

CAN PIC

CAN - grifo® Mini Module PIC

TECHNICAL MANUAL



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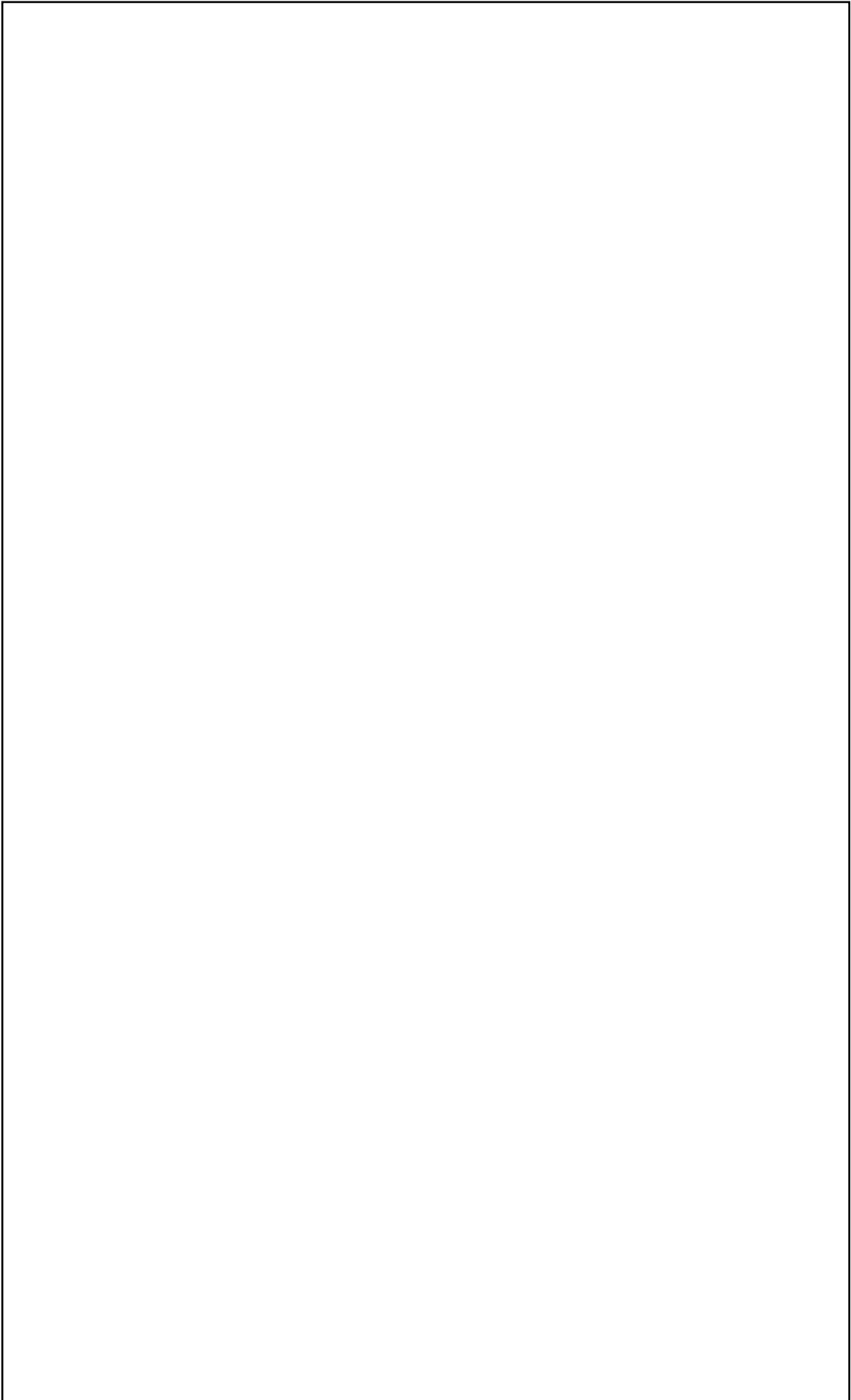


