROGRAM WITH PG4U

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.

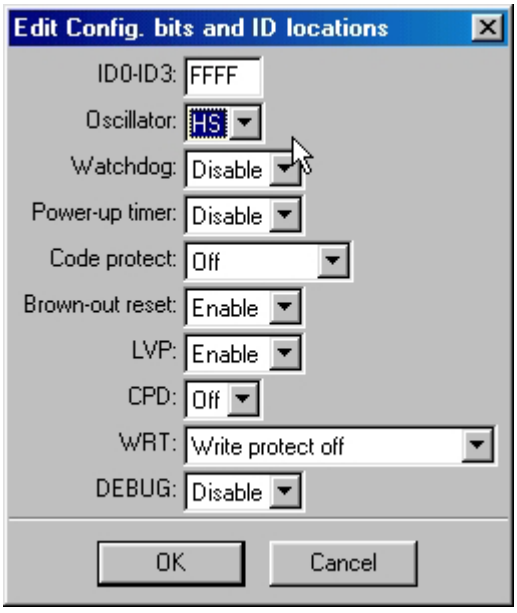


FIGURE 19: CONFIGURATION OF PROGRAMMING OPTIONS WITH PG4U

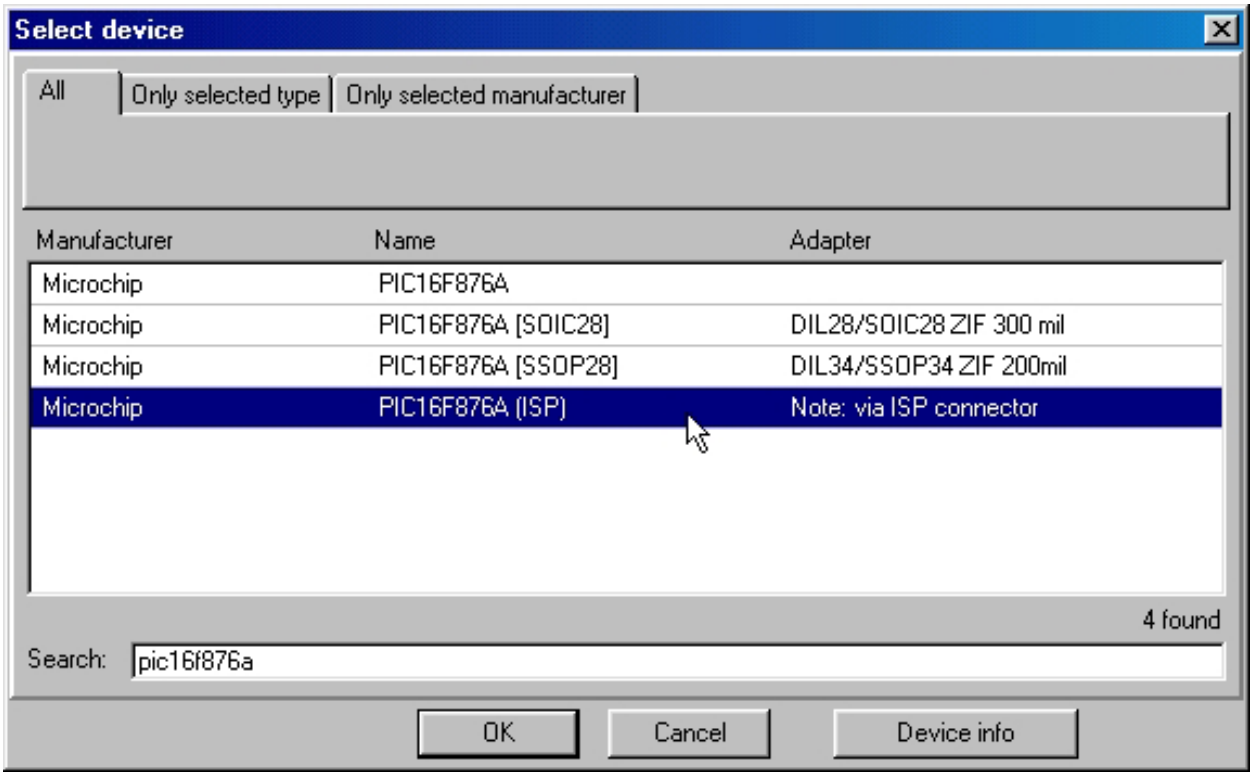


FIGURE 20: SELECT DEVICE WITH PG4U

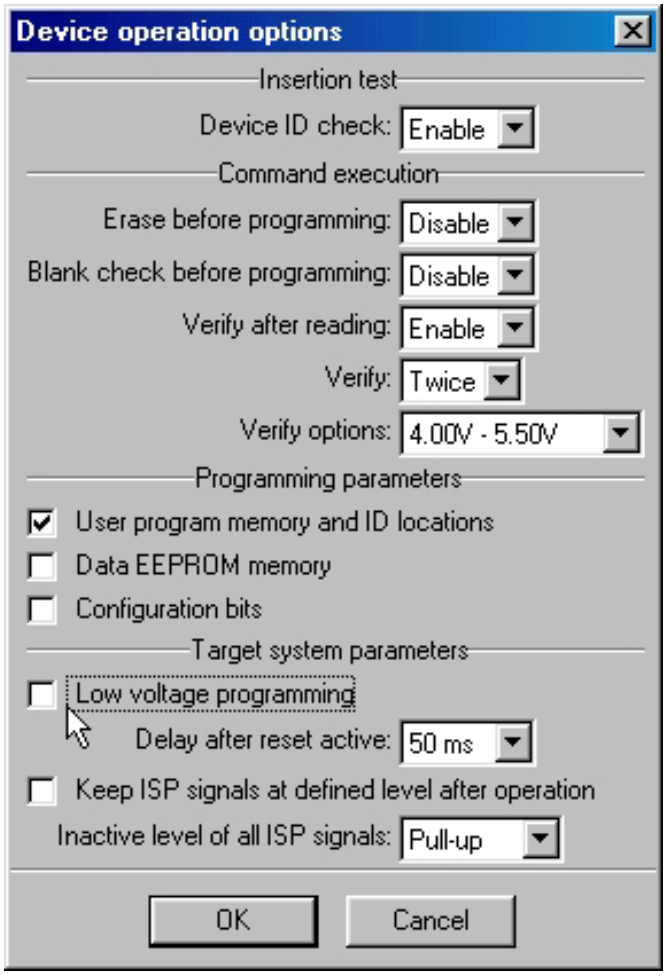


FIGURE 21: DEVICE OPERATIONS SETTING

IIh) Give the programming command.

