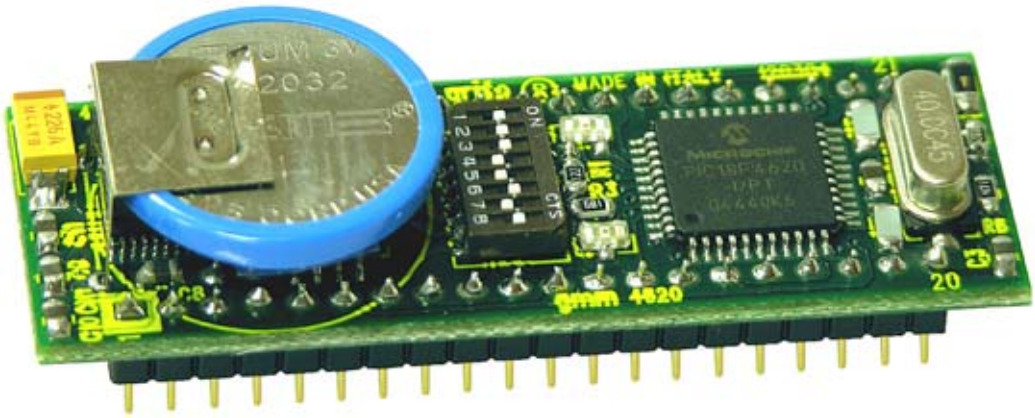
GMM 4620

grifo® Mini Module PIC18LF4620

TECHNICAL MANUAL



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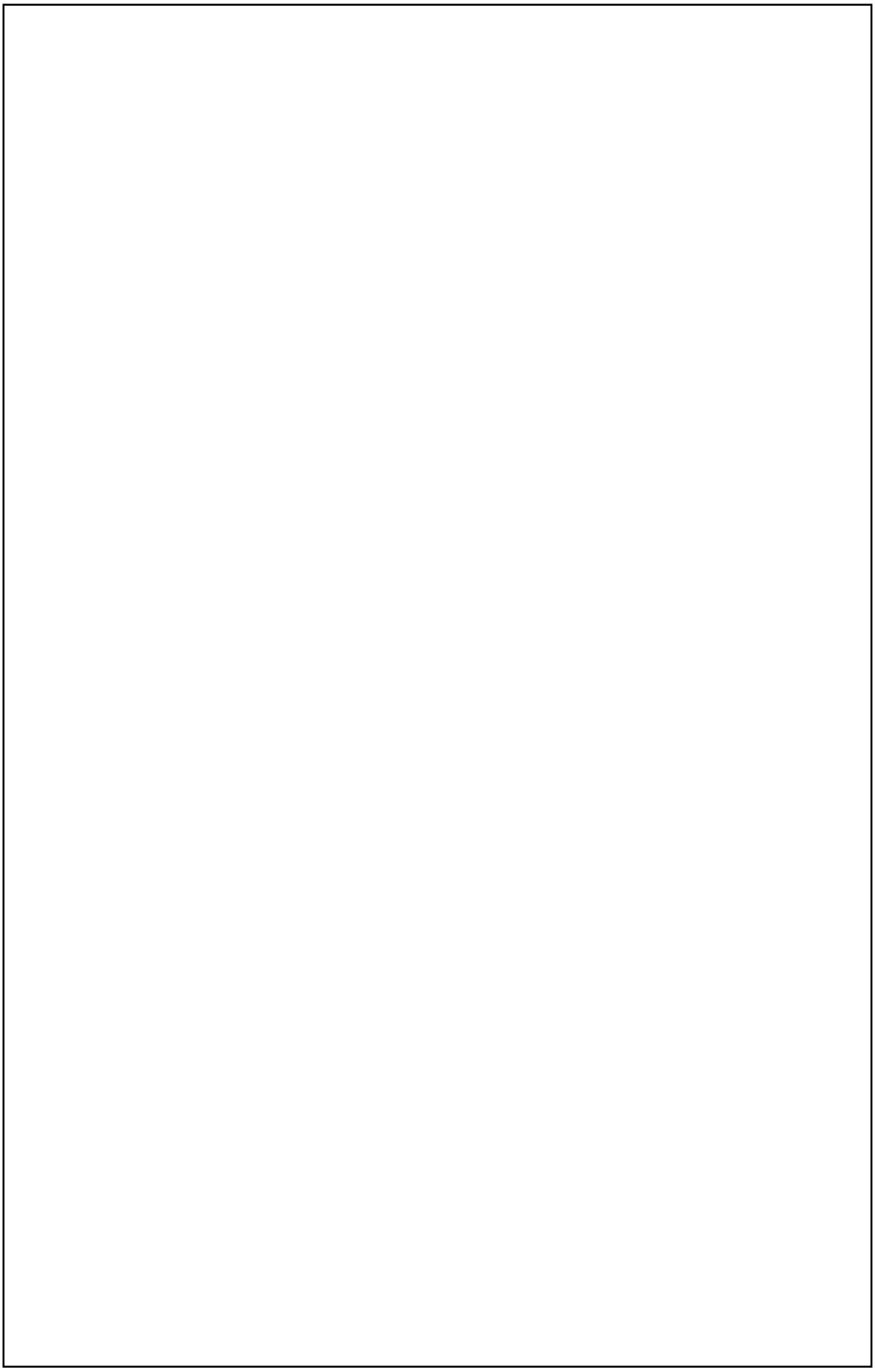
GMM 4620 Rel. 5.00 *Ed. 25 February 2005*



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TECHNICAL MANUAL

Standard container with **40** pins male socket, DIL, **100** mils pitch, **600** mils width. Size **20.8 x 61.5 x 16.3 mm**. **4 layers** PCB to obtain **best** noisy resistance and best **EMI** performance. Single power supply required between **3Vdc** and **5Vdc**, **11 mA**. Availability of **Idle Mode** and **Power Down Mode**. Microcontroller **Microchip PIC18LF4620** with **9.8304 MHz** crystal. Possibility to multiply by 4 the workin frequency by enabling intenal **PLL**. **64 KBytes FLASH** for code; **3986 bytes SRAM** for data; **1024 Byte EEPROM** for data. **13 A/D Converter** inputs with **10 bit** of resolution. **2 Bipolar Comparators** with several combinations of input and output signals. **21 Interrupt** sources; **4 Timer Counter**; **2 CCP** sections with resolution **16 bit** featuring **PWM**, compare, etc. **33** digital **I/O** signals connected to DIL socket. Hardware serial line with **Baud Rate** programmable up to **115.2 KBaud**. **Real Time Clock** capable to manage day, month, year, week day, hours, minutes, seconds and to generate periodic interrupts. **RTC** and **SRAM**, size **240 bytes**, can be backed with on board **Lithium battery. I^2C BUS** hardware. **SPI** hardware. Configuration **Dip Switch** featuring **8** pins. 2 signalation **LEDs** driven by software through **I/O** signals. Possibility to manage **FLASH**, and internal **EEPROM**, by **In System Programming** modality. Support for **ISP** programming allows to download the code directly to on board **FLASH**. Wide range of development software.

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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

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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.

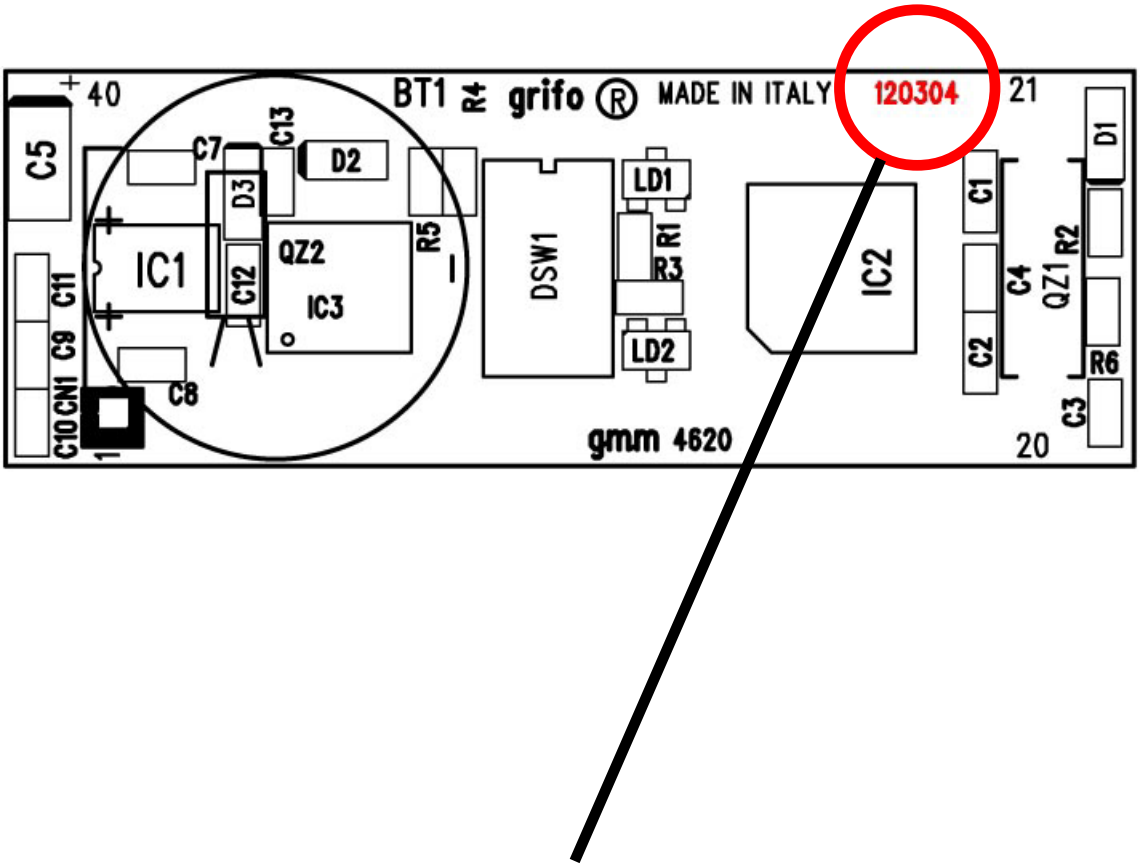
The devices can't be used outside a box. The user must always insert the cards in a container that rispect the actual safety normative. The protection of this container is not threshold to the only atmospheric agents, but specially to mechanic, electric, magnetic, etc. ones.

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 **GMM 4620** card release **120304**. The validity of the bring informations is subordinate to the number of the card release.



CARD RELEASE NUMBER

FIGURE 1: POSITION OF CARD RELEASE

GENERAL INFORMATION

GMM 4620 (**grifo®** **M**ini **M**odulo con **PIC18LF4620**) is a module based on microcontroller **Microchip PIC18LF4620**, 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 and the Real Time Clock, that can be backed up with on board Lithium battery, capable to manage date and time and to generate periodic intrettupts.
Possible applications of **GMM 4620** 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 4620** offers a very low cost to learn how to program a **PIC 16 bit** core CPU.
For this purpose are likewise interesting the **GMB HR168** Mini Block module, that allows to connect immediatly a RS 232 serial port to communicate to a PC and feature 16 digital optocoupled inputs and 8 digital relay outputs.
It is also provided with standard container DIN 50022 M6 HC53 that can be mounted on omega bars.
Overall features are:

- Standard container with **40** pins male socket, DIL, **100** mils pitch
- **600** mils width. Size **20.8 x 61.5 x 16.3 mm**
- **4 layers** PCB to obtain **best** noisy resistance and best **EMI** performance
- Single power supply required between **3Vdc** and **5Vdc**, **11 mA**
- Availability of **Idle Mode** and **Power Down Mode**
- Microcontroller **Microchip PIC18LF4620** with **9.8304 MHz** crystal
- Possibility to multiply by 4 the workin frequency by enabling intenal **PLL**
- **64 KBytes FLASH** for code; **3986 bytes SRAM** for data; **1024 Byte EEPROM** for data
- **13 A/D Converter** inputs with **10 bit** of resolution
- **2 Bipolar Comparators** with several combinations of input and output signals.
- **21 Interrupt** sources
- **4 Timer Counter**
- **2 CCP** sections with resolution **16 bit** featuring **PWM**, compare, etc.
- **33** digital **I/O** signals connected to DIL socket
- Hardware serial line with **Baud Rate** programmable up to **115.2 KBaud**. **Real Time Clock** capable to manage day, month, year, week day, hours, minutes, seconds and to generate periodic interrupts
- **RTC** and **SRAM**, size **240 bytes**, can be backed with on board **Lithium battery**
- **I²C BUS** hardware
- **SPI** hardware
- Configuration **Dip Switch** featuring **8** pins
- 2 signalation **LEDs** driven by software through **I/O** signals

- Possibility to manage **FLASH**, and internal **EEPROM**, by **In System Programming** modality
- Support for **ISP** programming allows to download the code directly to on board **FLASH**
- Wide range of development software: C compilers (HTC C PIC 18), BASIC compilers (PIC Basic Pro, mikroBasic), PASCAL compilers (mikroPascal), development environment (MicroCode Studio), etc.
- Several demo programs and use examples provided as commented source code and executable files, for many development environments

Here follows a description of the board's functional blocks, with an indication of the operations performed by each one.
To easily locate such section on verify their connections please refer to figure 2.