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Edition 07 February 2006

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Standard container with **28** pins male socket, dual in line, **100** mils pitch, **600** mils width; very small dimension: 43 x 25 x 15 mm; single power supply voltage required in the wide range from **5.0 Vdc** (the current consumption can change according with module connections); availability of power saving setting as **Idle Mode** and **Power Down Mode**; **Microchip PIC18F4680** microcontroller with working frequency **40 MHz**; **64 KBytes FLASH** for code, **3328 Bytes SRAM** for data, **1KBytes EEPROM** for data; **2** analog comparators with different input and output configurations options that allow to create easily bipolar A/D conversion; 10 channels multiplexed **A/D** converter, resolution **10 bits** and **20 µsec** conversion time; **32 Interrupt** sources; **4 Timers Counters**, up to **16 bits**; **2** peripherals featuring **PWM**, compare, capture, etc.; up to **24 digital I/O** lines available on connector. Some of these lines have multiple functions; one hardware serial communication line with programmable physical protocol (Baud Rate up to 115200 Baud, 8 or 9 data bits, 1 or 2 stop bit), **RS 232** buffered or at **TTL** level; one **CAN** differential serial line completely compatible with **CAN 2.0** specifications part **A** and **B**; **In Circuit Debugger** interface for in-circuit remote debugging with **MPLAB® IDE**; **I²C BUS** controller, completely software configurable; **SPI** interface programmable for synchronous, high speed communications; **Reset** circuitry; programmable **Watch Dog** from **41 ms** up to **131 s**; one **Real Time Clock** for long and accurate timing, active even in low power modes, capable to manage date and time and to generate periodic interrupts; **240** bytes of SRAM for configuration parameters; **RTC** and **SRAM** backed with on-board **Lithium** battery; **2** status **LEDs** managed by software through two digital I/O lines; internal **FLASH** and **EEPROM** can be managed through **ISP (In System Programming)**; wide range of Software Development tools used to develop the user application program, as: **Assembler**; **C** compilers (**HI-TECH PICC**); **BASIC Compilers** (**PICBASICPRO**, **mikroBasic**); **PASCAL Compilers** (**mikroPascal**); etc.; long list of Demo Programs and use examples supplied under source form, duly remarked, and executable form for the available development tools.

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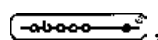
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For specific informations on the components mounted on the card, please refer to the Data Book of the builder or second sources.

SYMBOLS DESCRIPTION

In the manual could appear the following symbols:



Attention: Generic danger

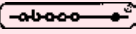


Attention: High voltage



Attention: ESD sensitive device

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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 environment, 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 respect 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

This handbook make reference to card **CAN PIC** with printed circuit version **101104**.

The validity of the information contained in this manual is subordinated to the printed circuit revision number and so the user must always check the correspondance.

The printed circuit revision number is always printed in several positions of the circuit and following figure shows the easiest to access.