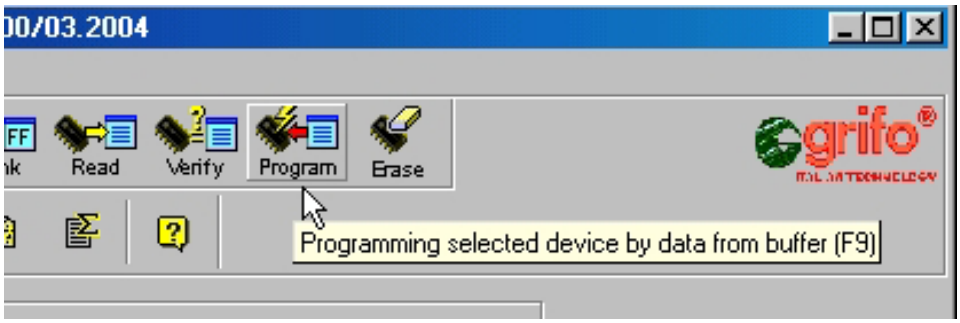


FIGURE 22: PROGRAMMING PIC16F886A USING MP PIK+

III) USING PROGRAM **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).

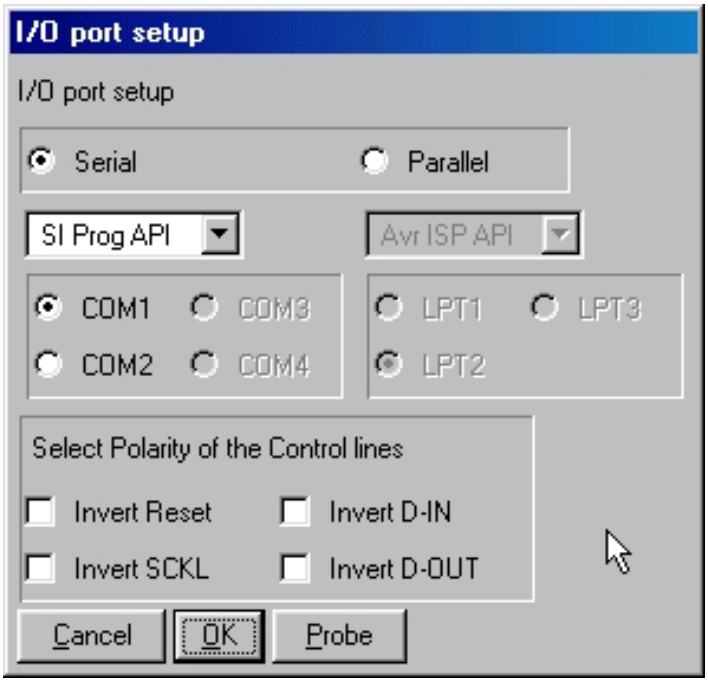


FIGURE 23: SELECT PONYPROG PROGRAMMING INTERFACE

IIId) Insert the Mini Module in socket ZC1 of grifo® **GMM PIC-PR** and select the device PIC 16 model PIC16F886 from the specific text box.

FIGURE 24: DEVICE SELECTION WITH PONYPROG

IIIe) Load file pr886_it.hex as shown in the following figure.

FIGURE 25: 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.

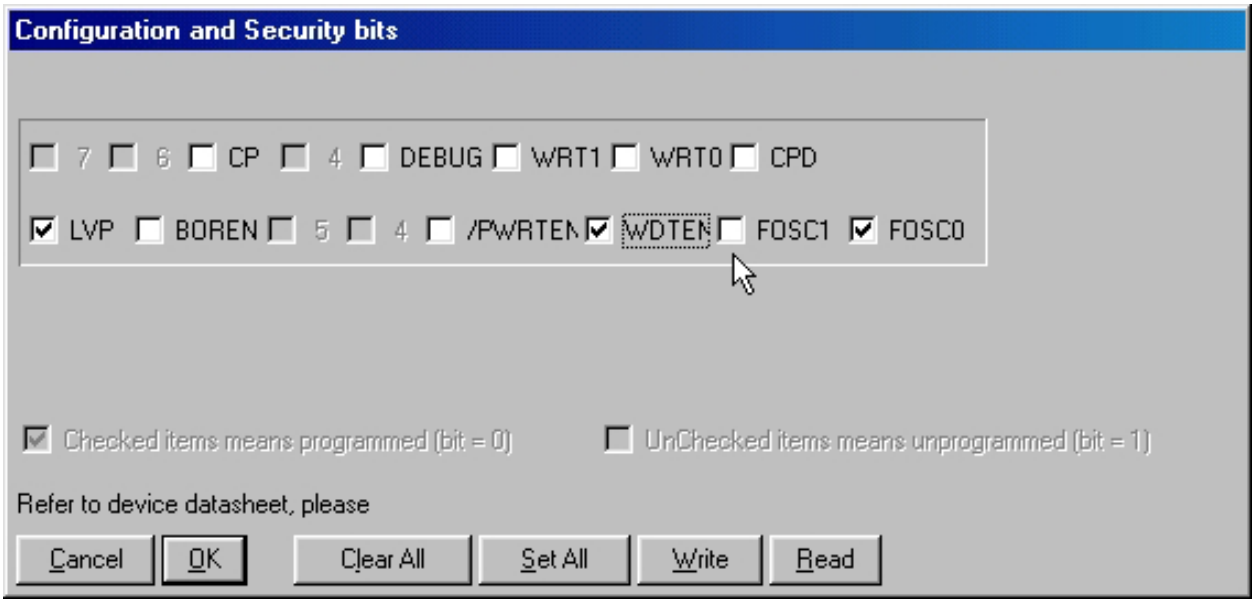


FIGURE 26: CONFIGURATION OF DEVICE WITH PONYPROG

IIIg) Program FLASH of PIC16F886, as shown in the following figure.