DIGITAL I/O LINES

The Mini Module **GMM 4620** is provided with 33 digital I/O lines at TTL level, of the microprocessor Microchip PIC18LF4620, grouped in three 8 bit ports (RB, RC and RD), one 6 bit port (RA) and one 3 bit port (RE).
Port bits are RA0÷5, RB0÷7, RC0÷7, RD0÷7 and RE0÷2.
These lines are connected directly to 40 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 4620** provides 13 analog inputs of Microchip PIC18LF4620 internal A/D converter, that is signals AN0÷AN12 multiplexed on signals of I/O port.
Main features of this section are: resolution 10 bit; analog inputs in the range defined by the pins Vref+ and Vref- or Vss÷Vdd; conversion time on a single channel 280 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 PIC18LF4620 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 4 milliseconds to more than two minutes.
For further information please refer to microcontroller data sheet or appendix A of this manual.

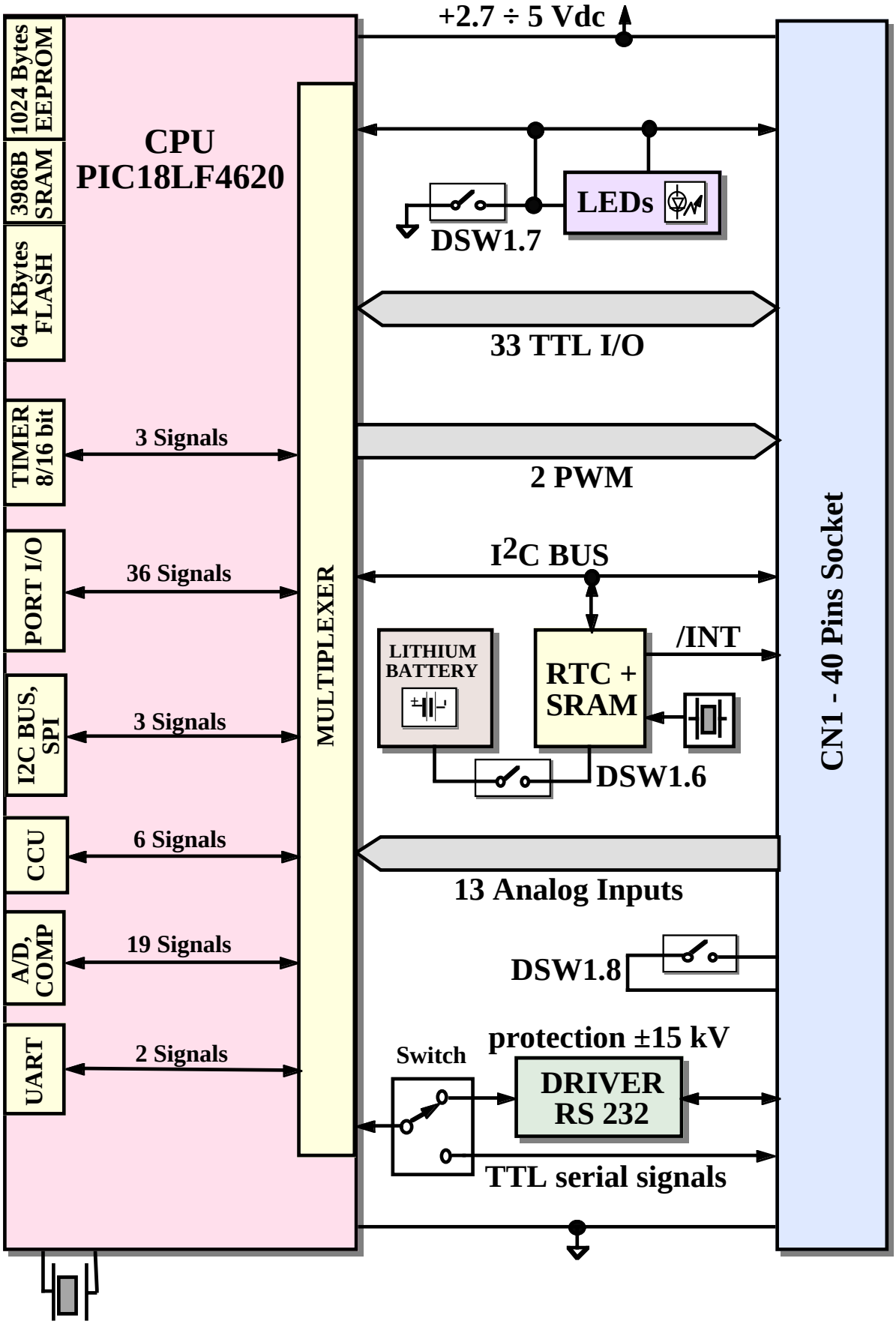


FIGURE 2: BLOCK DIAGRAM OF MINI MODULE GMM 4620

MEMORY DEVICES

The card is provided of 69K Bytes of memory divided with a maximum of **64K** Bytes (32K WORD) FLASH EPROM, **3986** Bytes of internal SRAM, **1024** Bytes of internal EEPROM and 240 bytes of external SRAM on I²C BUS RTC module. 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 I²C 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 4620 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. This LED can be kept ON by moving one of the switches; It can be useful for configurations.
Also, back up battery of SRAM + RTC module can be connected or disconnected moving another switch. By default battery is disconnected, for power saving. Of course, when battery is disconnected, time, date and SRAM content are lost on every power down.
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".

CLOCK

On **GMM 4620** module there is a clock circuitery that generates the clock signals for the microcontroller at a frequency of 9.8304 MHz.
Please remark that the CPU architecture is high performance RISC, which allows to execute intructions at **2.5 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.
It is also possible to work at the maximum frequency allowed of 40 MHz with the crystal intalled by enabling the **PLL** multiplicator by 4. Doing this, instructions will be executed at about **10 MIPS**.
For further information please refer to component data sheet or appendix A of this manual.

SERIAL COMMUNICATION

On **GMM 4620** 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.

I²C BUS INTERFACE

Standard pin out of 40 pins grifo® Mini Module connector reserves two pins, 12 and 13, to I²C BUS interface; some Mini Modules are provided with hardware interface, others emulate it by software.
In special case of **GMM 4620** 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 4620** 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 12, 13 and 19 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:	33 digital TTL I/O signals 13 A/D converter analog inputs 2 analog comparators 2 CCP sections 1 Watch Dog section 4 Programmable Timer/Counter 21 interrupt sources 1 RS 232 serial line 1 eight pins dip switch 2 status LEDs	
Memories:	64 KByte (32K Word) FLASH 3986 Bytes EEPROM 1024 Bytes SRAM 240 Bytes SRAM on I²C BUS	user program user data user data user data
CPU:	Microchip PIC18LF4620	
Clock frequency:	9.8304 MHz	
A/D resolution:	10 bit	
A/D conversion time:	280 µsec	
Watch Dog intervent time:	programmable from about 4 msec to more than 2 minutes	

PHYSICAL FEATURES

Size:	20.8 x 61.5 x 16.3 mm	
Weight:	14 g	
Connectors:	CN1	40 pins male socket DIL
Temperature range:	0÷50 °C	
Relative humidity:	20%÷90%	(without condense)

ELECTRIC FEATURES

Power supply voltage:	3 ÷ 5 Vdc	
Current consumption:	2 ma	(power down mode)
	11 ma	(normal)
	17 ma	(highest)
Analog inputs voltage range:	Vss ÷ Vdd	
Power failure theshold:	configurable amongst 2 Vdc, 2,65 Vdc, 4,11 Vdc or 4,36 Vdc	
Brown out time:	minimim 200 µse	

INSTALLATION

In this chapter there are the information for a right installation and correct use of **GMM 4620** card. In detail there are the locations and functions of each connector, of the dip switches, LED, and so on.

VISUAL SIGNALATIONS

GMM 4620 features the LEDs described in the following table:

LED	COLOUR	PURPOSE
LD1	Red	Visulizes the status of signal RB4 of Mini Module, it can be used as activity LED because it can be driven by software.
LD2	Green	Visulizes the status of signal RA3 of Mini Module, it can be used as activity LED because it can be driven by software. Dip Switch DSW1.7, when connected, keeps LED LD2 ON and signal RA3 connected to ground (Vss). In this case RA3 must be configured as input, to avoid conflicts.

FIGURE 3: LEDS TABLE

The main function of LEDs is to inform the user about card status, with a simple visual indication and in addition to this, LEDs make easier the debug and test operations of the complete system.
To recognize the LEDs location on the card, please refer to figure 8, while for further information please refer to paragraph “ACTIVITY LEDS”.

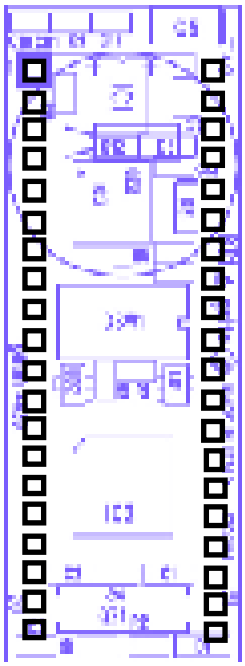
CONNECTIONS

The **GMM 4620** 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 8) 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 40 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 4 shows the signals directly on the top view of the **GMM 4620**; moreover the serigraph reports the pins number on the four corner of the card both on bottom (solder) and top (component) side.



RD0 , PSP0	1		40	+5 Vdc
RD1 , PSP1	2		39	N. C.
RD2 , PSP2	3		38	RD7 , PSP7 , P1D
RD3 , PSP3	4		37	RD6 , PSP6 , P1C
RE0 , /RD , AN5	5		36	RD5 , PSP5 , P1B
RE1 , /WR , AN6	6		35	RD4 , PSP4
DSW1.8	7		34	+5 Vdc
/MCLR	8		33	RA5 , AN4 , /SS , HLVDIN , C2OUT
RxD RS232 , RxD TTL , RC7 , DT	9		32	RA0 , AN0
TxD RS232 , TxD TTL , RC6 , CK	10		31	RA1 , AN1
/INTRTC	11		30	RC2 , CCP1 , P1A
RC3 , SCK , SCL	12		29	RB4 , KBI0 , AN11
RC4 , SDI , SDA	13		28	RB5 , KBI1 , PGM
RB3 , AN9 , CCP2	14		27	RB6 , KBI2 , PGC
RB2 , INT2 , AN8	15		26	RB7 , KBI3 , PGD
RA2 , AN2 , Vref- , CVref	16		25	RB0 , INT0 , FLT0 , AN12
RE2 , /CS , AN7	17		24	RB1 , INT1 , AN10
RA3 , AN3 , Vref+	18		23	RA4 , T0CKI , C1OUT
RC5 , SDO	19		22	RC0 , T1OSO , T13CKI
GND	20		21	RC1 , T1OSI , CCP2

FIGURE 4: SOCKET AND MINI MODULE SIGNALS

Signals description:

+5 Vdc = I - +5 Vdc power supply
GND = - Ground
/MCLR = 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 n = 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÷12 = I - Analog inputs
CnOUT = O - Analog comparators outputs
N. C. = - No connection

CONNECTOR SIGNALS INTERFACEMENT

To prevent possible connecting problems between **GMM 4620** 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 Vss to Vdd, 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 4620** 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 15 of CN1 -> Generates INT 2 to the CPU.
- Pin 24 of CN1 -> Generates INT 1 to the CPU.
- Pin 25 of CN1 -> Generates INT 0 to the CPU.
- CPU inside devices -> Can generate an internal interrupt. Possible sources of internal interrupt events are: timer 0÷3, CCP1÷2, UART, SPI, I^2C BUS, A/D converter, analog comparators, EEPROM operations.

The CPU features a 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.