PRINTED CIRCUIT REVISION NUMBER

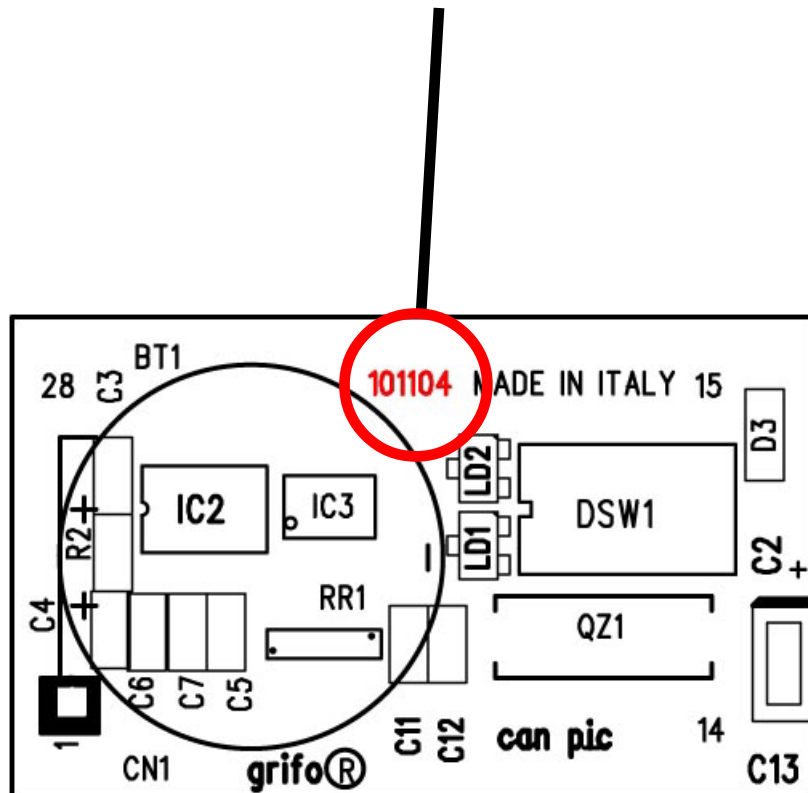


FIGURE 1: LOCATION OF REVISION NUMBER

GENERAL INFORMATION

CAN PIC (CAN - **grifo**[®] Mini Module PIC) is a module based on microcontroller **Microchip PIC18F4680**, a powerful and complete system on a chip provided with **CPU**, integrated memory (both for data and code), a **watch dog**, many digital I/O lines, 4 **timers counters**, peripherals featuring capture and compare capability, one asynchronous serial line, one CAN serial line, one **I²C BUS** synchronous serial line, 2 comparators for analog signals, etc.

In module's very small area, are already mounted the components that exploit microcontrollers' performance and that allow each functionality mode like a reset generator circuitry.

Possible applications of **CAN PIC** Mini Modules are several.

For example, native CAN application, that is **car automation** (lights turning ON/OFF, heating and cooling systems control, supervision of electric devices, anti-theft and access control systems, functionality checks, etc.). Also, **connection** on CAN networks with **your own protocols** or with standard protocols (like CANopen, DeviceNet, SDS, CAN Kingdom etc.).

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, **conversion** between **CAN** and **asynchronous serial** line or **I²C BUS** line and **home automation** (lights turning ON/OFF, heating and cooling systems control, supervision of electric devices, security and access control systems).

It is really important the **Didactics** use in fact **CANPIC** offers a very low cost system suitable to learn a **RISC** microcontroller with PIC16 core and to develop the typical start applications for the students. For this purpose it is likewise interesting the **CAN GMT** support card that solves the problems for power supply, RS 232 serial connection to development PC, CAN connection and for module lines connection.

CANPIC is delivered with a Boot Loader preinstalled. This program allows to reprogram Flash and EEPROM through a simple RS 232 serial port (for example, PC COM port).

On board microcontroller electronics also supports the In Circuit Debugger interface, that allows to control its working status directly on the application it is running.

In this case debugging is controlled through the PC and a specific interface to connect to the six signals of Mini Module directly available on its socket.

The PC program that controls In Circuit Debugger interface is MPLAB[®], free IDE developed by Microchip they distribute through their website.

Both the solutions ensure a short time to market: the user can obtain a prototype or even a ready product **in one week**.

Overall features are:

- Standard container with **28** pins male socket, dual in line, **100** mils pitch, **600** mils width
- Very small dimension: 43 x 25 x 15 mm
- Single power supply voltage required in the wide range from **5.0 Vdc** (the current consumption can change according with module connections)
- Availability of power saving setting as **Idle Mode** and **Power Down Mode**
- **Microchip PIC18F4680** microcontroller with working frequency **40 MHz**
- **64 KBytes FLASH** for code, **3328 Bytes SRAM** for data, **1KBytes EEPROM** for data
- **2** analog comparators with different input and output configurations options that allow to create easily bipolar A/D conversion

- 10 channels multiplexed **A/D** converter, resolution **10 bits** and **20 µsec** conversion time
- **32 Interrupt** sources
- **4 Timers Counters**, up to **16 bits**
- **2 peripherals** featuring **PWM**, compare, capture, etc.
- Up to **24 digital I/O** lines available on connector. Some of these lines have multiple functions
- One hardware serial communication line with programmable physical protocol (Baud Rate up to 115200 Baud, 8 or 9 data bits, 1 or 2 stop bit), **RS 232** buffered or at **TTL** level
- One **CAN** differential serial line completely compatible with **CAN 2.0** specifications part **A** and **B**
- **In Circuit Debugger** interface for in-circuit remote debugging with **MPLAB® IDE**
- **I²C BUS** controller, completely software configurable
- **SPI** interface programmable for synchronous, high speed communications
- **Reset** circuitry
- Programmable **Watch Dog** from **41 ms** up to **131 s**
- One configuration dip switch
- One **Real Time Clock** for long and accurate timing, active even in low power modes, capable to manage date and time and to generate periodic interrupts
- **240 bytes** of **SRAM** for configuration parameters
- **RTC** and **SRAM** backed with on-board **Lithium** battery
- **2 status LED** managed by software through two digital I/O lines
- Internal **FLASH** and **EEPROM** can be managed through **ISP (In System Programming)**
- Wide range of Software Development tools used to develop the user application program, as: **Assembler**; **C** compilers (HI-TECH PICC); **BASIC Compilers** (PIC BASIC PRO, mikroBasic); **PASCAL Compilers** (mikroPascal); etc.
- Long list of Demo Programs and use examples supplied under source form, duly remarked, and executable form for the available development tools.