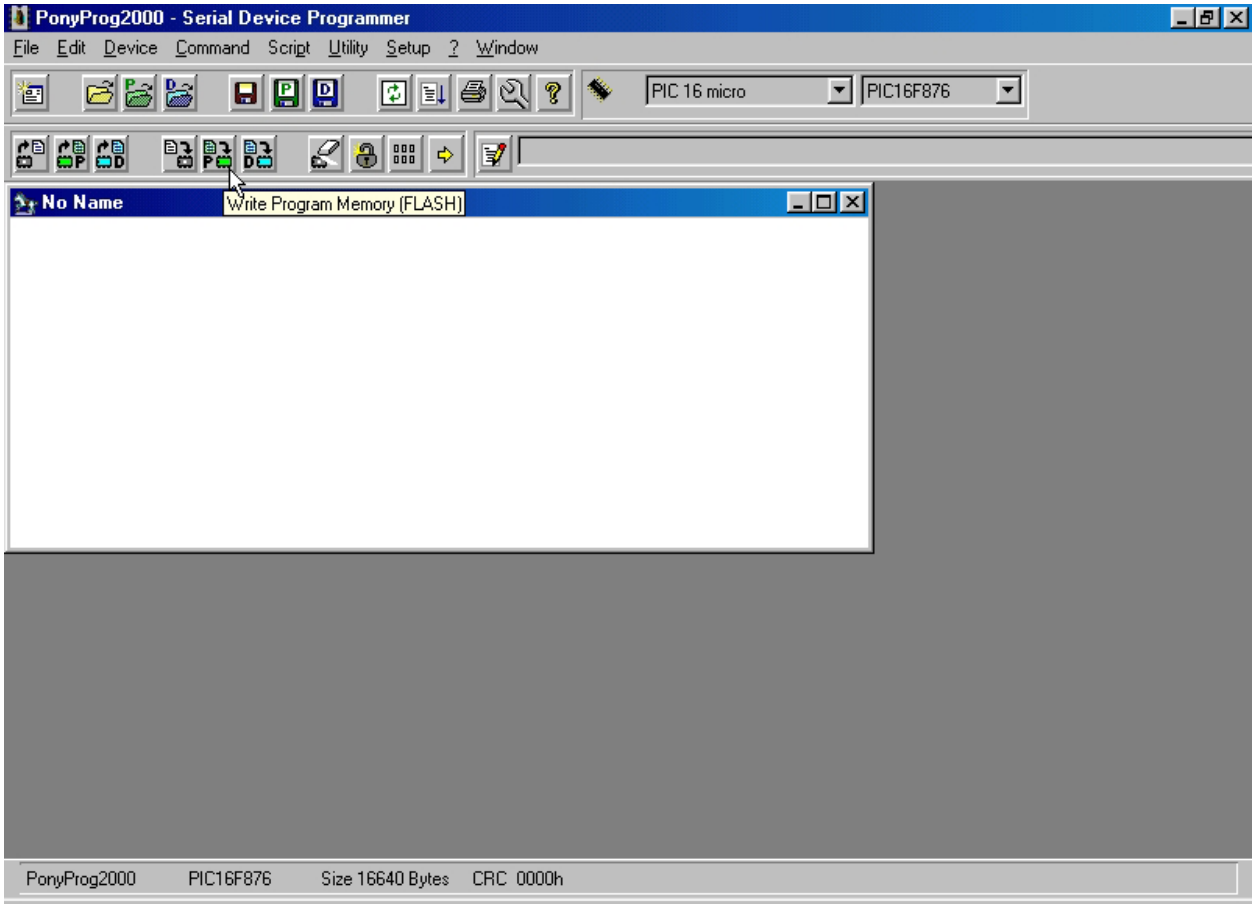


FIGURE 27: PROGRAMMING THE DEVICE WITH PONYPROG

B3) Connect Mini Module to terminal emulator on PC and supply it, in the terminal emulator window the starting screen of demo appears, like in step A3.

C) *Creating the executable code of demo program*

C1) Install on the P.C.'s hard disk the development environment selected to develop the application program. As described in chapter SOFTWARE DESCRIPTION several environments exist to satisfy the customers requests,anyway here we use, just as an example, Pic Basic Standard with MicroCode Studio.

C2) On CD **grifo®** you can find source file(s) of demo program in addition to the executable files. These files feature an extension that allows to identify the development environment (e.g. pr886_it.bas for Pic Basic) and are organized in the examples table on CD folders, together with eventual definitions files. After these files have been found they must be saved on a comfortable position on development P.C.

FIGURE 28: GMM PIC-PR PROGRAMMER WITH GMM 886 INSTALLED ON ZIF SOCKET

Clockwise, you can see: connector for power supply; D9F connector for RS 232 serial line to a PC; connector RJ12 to communicate with Microchip MPLAB® ICD 2; low profile vertical male connector 10 pins, pitch 2.54 mm, to communicate to MP PIK+ programmer.

C3) Recompile the source file in the selected development environment, to obtain the file pr876_it.hex like the one on CD **grifo®** already used in steps B.