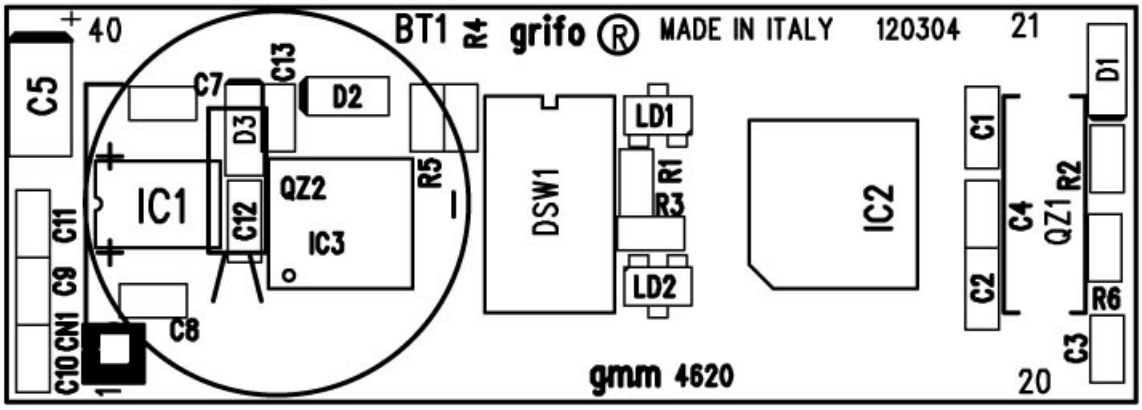


FIGURE 5: COMPONENTS MAP - COMPONENTS SIDE

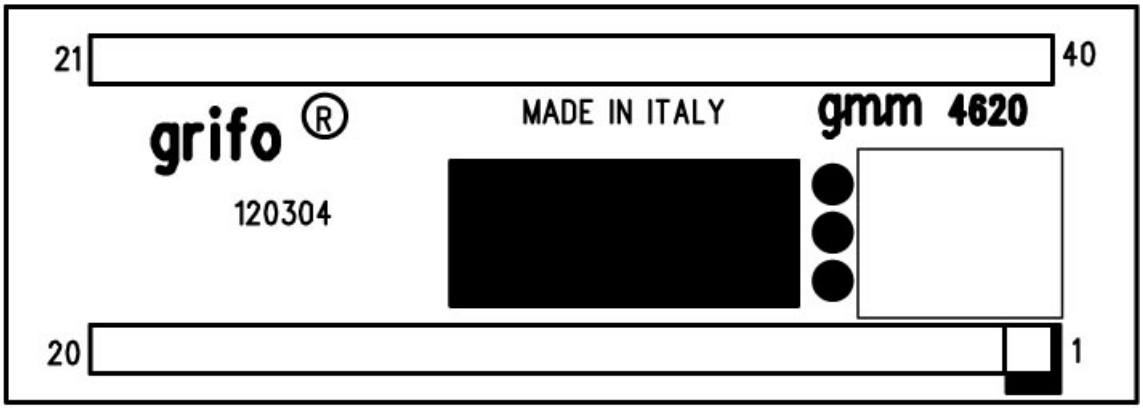


FIGURE 6: COMPONENTS MAP - SOLDER SIDE

DIP SWITCH

SWITCH	POSITION	PURPOSE	DEF.
1	ON	Connects signal RC7 , RX , DT of microcontroller to TTL input of serial driver corresponding to signal RxD RD 232 of serial drivers itself.	*
	OFF	Does not connect signal RC7 , RX , DT of microcontroller to TTL input of serial driver corresponding to signal RxD RD 232 of serial drivers itself.	
2	ON	Connects signal TxD RS 232 , TxD TTL , RC6 , CK of CN1 to serial driver. DSW1.4 must be OFF to avoid conflicts. Used in conjunction 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.	
3	ON	Connects signal RxD RS 232 , RxD TTL , RC7 , DT of CN1 to serial driver. DSW1.5 must be OFF to avoid conflicts. Used in conjunction with switch DSW1.2.	*
	OFF	Does not connect signal RxD RS 232 , RxD TTL , RC7 , DT of CN1 to serial driver,allowing direct connection to CPU.	
4	ON	Connects signal TxD RS 232 , TxD TTL , RC6 , CK of CN1 directly to CPU. DSW1.2 must be OFF to avoid conflicts. Used in conjunction with switch DSW1.5.	
	OFF	Does not connect TxD RS 232 , TxD TTL , RC6 , CK of CN1 to CPU, allowing connection to the serial driver.	*
5	ON	Connects signal RxD RS 232 , RxD TTL , RC7 , DT of CN1 directly to CPU. DSW1.3 must be OFF to avoid conflicts. Used in conjunction with switch DSW1.4.	
	OFF	Does not connect RxD RS 232 , RxD TTL , RC7 , DT of CN1 to CPU, allowing connection to the serial driver	*
6	ON	Connects back up Lithium battery to the Real Time Clock featuring 240 Bytes of SRAM, allowing to keep its content, date and time.	
	OFF	Does not connect back up Lithium battery to the Real Time Clock featuring 240 Bytes of SRAM, erasing its content, date and time.	*
7	ON	Connects signal RA3 to the ground (Vss), allowing to keep LED LD2 ON. RA3 must be configured as input to avoid conflicts.	
	OFF	Does not connect signal RA3 to the ground (Vss), allowing to drive LED LD2 via software, as user LED.	*
8	ON	Connects pin 7 and 39 of 40 pins socket.	
	OFF	Does not connect pin 7 and 39 of 40 pins socket.	*

FIGURE 7: DIP SWITCH TABLE

A eight pins dip switch is installed on **GMM 4620** Mini Module. It allows to perform selection regarding the module's working way.
Figure 7 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 8.

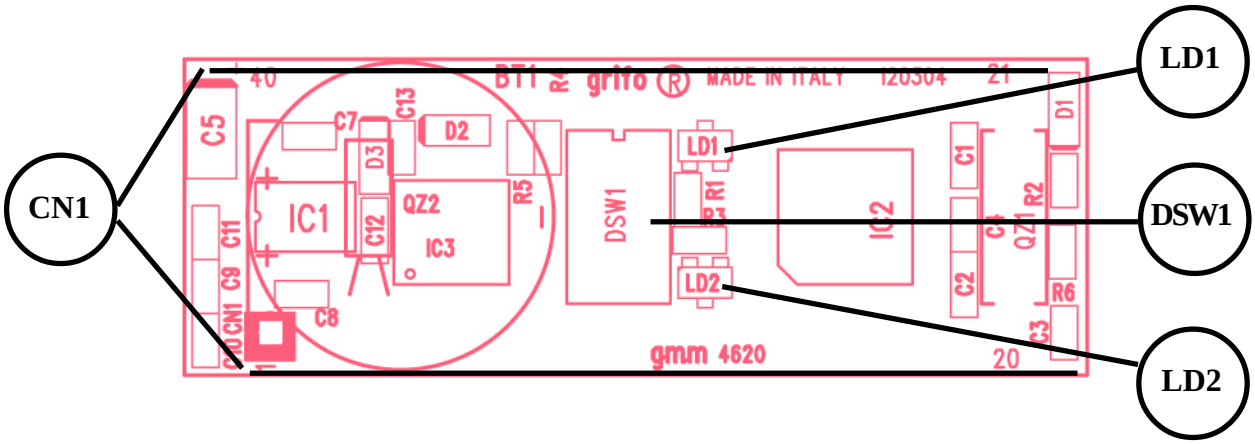


FIGURE 8: LEDS, DIP SWITCH, CONNETTOR, ETC. LOCATION

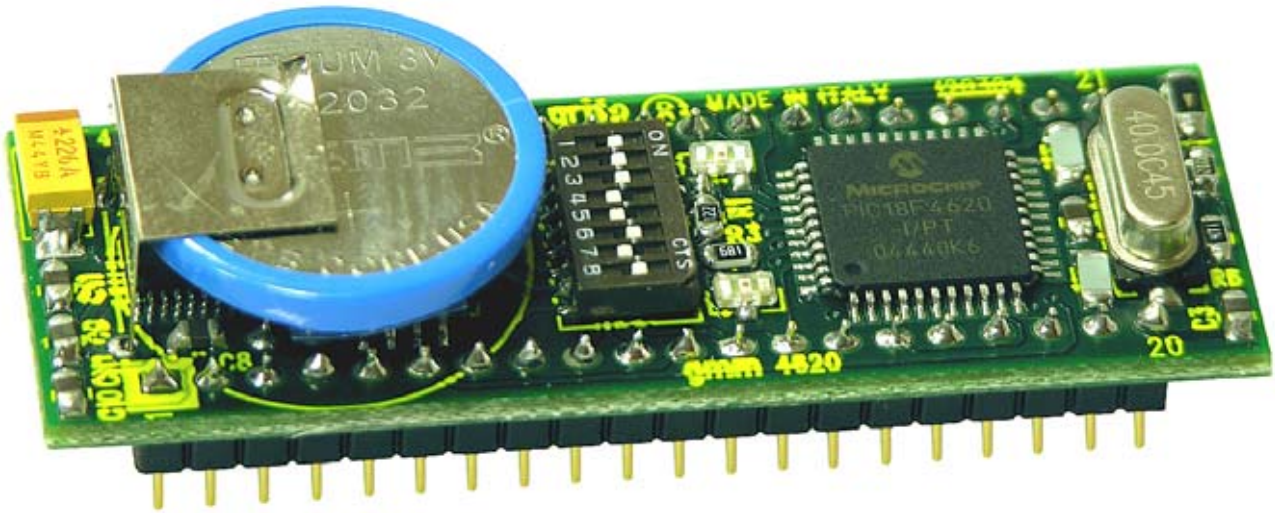


FIGURE 9: MINI MODULE GMM 4620

SUPPORT CARDS

GMM 4620 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 HR168 MODULE

Amongst **grifo®** cards, **GMB HR168** module is the one designed specifically to provide 16 optocoupled inputs; relay outputs and in addition to the comfortable cabling by quick release connecters and the possibility to install on omega rails.
It can be also ordered with an optional Real Time Clock (code option **.RTC**) backed up through a Lithium battery, featuring 240 Bytes of SRAM and capable to manage hour, minutes, seconds, day, month and year.
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.

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 eight TTL I/O signals of microprocessor ports on bufferd relays driving and visualized through red LEDs;

- to connect on **I^2C BUS** and +5 Vdc power supply on a dedicated connector;

- to connect immediatly communication serial line through a comfortable 8 pins standard AMP MODU II 8 pins connector;

- to buffer easily TTL UART signals from microprocessor in RS 422, RS 485 or current loop;

- to connect PWM signal through a comfortable standard AMP connector;

- to have an optional Real Time Clock (code **.RTC**) installed on board featuring date and time, periodic interrupt generation, 240 Bytes SRAM and Lithium batterty backup;

FIGURE 10: IMAGE OF MODULE GMB HR 168 AN GMM 4620

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.
Electric diagram of **GMM TST 2** can be found at appendix B.
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 4620** in their basic version and in RS 232:

*Configuration **GMM 4620***			*Configuration **GMM TST 2***		
DSW1.1	=	ON	J1	=	2-3
DSW1.2	=	ON	J2	=	2-3
DSW1.3	=	ON	J3	=	not connected
DSW1.4	=	OFF	J4	=	not connected
DSW1.5	=	OFF	J5	=	not connected
DSW1.6	=	OFF	J6	=	not connected
DSW1.7	=	OFF	J7	=	not connected
DSW1.8	=	OFF			

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).

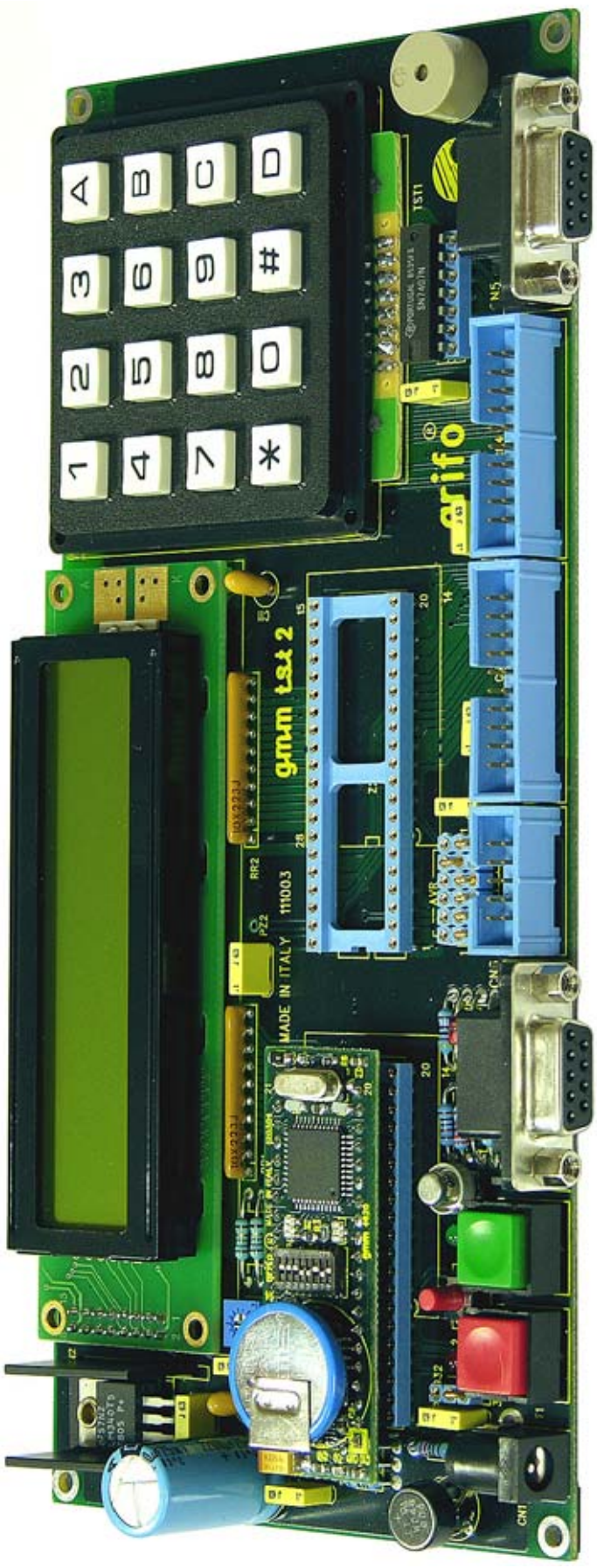


FIGURE 11: DEVELOPMENT BOARD GMM TST 2 WITH A GMM 4620 INSTALLED

HOW TO START

One of the most important features is the possibility to program the microprocessor Microchip PIC18LF4620 internal FLASH through specific tools made by **grifo®** and Microchip.