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 **CAN PIC** is provided with 24 TTL digital I/O lines, of the microprocessor Microchip PIC18F4680, that are all the signals of Port RC, signals from 0 to 5 of RA, signals 0, 1 and from 4 to 7 of RB, signals 0, 2 and 3 of RE and signal 4 of RD.

These lines are connected directly to 28 pins connectors with standard **grifo**® Mini Module pin out, allowing to be connected directly 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, I²C BUS, SPI, etc.), simply programming some CPU internal registers.

For further information please refer to paragraph CONNECTIONS and PERIPHERAL DEVICES SOFTWARE DESCRIPTION.

SERIAL COMMUNICATION

On **CAN PIC** there is always availability of one hardware serial line that is completely software configurable for physical protocol (baud rate, stop bits number, length of character, etc) by simply programming some microprocessor registers as described in the manufacturer documentation or in appendix A of this manual.

The serial line is connected to connector CN1 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 422, RS 485, Current loop, etc.). Please remember that on connector CN1 more than standard receive and transmit signals are available also 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 it can be used the **MSI 01** module that converts a TTL serial line in any other electric standards in a practical and inexpensive way.

Please read SERIAL COMMUNICATION SELECTION paragraph of this manual or contact directly **grifo**® technician for further explanation or any other necessary information.

CLOCK

On **CAN PIC** module there are two separate and independent circuits based on crystals, that generate the clock signals for the microcontroller and the RTC module.

The first generates a 10 MHz while the second generates a 32768 Hz.

Microcontroller is internally configured to activate the PLL section on crystal, so the working frequency for the CPU and peripherals is the crystal frequency multiplied by four, that is 40 MHz. The choice of using two circuits and two separated clock sources, has the advantage to reduce cost in the larger number of low, middle speed applications and to afford the high speed applications when necessary.

About speed and performances, considering the high working frequency obtained activating the PLL multiplier by four, execution speed may be almost 10 MIPS.