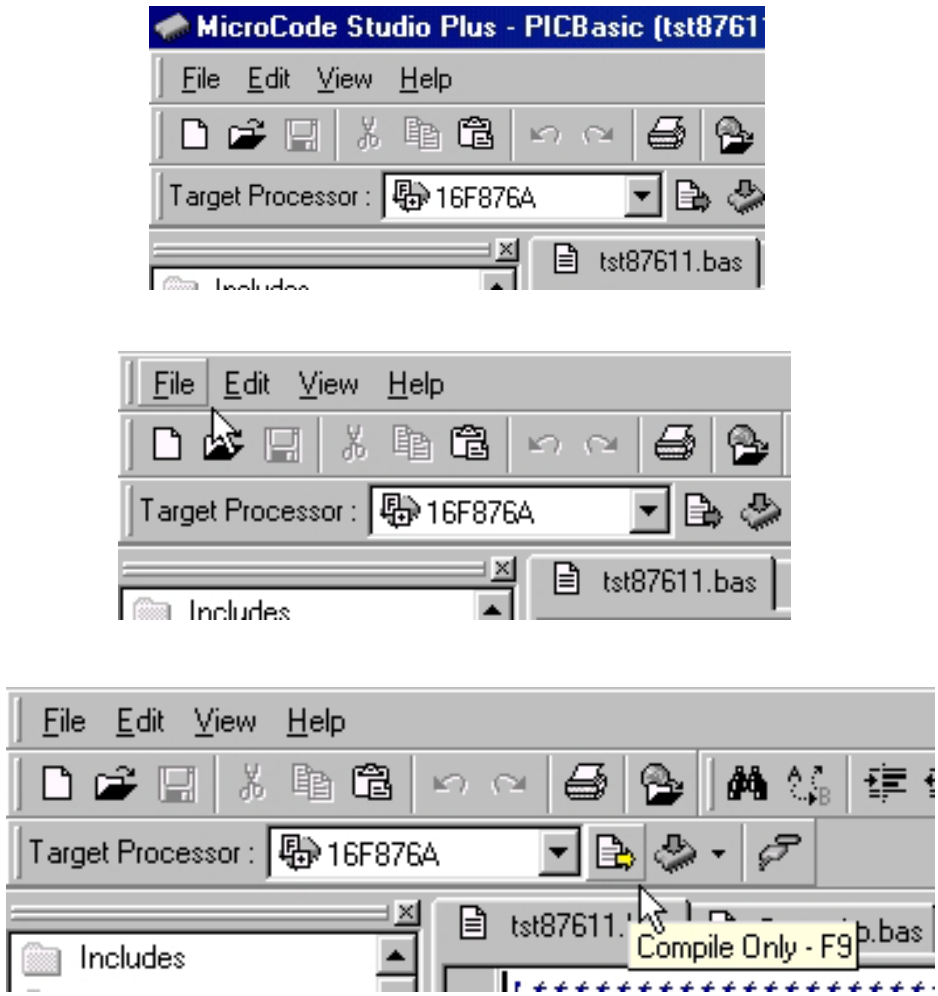


FIGURE 29: USE OF MICROCODE STUDIO TO COMPILE A PROGRAM

C4) Re-program the FLASH of the Mini Module, repeating steps B2÷B3.

When during execution of the steps above described a problem or a malfunction is 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 a first application program that coincides with demo of **GMM 886**.
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 B2 to C3) in cyclic mode, until the developed application program is completely well running.

POWER SUPPLY

Mini Module can be supplied with 3.15 ÷ 5 ± 5% Vdc.
On the board all the circuits and components have been chosen to obtain the best noisy immunity and the lowest consumption, including the possibility to use four different power down setting of the microcontroller. In the best conditions a minimum consumtion of 8 mA is reached and it is suitable for portable applications where battery life time is increased.
Detailed information are reported in "ELECTRIC FEATURES" chapter.

MEMORY ARCHITECTURE

Memory of MiniModule **GMM 886** is made by microprocessor internal memories.
In detail:

Internal memory

- 14,3 Kbyte (8 KWord)	FLASH	user program
- 368 Bytes	EEPROM	user memory
- 256 Bytes	SRAM	user memory

Acces to microcontroller inernal memories is explained in the component data sheet, so please refer to this latter or to appendix A of this manual for further information.

SERIAL COMMUNICATION SELECTION

Serial line of **GMM 886** can be buffered in RS 232 or TTL.
By software the serial line can be programmed to operate with all the standard physical protocols, in fact the bits per character, parity, stop bits and baud rates can be decided by setting opportunes microprocessor's internal registers.
By hardware can be selected which one of the electric standards is used, through dip switches configuration, as described in the previous tables; the user can select in autonomy one or the other type by following the information below:

- SERIAL LINE IN RS 232 (default configuration)

DSW1.1	=	ON
DSW1.2	=	ON
DSW1.3	=	OFF
DSW1.4	=	OFF

- SERIAL LINE IN TTL

DSW1.1	=	OFF
DSW1.2	=	OFF
DSW1.3	=	ON
DSW1.4	=	ON

The following figure and figure 16 show how a generic external system can be connected to **GMM 886** serial line, with both the electric standard.