A) FLASH REPROGRAMMING:

A1) Find on CD **grifo®** and save to a comfortable position on your hard drive the demo program"uk_gmb_iob.hex". It can be found starting from main page following the path: English | Examples tables | Mini Modules and Mini Block examples | GMB HR168 (please refer to figure 12).

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**

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 PIC18LF4620 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 12: EXAMPLES TABLES

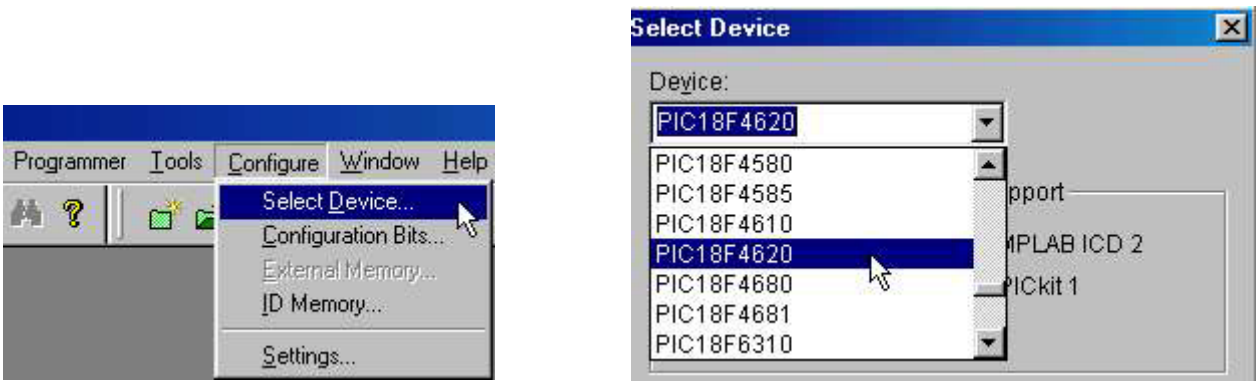
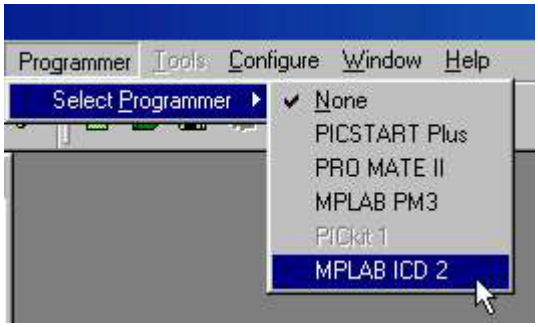


FIGURE 13: DEVICE SELECTION WITH MP LAB® ICD 2

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.



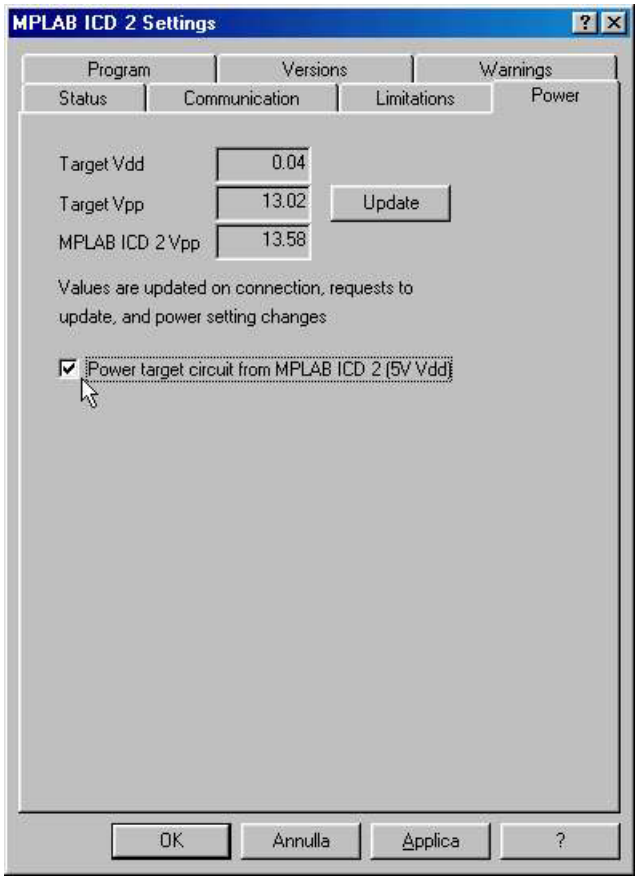


FIGURE 14: CONNECTION TO MP LAB® ICD 2

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

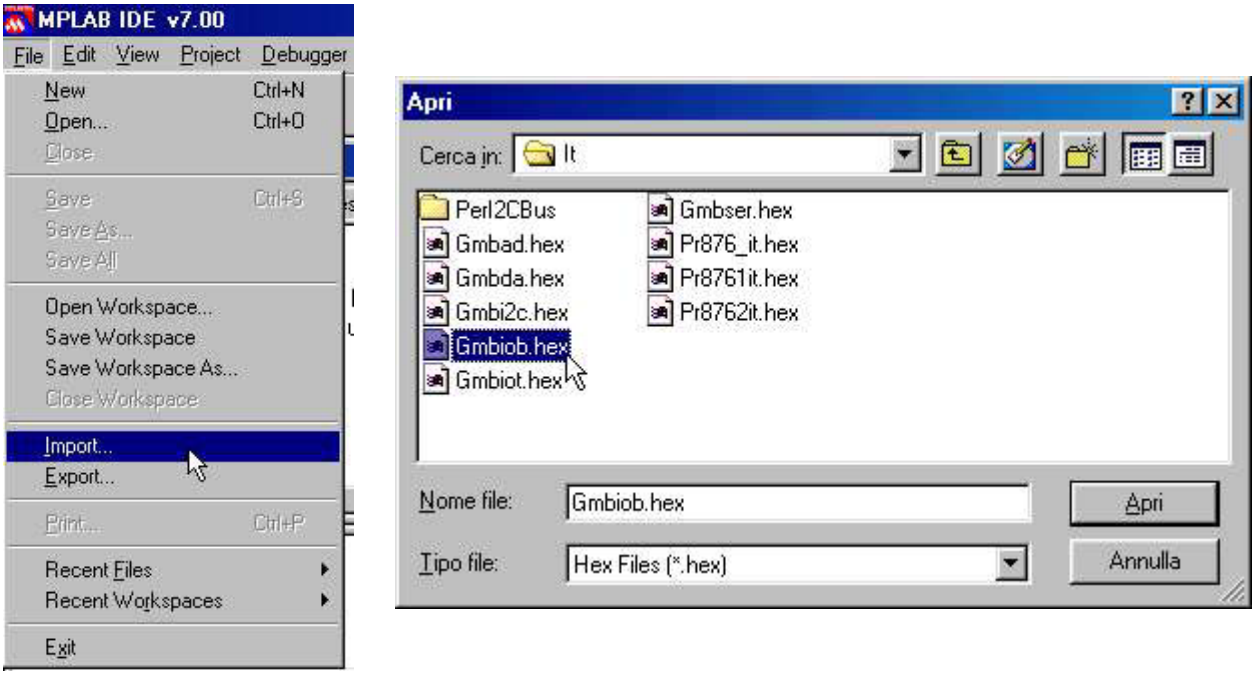


FIGURE 15: LOADING FILE TO PROGRAM WITH MP LAB® ICD 2

Ig) In menu Configuration | Configuration Bits configure "Oscillator" as "HS" and "WatchDog" as "Off", "Brown Out" as "Enabled in hardware" and "Extended CPU Enable" as "Disabled".

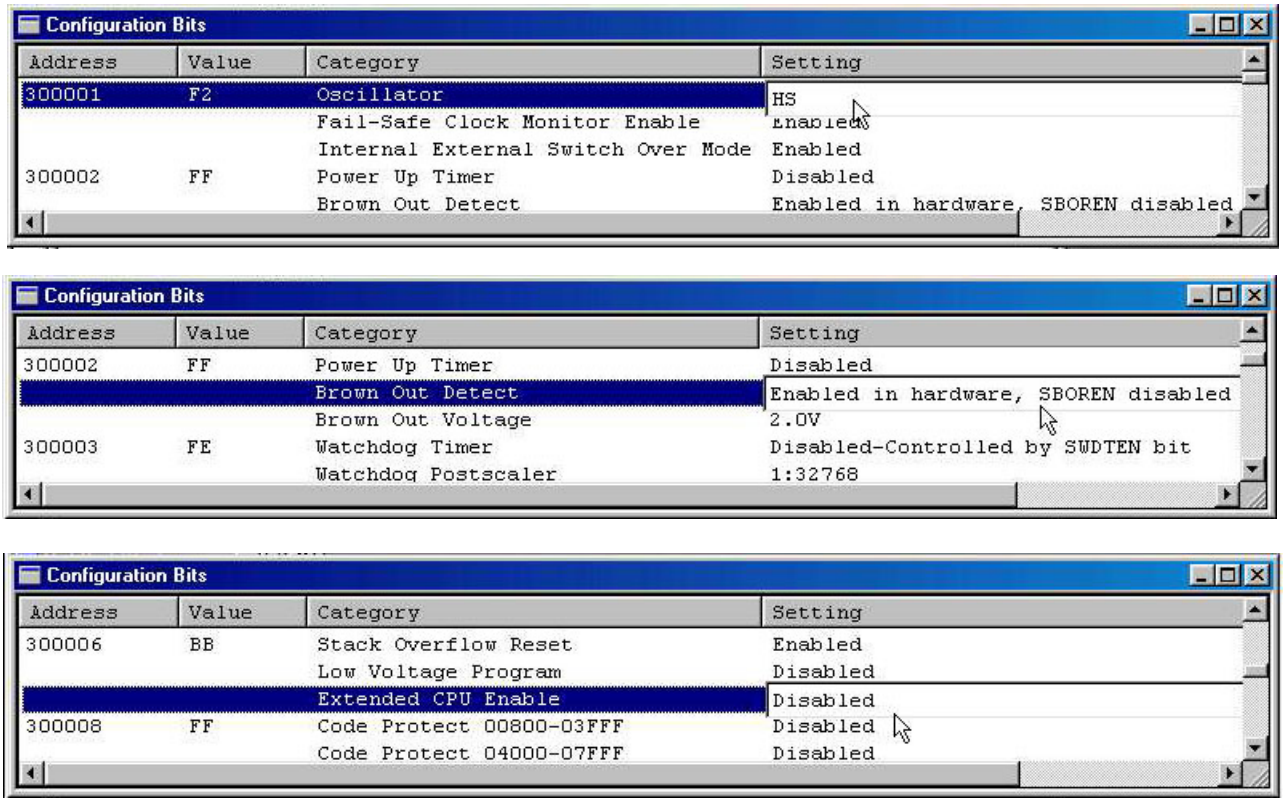


FIGURE 16: CONFIGURATION OF MP LAB® ICD 2

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

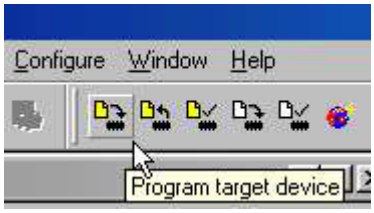


FIGURE 17: FLASH MEMORY PROGRAMMING WITH MP LAB® ICD 2

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.com) 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 PIC18LF4620 (ISP) using menu Device| Select device as shown in figure 18.