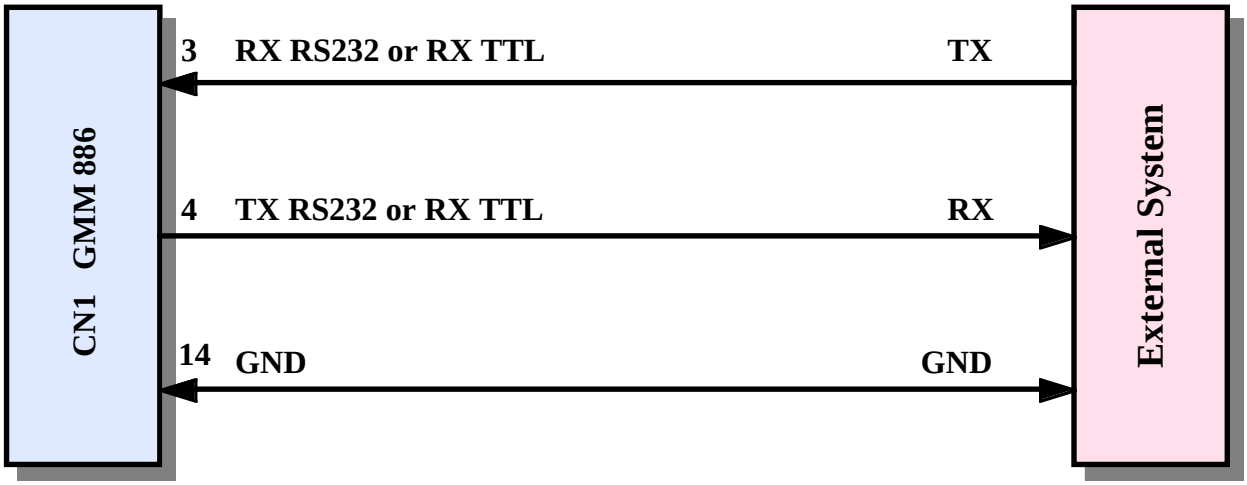


FIGURE 30: EXAMPLE OF SERIAL TTL CONNECTION

SOFTWARE DESCRIPTION

A wide selection of software development tools can be obtained, allowing use of the module as a system for its own development, both in assembler and in other high level languages; in this way the user can easily develop all the requested application programs in a very short time. Generally all software packages available for the mounted microprocessor, or for the PIC 16 family, can be used. All the software development tools supplied by **grifo®** always include many example programs, in source and executable format, fully remarked, that shows how to manage each section of the card. Among these we remind:

HI TECH C PIC: cross compiler for C source program.
It is a powerful software tool that includes editor, C compiler, assembler, optimizer, linker, library, and remote symbolic debugger, in one easy to use integrated development environment.
Library sources included.

PIC BASIC STANDARD: Cross compiler for BASIC programs, it is an extension of BASIC Stamp I that supports most of its instructions and use modalities, adding to it support for most recent and powerful Microchip microcontrollers.
New specific instructions of PIC BASIC and the powerful support for in line assembly directly in basic source allow to exploit fully all the new features of the latest chips.

PIC BASIC PRO: Cross compiler for BASIC programs, it is an extension of PIC BASIC STANDARD, which is an extension of BASIC Stamp I.
It mantains full compatibility with BASIC Stamp I, but the new instructions and the present of structured constructs like IF..THEN..ELSE or CASE allow to exploit fully all the features of a high level language like BASIC keeping an instruction control up to register level.

MICROCODE STUDIO: It is an I.D.E. that works under Windows designed to completely supoort the different versin of PIC BASIC.
Although the flexibility of PIC BASIC allows also other integrated environments, like Microchip MPLAB® IDE, to support it, MicroCode Studio offers a specific support.
It can also be used as a source level debugger just making a little code integration to the application program.

PERIPHERAL DEVICES SOFTWARE DESCRIPTION

In the previous paragraphes 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 addressing tables, for the registers name and addresses values).
For microprocessor internal peripheral devices, not described in this paragraph, or for further information, please refer to manufacturing company documentation or appendix A of this manual.
In the following paragraphs the **D7÷D0** and **.0÷7** indications denote the eight bits of the combination involved in I/O operations.

STATUS LED

LED DL1 (red) can be software driven and their status can be read by simple read and write operations on port B:

PB4 -> DL1

Driving is in complemented logic, in fact LED is **ON** when bit is **0** and LED is **OFF** when the corresponding bit is **1**.
Signals of port B are kept at logic level 1 during the reset or the power on, so when on these phases happen, LEDs are OFF.

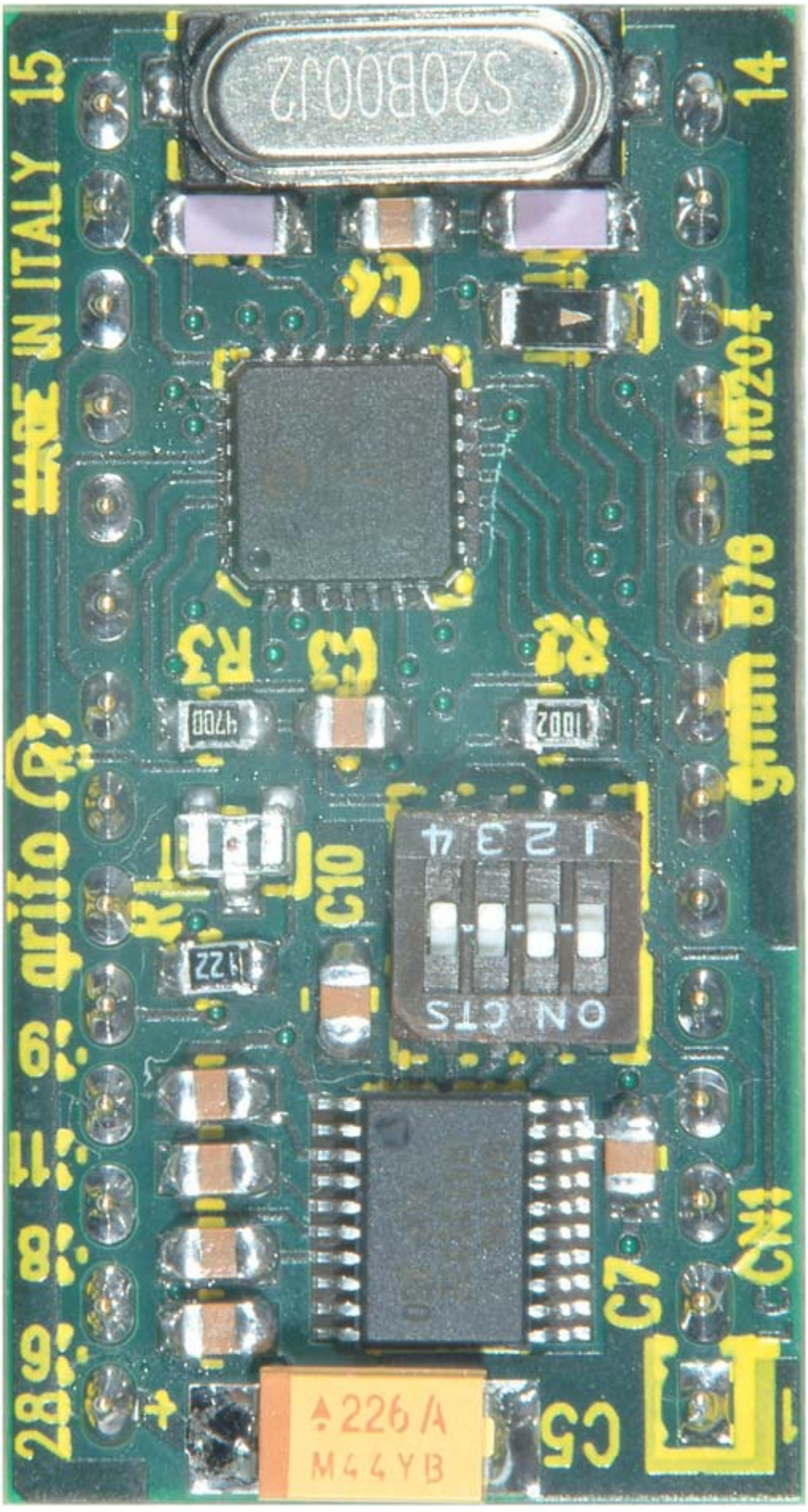


FIGURE 31: TOP VIEW OF MINI MODULE GMM 886

EXTERNAL DEVICES

Can be used with user made hardware, or with Mini Block **GMB HR 84**, **GMB HR 168**, etc.
In addition, using the serial comunication line, they can easily drive the several operator panels from QTP listing.

GMB HR84

grifo® Mini Block Housing, 8 opto inputs, 4 relays outputs

8 optocoupled **inputs NPN** or **PNP** visualized through **LEDs**; some inputs can be **counter** or **interrupt** source; **4 relay outputs** up to 5 A visualized through 4 **LEDs**; some outputs can make **PCA** functions for automatic timed commands; **Serial line** RS 232, RS 422, RS 485, current loop or TTL; switching power supply; logic protection trhough **TransZorb™**; **DC** or **AC** power supply from 12 Vdc up to 24 Vac.

GMB HR168

grifo® Mini Block Housing, 16 opto inputs, 8 relays outputs

Plastic container for rails DIN 50022 Modulbox model M6 HC53; front 90 x 106; height 58 mm; 16 optocoupled **inputs NPN** or **PNP** visualized through **LEDs**; some inputs can be **counter** or **interrupt** source; **8 relay outputs** up to 5 A visualized through **LEDs**; some outputs can make **PCA** functions for automatic timed commands; **RTC** with Lithium battery; 1 TTL output driven by RTC and visualized through LED.

GMM TST2

grifo® Mini Module Test 2

Low price card usefull for evaluating and test purpose of 28 or 40 pins grifo® Mini Modules type **GMM 932, GMM AM08 GMM AM32**, etc...It provides: **D9 connectors** for a direct connections to **RS 232** line and **AVR programmer**; **Buzzer**; Connectors 10 pin for a direct connections to AVR ISP; **16 Key** buttons; 2 lines **LCD** display; **power supply** section with standard connector; push buttons and LEDs for digital I/O signals management; etc.

CAN GMT

Controller Area Network - grifo® Mini Module Test

Low price card usefull for evaluating and test purpose of 28 pins MiniModules type **CAN GM2, CAN GM2, GMM 5115**, etc.. It provides: **D9 connectors** for a direct connections to **CAN** line and **RS 232** line; **power supply** section with standard connector; **push buttons** and **LEDs** for digital I/O signals management; prototype area; etc.

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.

MSI 01

Multi Serial Interface 1 line

Interface for TTL serial line and buffered serial line in RS 232, RS 422, RS 485 or Current Loop. The TTL line is on a screw terminal connector and the buffered one is on a standard plug connector.