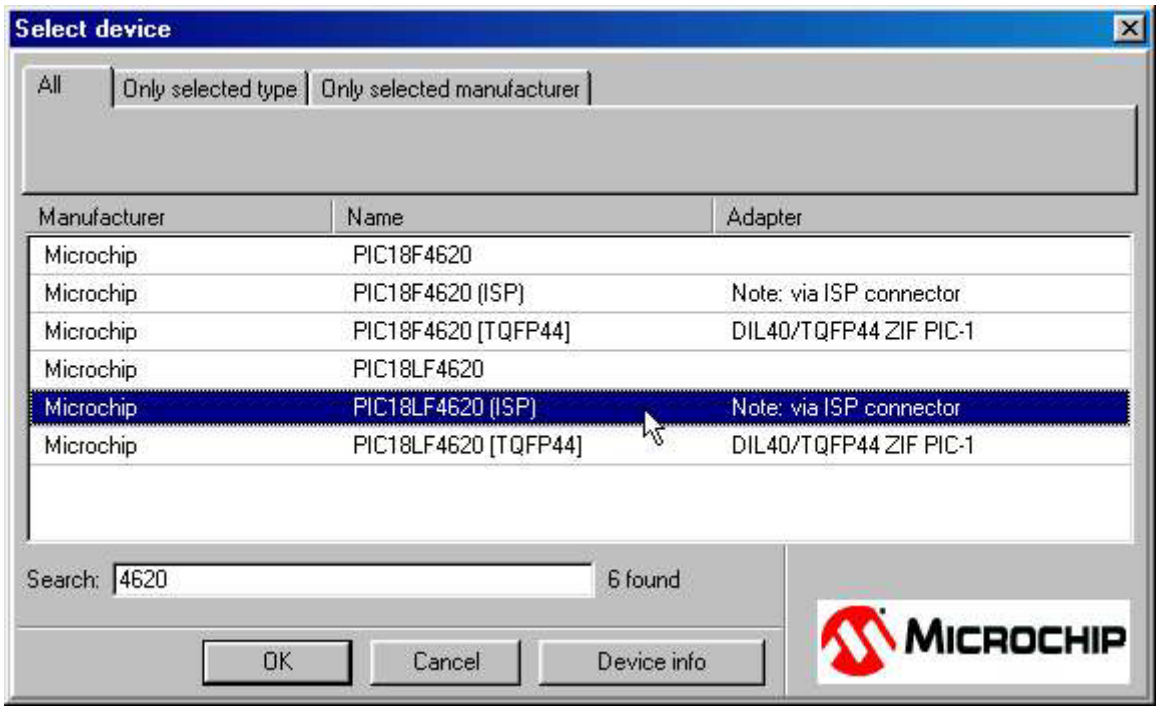


FIGURE 18: DEVICE SELECTION WITH MP PIK+

FIGURE 19: IMAGE OF GMM 4620 ON A GMM PIC-PR CONNECTED TO MP LAB® ICD 2

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

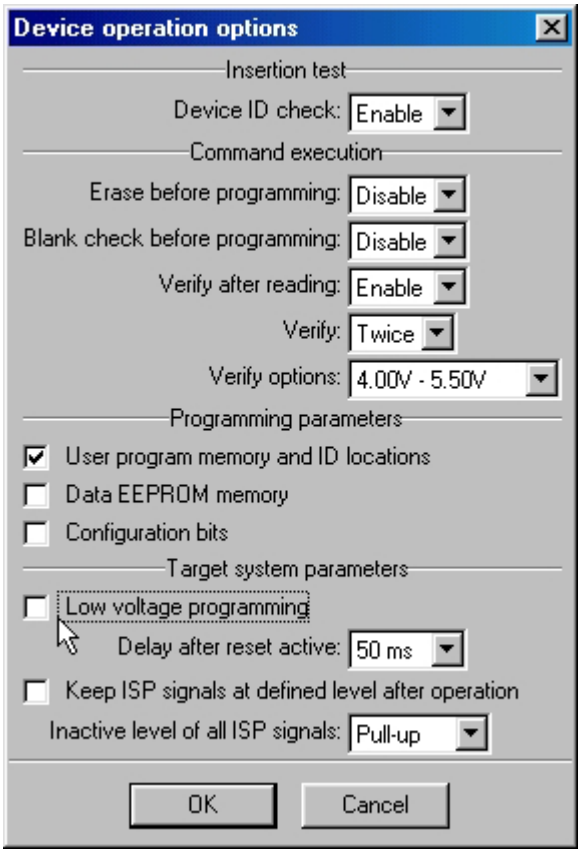


FIGURE 20: CONFIGURATION OF PROGRAMMER MP PIK+

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

FIGURE 21: LOADING FILE TO PROGRAM WITH MP PIK+

FIGURE 22: IMAGE OF GMM 4620 ON A GMM PIC-PR CONNECTED TO MP PIK+

IIg) Open the "Edit config." window (pressing key ALT and letter "s") then set "Oscillator" as "HS", "Watchdog" as "Disable", "Brown Out" as "Enabled in hardware" and "Extended CPU Enable" as "Disabled" like shown in figure.

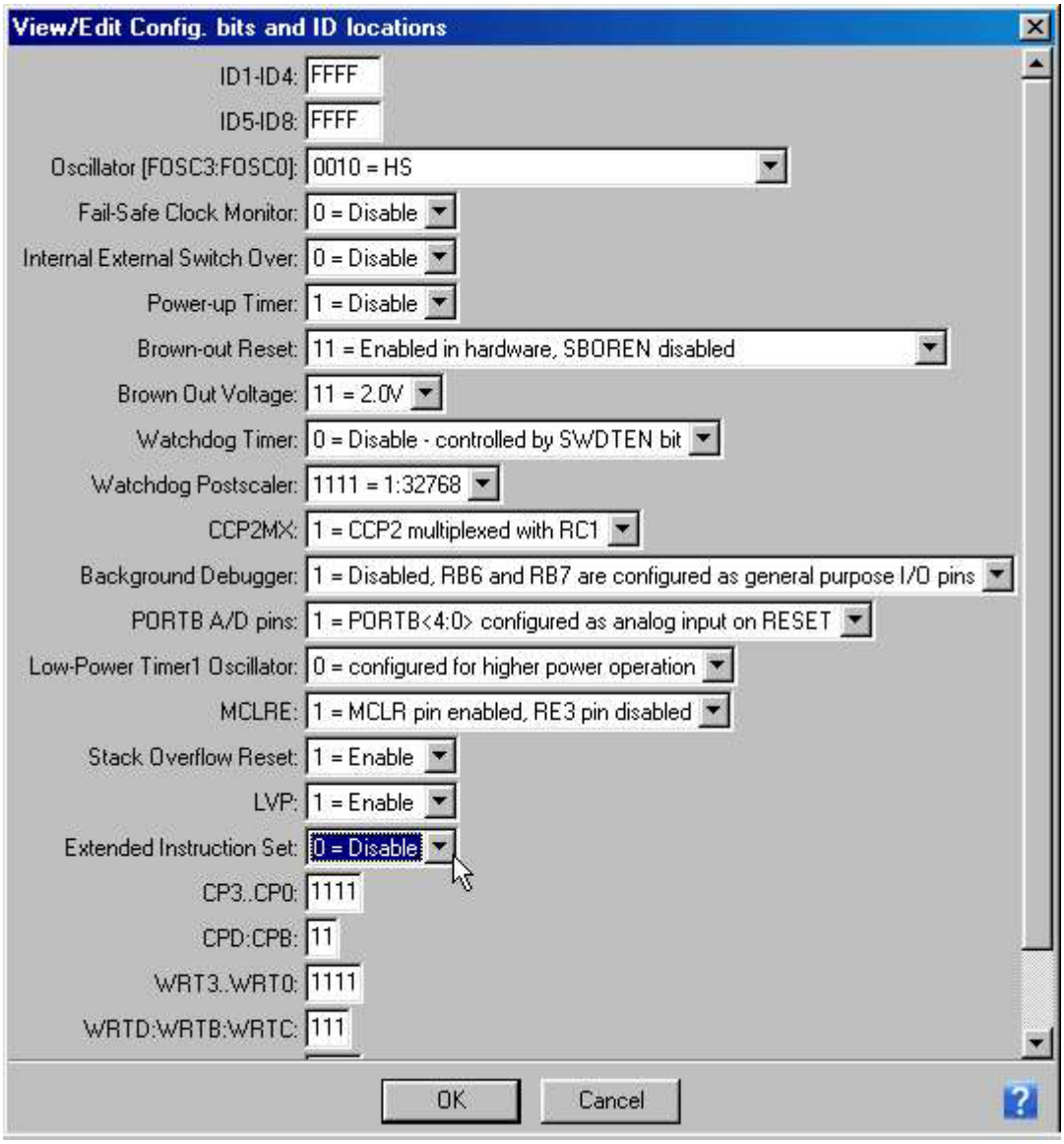


FIGURE 23: CONFIGURATION OF DEVICE WITH MP PIK+

IIh) Give the programming command.

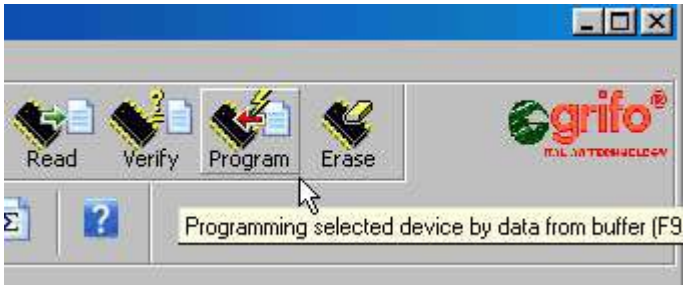


FIGURE 24: PROGRAMMING OF PIC18LF4620 WITH MP PIK+

B) SERIAL CONNECTION TO THE PC:

B1) If you do not have a **GMB HR168**, jump to point B3. First of all, open the container of **GMB HR168** to install Mini Module **GMM 4620** on socket ZC1.

. B2) To supply **GMB HR168**, power supply **EXPS-2** can be used. It can provide two galvanically isolated tensions, required for the correct working of **GMB HR168 & GMM 4620**. 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 board. 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 PRO, mikroBasic, mikroPascal, HI TECH C PIC 18 + 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 uk_gmb_iob.bas for Microcode Studio + PIC BASIC, uk_gmb_iob.c for HI Tech C PIC, uk_gmb_iob.pbas for mikroBasic, uk_gmb_iob.ppas for mikroPascal) and they are properly organized inside demo programs tables available on CD, together with possible definition file (uk_gmb_iob.mcw for HI Tech C PIC+MP LAB® ICD 2, uk_gmb_iob.pbp for mikroBasic, uk_gmb_iob.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 uk_gmb_iob.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 PIC18LF4620, as shown in figure :

FIGURE 26: SELECTIN TARGET PROCESSOR WITH MICROCODE STUDIO + PIC BASIC PRO

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

FIGURE 27: LOADING SOURCE FILE WITH MICROCODE STUDIO + PIC BASIC PRO

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

FIGURE 28: COMPILING THE PROGRAM WITH MICROCODE STUDIO + PIC BASIC PRO

II) *Ricompilation with mikroBasic.*

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

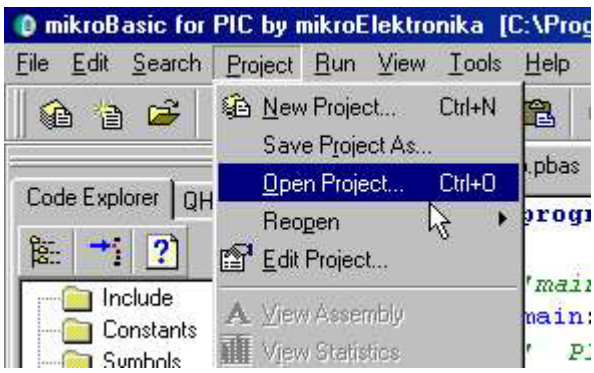


FIGURE 29: LOADING PROJECT FILE WITH MIKROBASIC

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 30: COMPILING WITH MIKROBASIC

III) *Ricompilation with mikroPascal.*

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

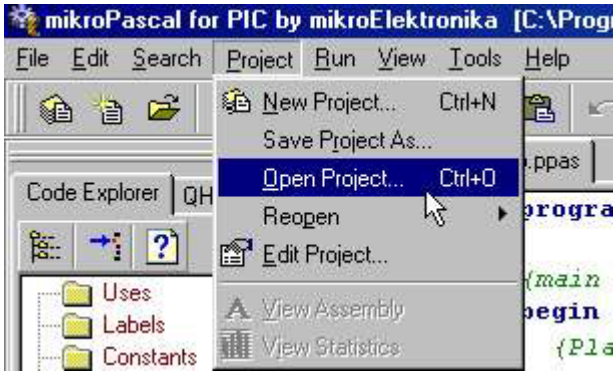


FIGURE 31: LOADING PROJECT FILE WITH MIKROPASCAL

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.