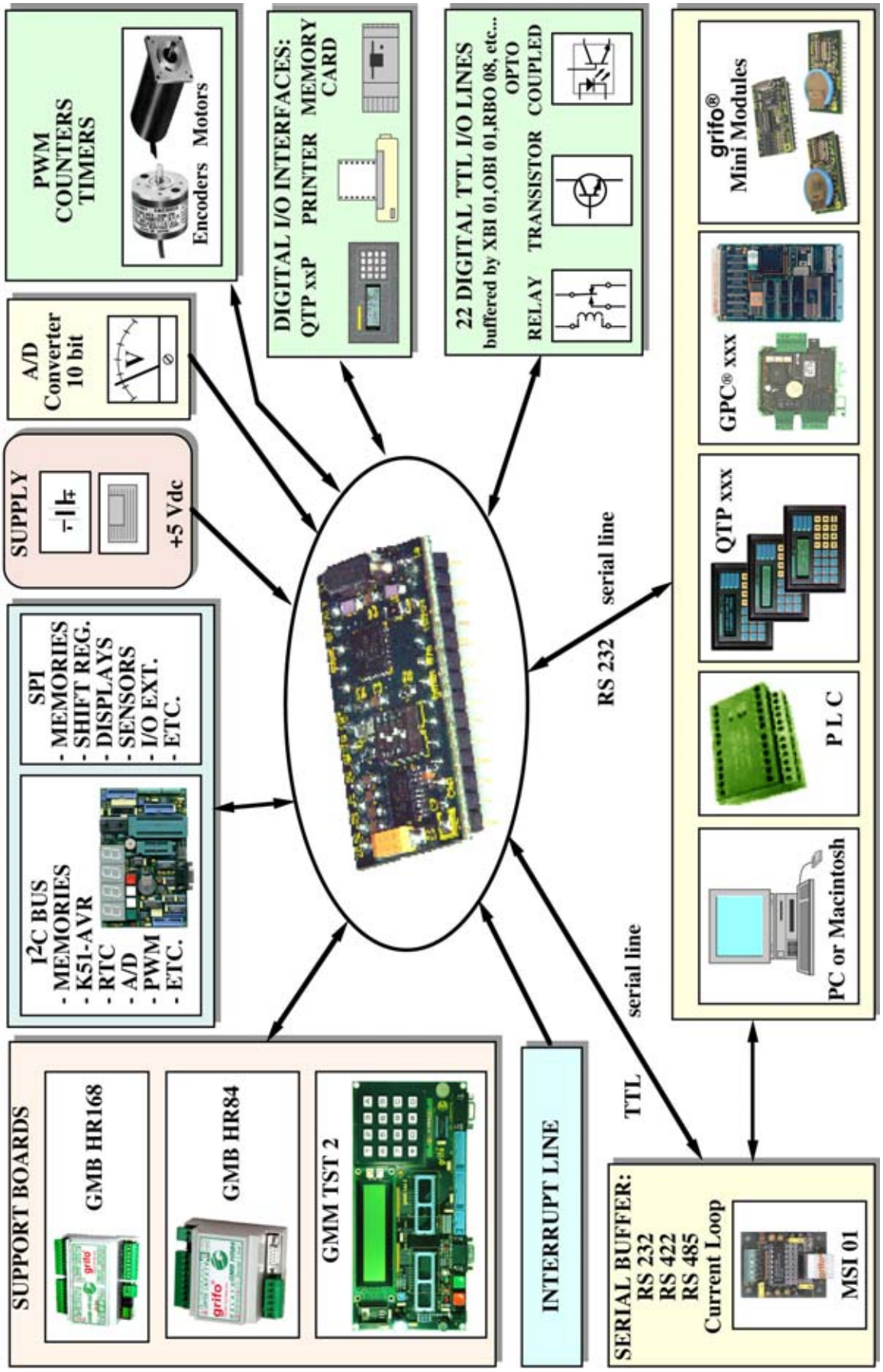


FIGURE 32: POSSIBLE CONNECTIONS DIAGRAM

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 **GMM 886**.

Manual MAXIM: *New Releases Data Book - Volume IV*

Manual MAXIM: *New Releases Data Book - Volume V*
Technical documentation MAXIM: *True RS 232 Transceivers*

Data Sheet Microchip: *PIC16F88X Data Sheet*

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

APPENDIX A: DATA SHEET

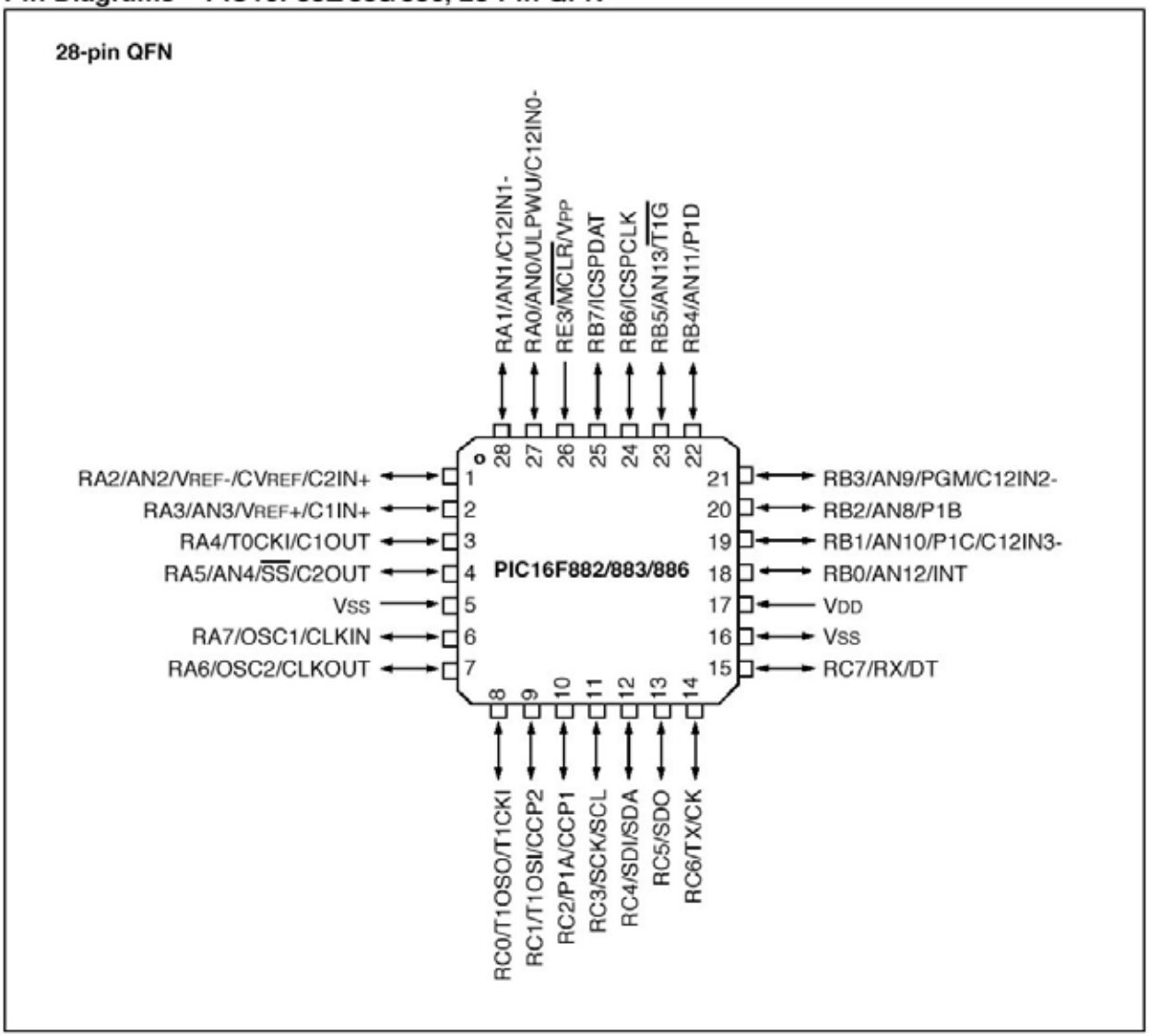
grifo® provides a completely free technical documentation service to make available data sheets of on board components, through its web site. In this chapter the user found the complete and ready to use links and URLs to these information, together with the first pages of the same documents. To use our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

PIC 16F886

Link: Home | Technical documentation Service | Microchip | Data-Sheet PIC 16F88x
URL: http://www.grifo.com/PRESS/DOC/Microchip/PIC16F88x.pdf

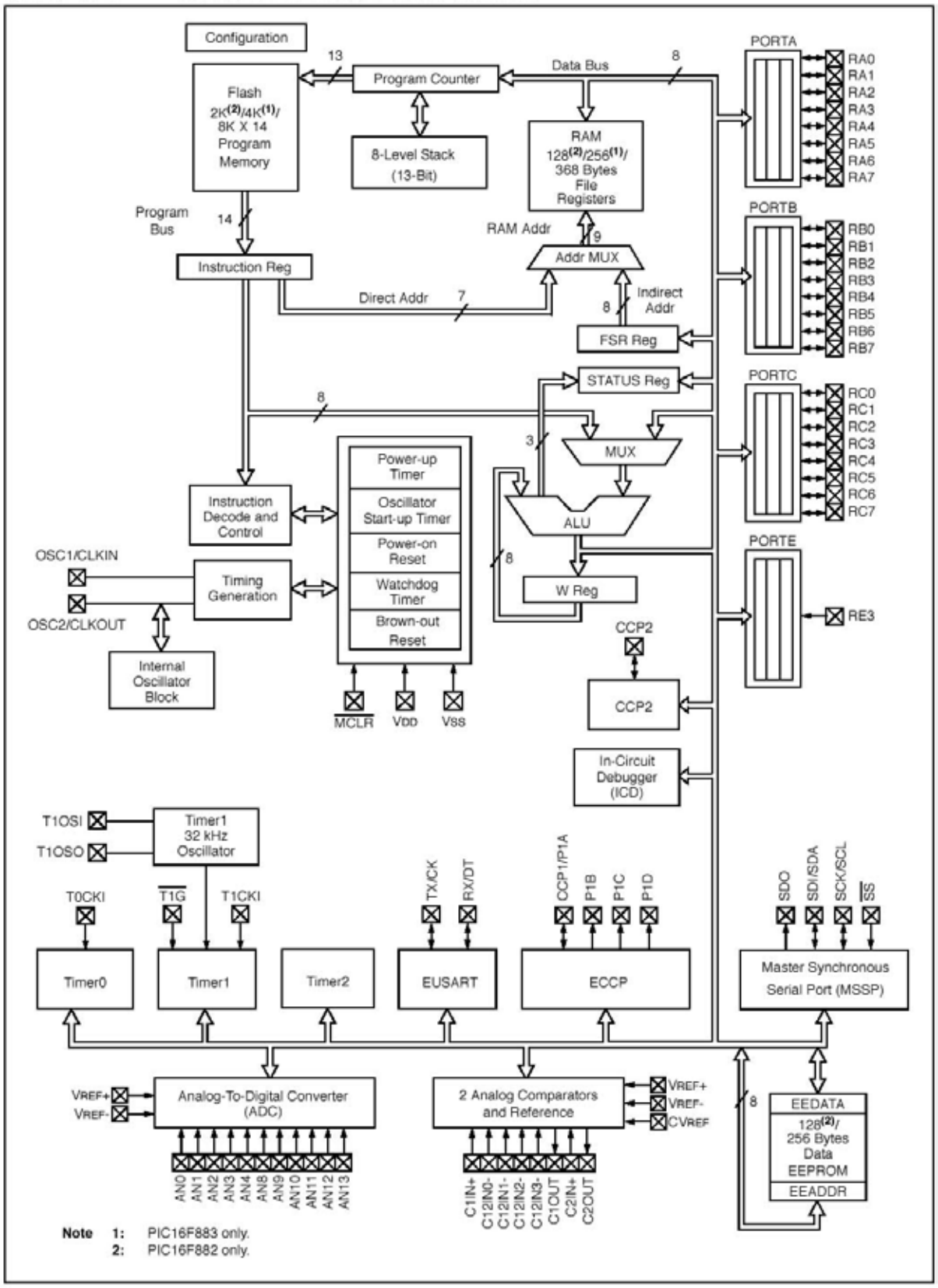
PIC16F882/883/884/886/887

Pin Diagrams – PIC16F882/883/886, 28-Pin QFN



PIC16F882/883/884/886/887

FIGURE 1-1: PIC16F882/883/886 BLOCK DIAGRAM



Note 1: PIC16F883 only.
2: PIC16F882 only.

APPENDIX B: ALPHABETICAL INDEX

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