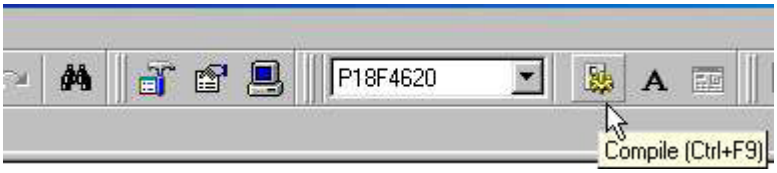


FIGURE 32: COMPILING WITH MIKROBASIC

IV) *Ricompilation with HI Tech C PIC 18 + MP LAB® IDE.*

IVa) First of all, HI Tech C 18 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 uk_gmb_iob.mcp using the menu Project | Open Project or pressing the button shown in the following figure:

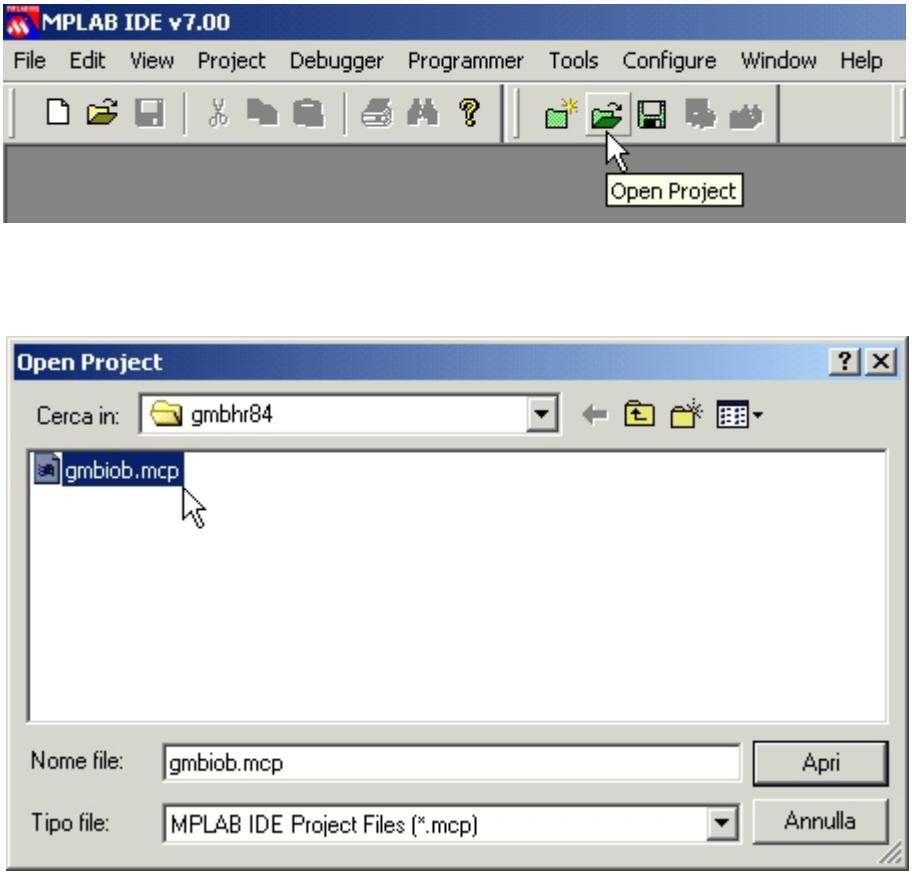


FIGURE 33: LOADING PROJECT FILE WITH HI TECH C PIC 18 + MP LAB® IDE

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.

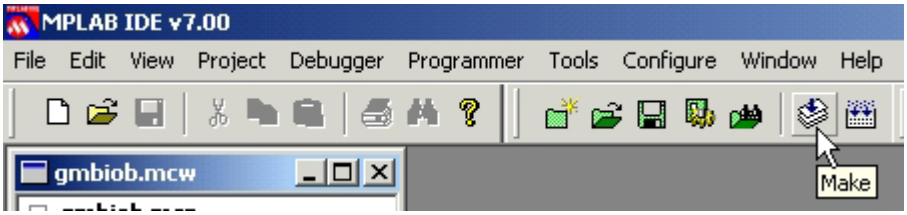


FIGURE 34: COMPILING WITH HI TECH C PIC 18 + MP LAB® IDE

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 4620 & GMB HR168**.
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, B and C) 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 4620** in **GMB HR168** and close it.

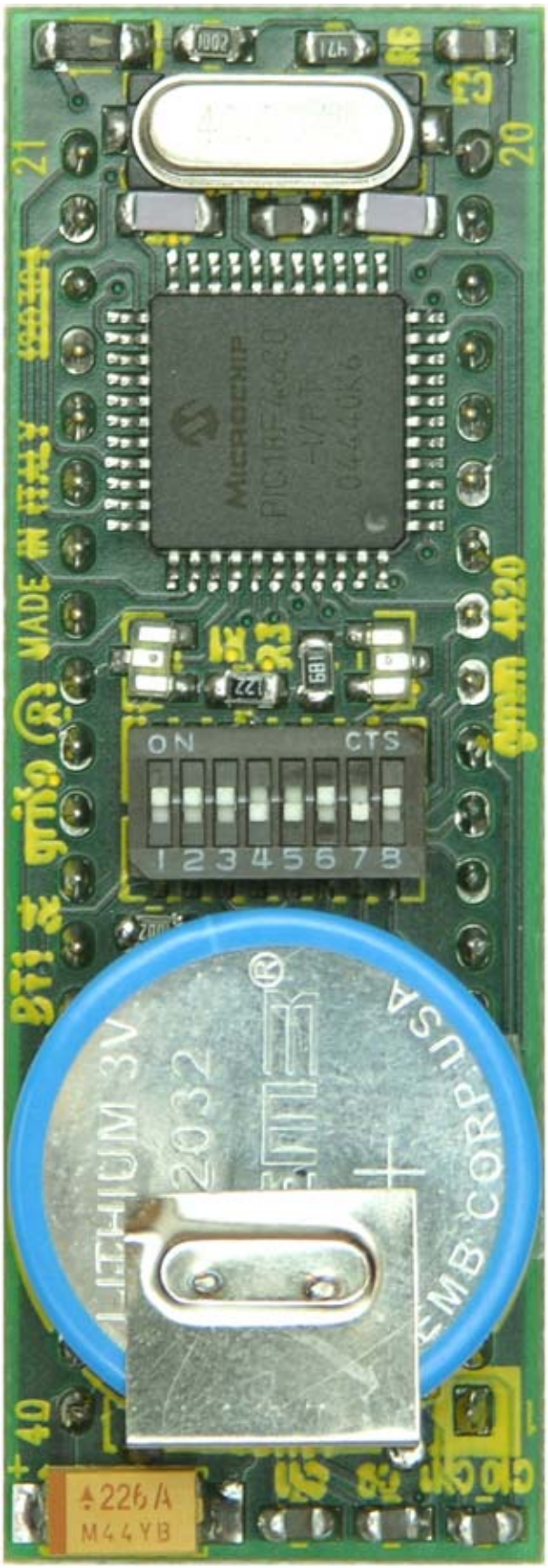


FIGURE 35: IMAGE OF GMM 4620 FROM THE TOP

POWER SUPPLY

Mini Module can be supplied with 3 ÷ 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 2 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 4620** is made by microprocessor internal memories.
In detail:

Internal memory

- 64 Kbyte (32 KWord)	FLASH	user program
- 3986 Bytes	SRAM	user memory
- 1024 Bytes	EEPROM	user memory

External memory (I^2C BUS module RTC + SRAM)

- 240 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.

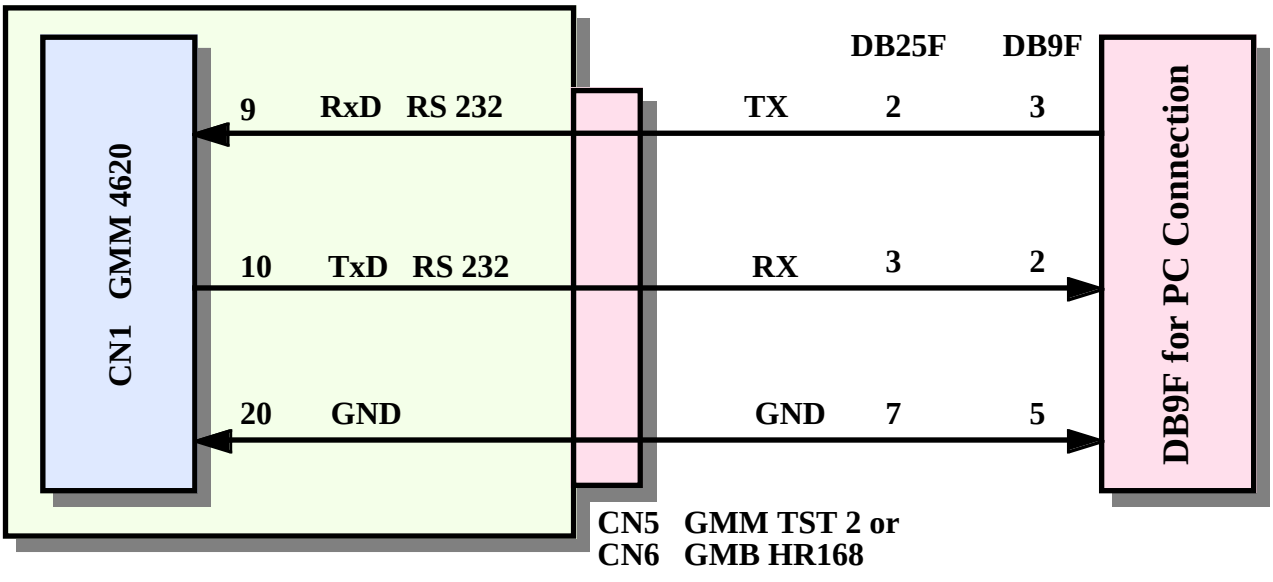


FIGURE 36: EXAMPLE OF SERIAL CONNECTION TO A PC

SERIAL COMMUNICATION SELECTION

Serial line of **GMM 4620** 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	=	ON
DSW1.4÷8	=	OFF

- SERIAL LINE IN TTL

DSW1.1	=	OFF
DSW1.2	=	OFF
DSW1.3	=	OFF
DSW1.4	=	ON
DSW1.5	=	ON
DSW1.6÷8	=	OFF

The following figure and figure 36 show how a generic external system can be connected to **GMM 4620** serial line, with both the electric standard.

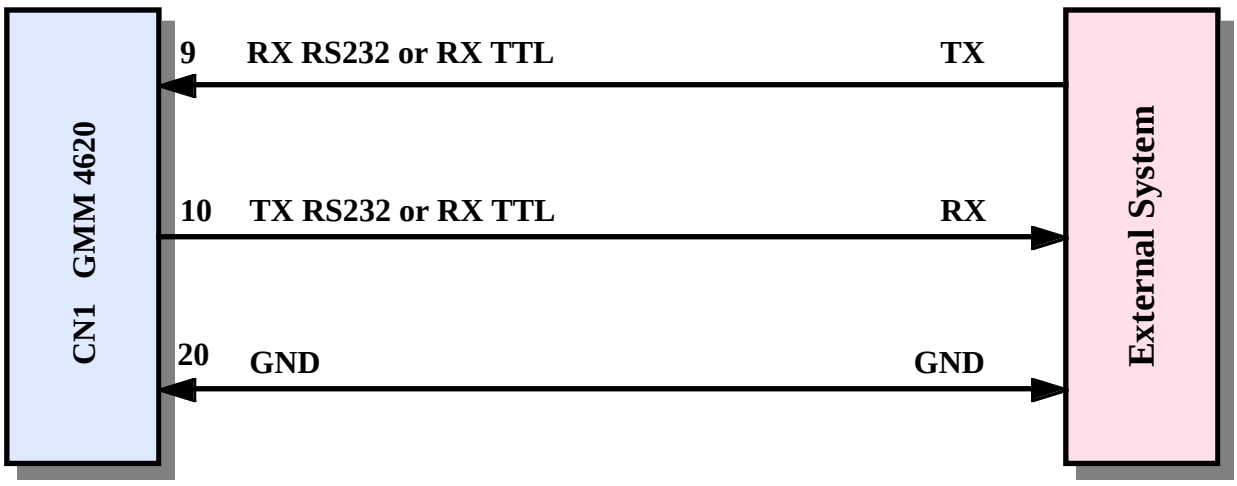


FIGURE 37: EXAMPLE OF SERIAL TTL CONNECTION

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 18 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.

MIKROBASIC: Cross compiler for BASIC running under windows featuring its own IDE.
MikroBasic epecially solves automatically the problem of memory management, both for code memory and for data memory, because it can allocate all the variables and link the code segments, so the programmer should not worry about these typical problems.

MIKROPASCAL: Cross compiler for PASCAL running under windows featuring its own IDE.
MikroPascal epecially solves automatically the problem of memory management, both for code memory and for data memory, because it can allocate all the variables and link the code segments, so the programmer should not worry about these typical problems.

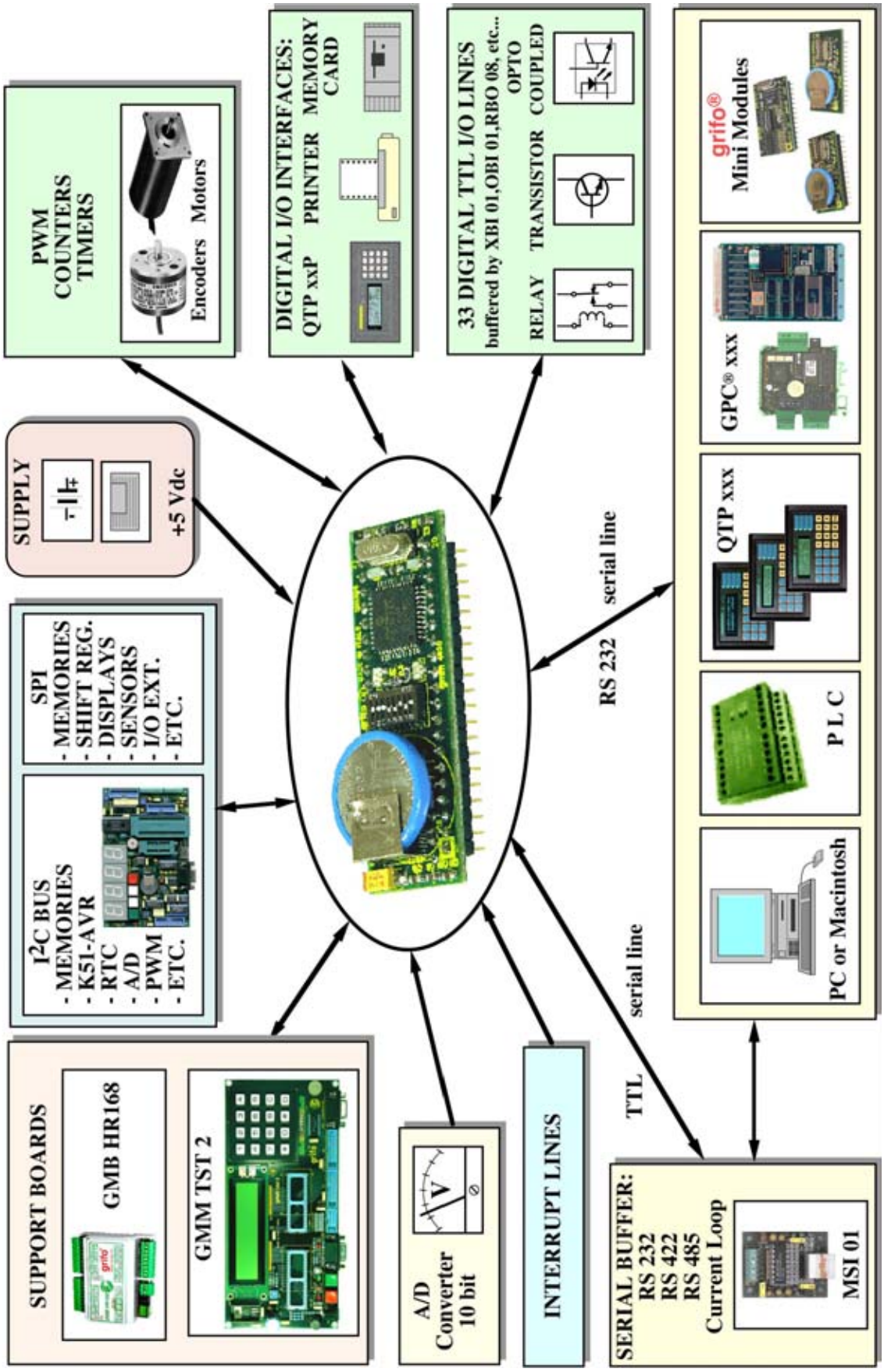


FIGURE 38: POSSIBLE CONNECTIONS DIAGRAM

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 LEDS

LED LD1 (red) and LD2 (green) can be software driven and their status can be read by simple read and write operations on port B:

RB4 -> LD1
RA3 -> LD2

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 all ports are configured as inputs during the reset or the power on, so when on these phases happen, LEDs are OFF.
Please remark that RA3 can be connected directly to Vss when dip switch number 7 is ON, so in that case LED LD2 remains always ON and signal RA3 must be configuret as input to avoid conflicts.

BACKED SRAM + SERIAL RTC

For software management of serial SRAM + RTC backed module, please refer to specific manufacturer documentation. This manual reports no software information because management of this component is complex and requires a deep knowledge, anyway the user can use the demo programs supplied with the card. The board control logic allows to realize a serial communication with I^2C bus standard protocol, through two I/O microprocessor pins. The only necessary information is the electric connection:

DATA line (SDA) -> RC4 (input/output) of CPU
CLOCK line (SCL) -> RC3 (output) of CPU

Please remark that **A0** of this component's slave address is bound to logic 0.

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 4620**.

Manual MAXIM:	*New Releases Data Book - Volume IV*
Manual MAXIM:	*New Releases Data Book - Volume V*
Technical documentation MAXIM:	*True RS 232 Transceivers*
Manual PHILIPS:	*I2C-bus compatible ICs*
Data sheet Microchip:	*PIC18F2525/2620/4525/4620 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 18LF4620

Link: Home | Technical documentation Service | Microchip | Data-Sheet PIC 18LF4620
URL: http://www.grifo.com/PRESS/DOC/Microchip/18F4620.pdf

MICROCHIP **PIC18F2525/2620/4525/4620**

28/40/44-Pin Enhanced Flash Microcontrollers with 10-Bit A/D and nanoWatt Technology

Power Managed Modes:

- Run: CPU on, peripherals on
- Idle: CPU off, peripherals on
- Sleep: CPU off, peripherals off
- Idle mode currents down to 2.5 µA typical
- Sleep mode current down to 100 nA typical
- Timer1 Oscillator: 1.8 µA, 32 kHz, 2V
- Watchdog Timer: 1.4 µA, 2V typical
- Two-Speed Oscillator Start-up

Flexible Oscillator Structure:

- Four Crystal modes, up to 40 MHz
- 4x Phase Lock Loop (PLL) – available for crystal and internal oscillators)
- Two External RC modes, up to 4 MHz
- Two External Clock modes, up to 40 MHz
- Internal oscillator block:
  - 8 user selectable frequencies, from 31 kHz to 8 MHz
  - Provides a complete range of clock speeds from 31 kHz to 32 MHz when used with PLL
  - User tunable to compensate for frequency drift
- Secondary oscillator using Timer1 @ 32 kHz
- Fail-Safe Clock Monitor
  - Allows for safe shutdown if peripheral clock stops

Peripheral Highlights:

- High-current sink/source 25 mA/25 mA
- Three programmable external interrupts
- Four input change interrupts
- Up to 2 Capture/Compare/PWM (CCP) modules, one with Auto-Shutdown (28-pin devices)
- Enhanced Capture/Compare/PWM (ECCP) module (40/44-pin devices only):
  - One, two or four PWM outputs
  - Selectable polarity
  - Programmable dead time
  - Auto-Shutdown and Auto-Restart

Peripheral Highlights (Continued):

- Master Synchronous Serial Port (MSSP) module supporting 3-wire SPI™ (all 4 modes) and I^2C™ Master and Slave modes
- Enhanced Addressable USART module:
  - Supports RS-485, RS-232 and LIN 1.2
  - RS-232 operation using internal oscillator block (no external crystal required)
  - Auto-Wake-up on Start bit
  - Auto-Baud Detect
- 10-bit, up to 13-channel Analog-to-Digital Converter module (A/D):
  - Auto-acquisition capability
  - Conversion available during Sleep
- Dual analog comparators with input multiplexing
- Programmable 16-level High/Low-Voltage Detection (HLVD) module:
  - Supports interrupt on High/Low-Voltage Detection

Special Microcontroller Features:

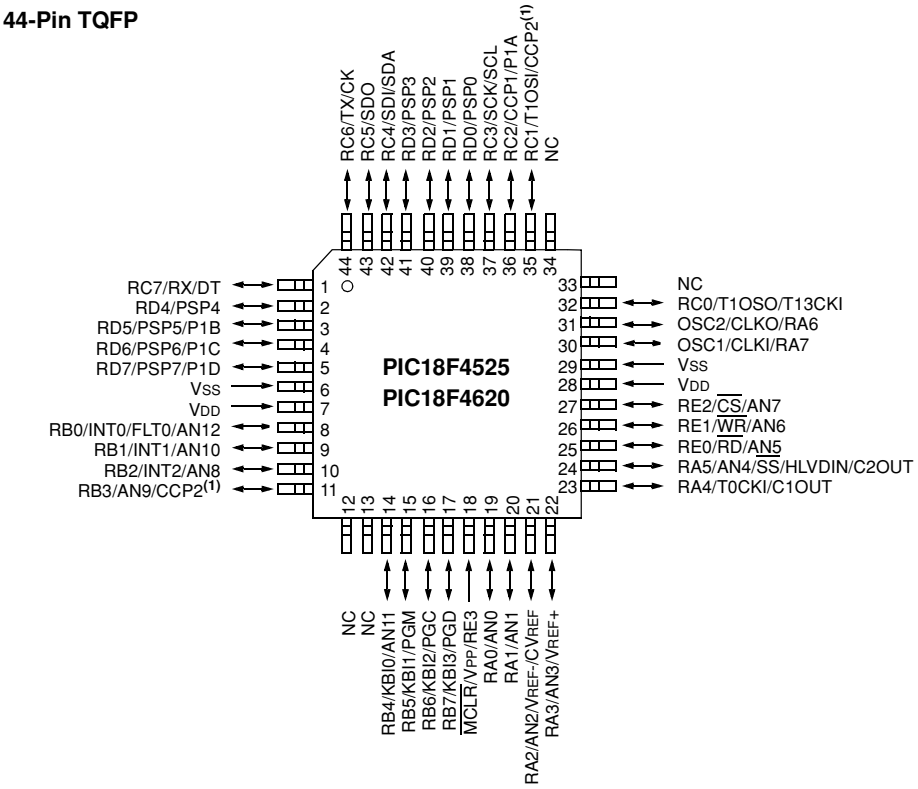
- C compiler optimized architecture:
  - Optional extended instruction set designed to optimize re-entrant code
- 100,000 erase/write cycle Enhanced Flash program memory typical
- 1,000,000 erase/write cycle Data EEPROM memory typical
- Flash/Data EEPROM Retention: 100 years typical
- Self-programmable under software control
- Priority levels for interrupts
- 8 x 8 Single Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT):
  - Programmable period from 4 ms to 131s
- Single-supply 5V In-Circuit Serial Programming™ (ICSP™) via two pins
- In-Circuit Debug (ICD) via two pins
- Wide operating voltage range: 2.0V to 5.5V
- Programmable Brown-out Reset (BOR) with software enable option

Device	Program Memory		Data Memory		I/O	10-bit A/D (ch)	CCP/ ECCP (PWM)	MSSP		EUSART	Comp.	Timers 8/16-bit
	Flash (bytes)	# Single-Word Instructions	SRAM (bytes)	EEPROM (bytes)				SPI™	Master I^2C™			
PIC18F2525	48K	24576	3986	1024	25	10	2/0	Y	Y	1	2	1/3
PIC18F2620	64K	32768	3986	1024	25	10	2/0	Y	Y	1	2	1/3
PIC18F4525	48K	24576	3986	1024	36	13	1/1	Y	Y	1	2	1/3
PIC18F4620	64K	32768	3986	1024	36	13	1/1	Y	Y	1	2	1/3

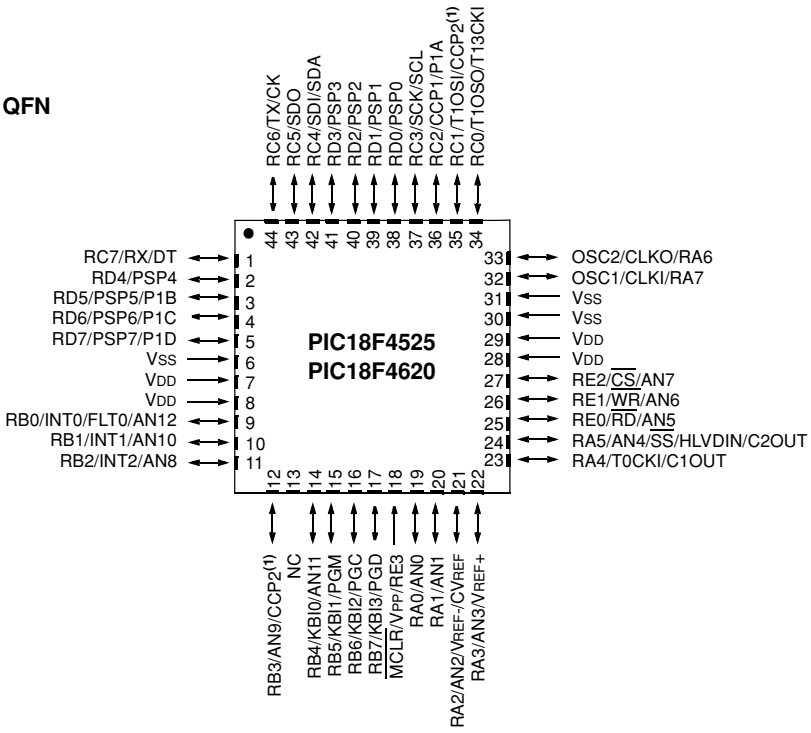
PIC18F2525/2620/4525/4620

Pin Diagrams (Cont.'d)

44-Pin TQFP

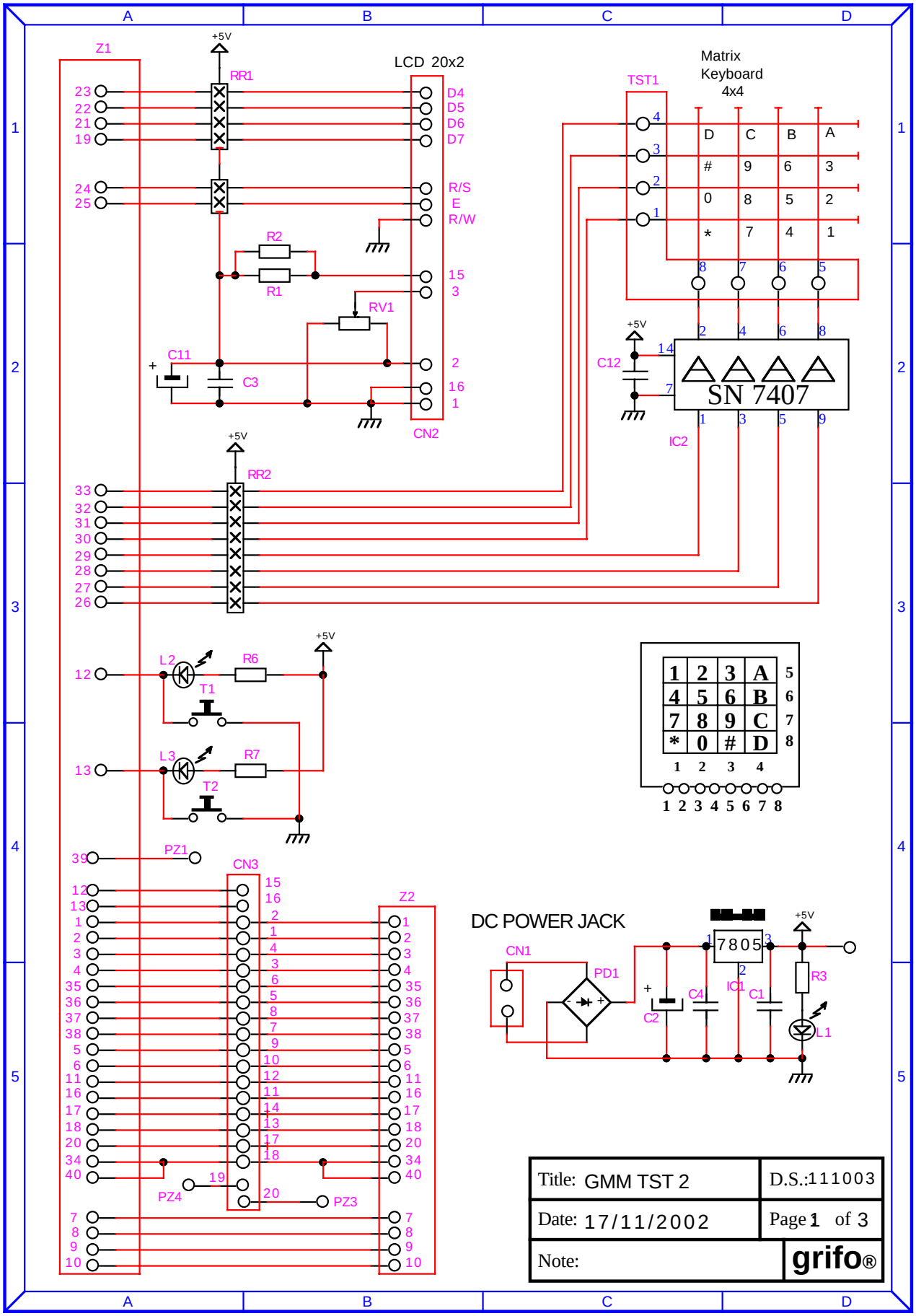


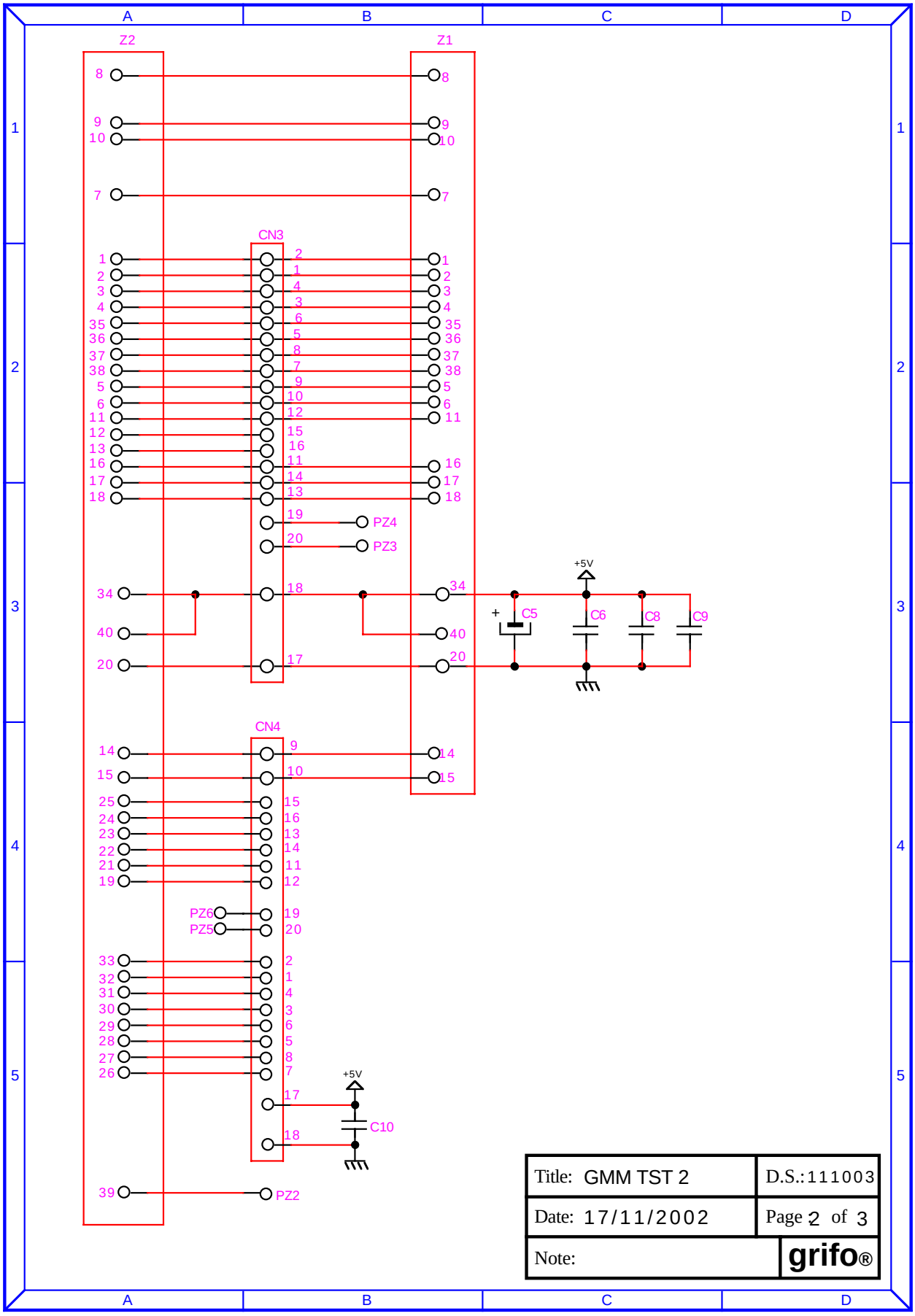
44-Pin QFN



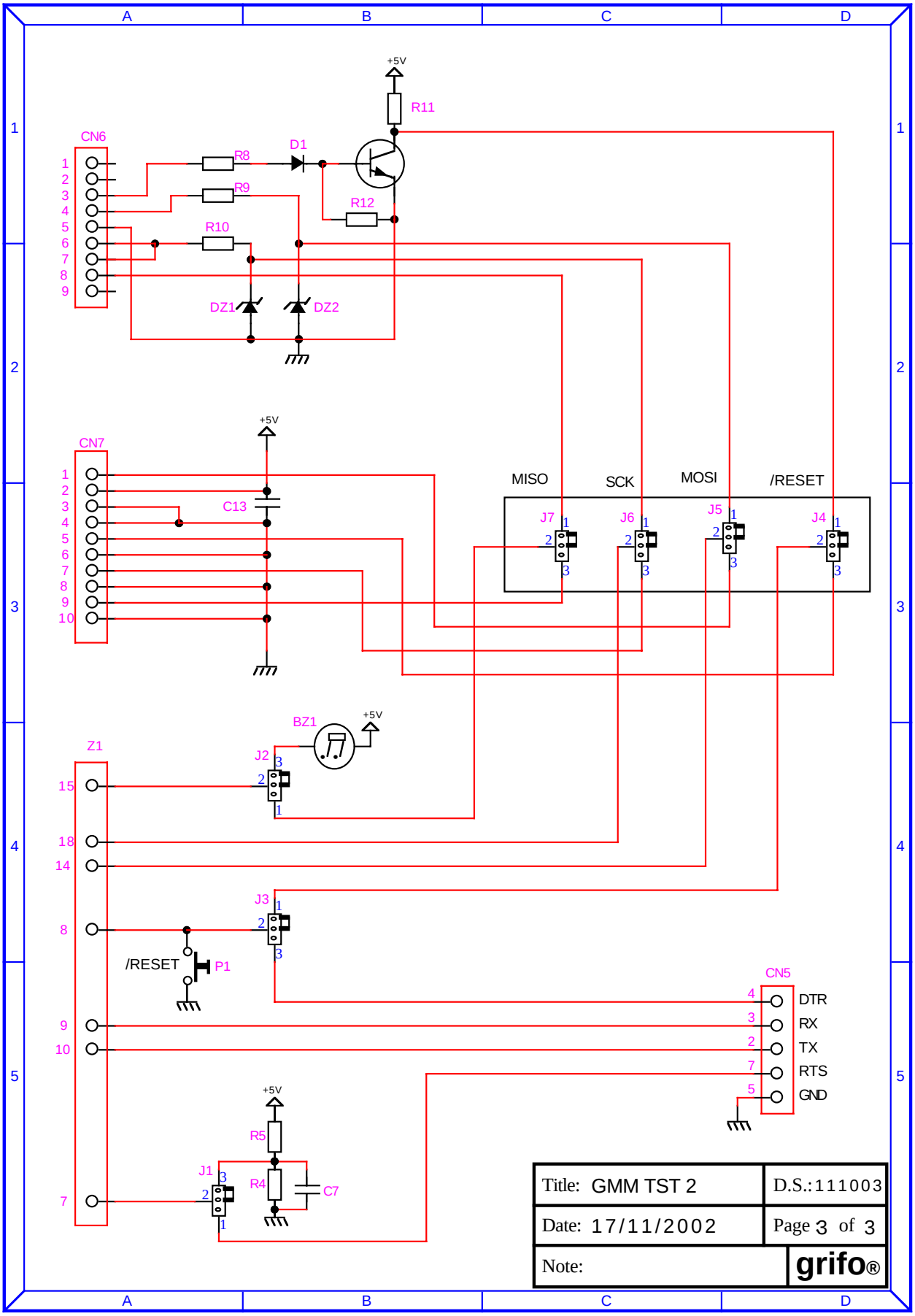
Note 1: RB3 is the alternate pin for CCP2 multiplexing.

APPENDIX B: ELECTRIC DIAGRAM OF GMM TST 2





Title: GMM TST 2	D.S.:111003
Date: 17/11/2002	Page 2 of 3
Note:	grifo®


A
B
C
D
1
2
3
4
5
+5V
R11
CN6
R8
D1
R9
R12
R10
DZ1
DZ2
CN7
C13
MISO
SCK
MOSI
/RESET
J7
J6
J5
J4
BZ1
J2
Z1
J3
/RESET
P1
CN5
DTR
RX
TX
RTS
GND
R5
J1
R4
C7
Title: GMM TST 2
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