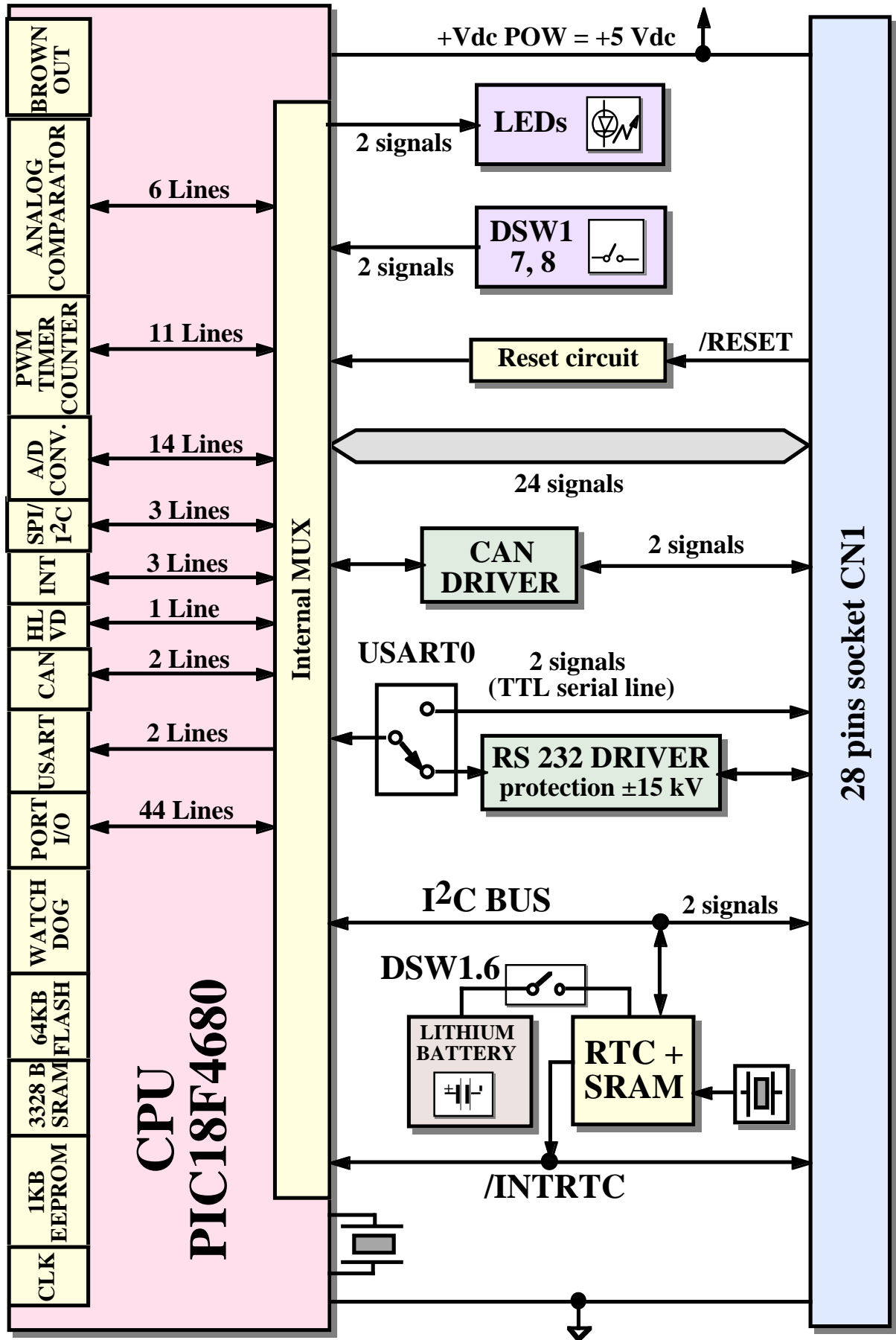


FIGURE 2: BLOCKS DIAGRAM

MEMORY DEVICES

The card is provided of 68.56KBytes of memory divided with a maximum of **64K** Bytes FLASH EPROM, **3328 Bytes** of internal SRAM, **1KBytes** EEPROM and 240 Bytes in RTC module, reachable only through I²C BUS.

The memory configuration must be chosen considering the application to realize or the specific requirements of the user.

Thanks to on board EEPROM (and SRAM of RTC when the back up battery is connected) 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 SPI and I²C BUS interface of the card.

The addressing of memory devices is controlled by microcontroller as described in the component data sheet or in 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. These signals are provided with a 4.7 k Ω pull-up on the Mini Module board.

CAN PIC features a hardware I²C BUS interface and is managed through microcontroller internal registers. It can work both as master or slave, in transmission or reception.

This interface allows to connect components featuring the same communication standard to expand locally the potentialities of Mini Module.

For this Mini Module, a rich serie of demo programs that explain how to use A/D and D/A converters, memories, temperature sensors, on-board RTC, etc. by a complete and well commented code is available.

Remarkable is the possibility to connect the **grifo**[®] **QTP** operator panels serie through I²C BUS. **QTP** are capable to manage alphanumeric and graphicdisplay and several models of keyboards, according to the model selected.

Mini Modules support cards manufactured by **grifo**[®] (like **CAN GMT**) are provided also with a connector dedicated to I²C BUS, to easy the field connections.

Please remark that RTC with backed SRAM permanently takes the slave address **A0**, so user applications cannot use it.

For further information please refer to component data sheet or appendix A of this manual.

SPI INTERFACE

Mini Module **grifo**[®] **CAN PIC** is provided with a SPI serial inteface featured through a specific hardware section of the microcontroller.

Signals SDI, SDO and SCKof SPI interface are available respectively on pins 7, 13 and 6 of CN1. All interface parameters are managed through microcontroller internal registers.

For further information please refer to component data sheet or appendix A of this manual.

CAN INTERFACE

Mini Module **CAN PIC** is provided with a powerful hardware CAN interface, capable to reach the maximum bit rate of 1 Mbp/sec. Signals CAN L and CAN H are available respectively on pins 8 and 9 of CN1.

This interface is fully compatible with CAN 2.0 specifications parts A and B.

DIP SWITCH

CAN PIC Mini Module is provided with one dip switch (eight ways) whose purpose is to set up several electric parameters of module itself and the card operating mode.

In fact DSW1 allows to decide whether serial interface must be buffered as **RS 232** or **TTL**, in this latter case allowing to use an external buffer like **RS 422**, **RS 485** or **current loop** drivers.

DSW1 also allows to connect or not the back up battery of RTC + SRAM module.

In addition, status of some switches can be acquired by software through reading specific microcontroller signals (RD2 and RD3).

For further information please see also the paragraph **MINI MODULE CONFIGURATION**.

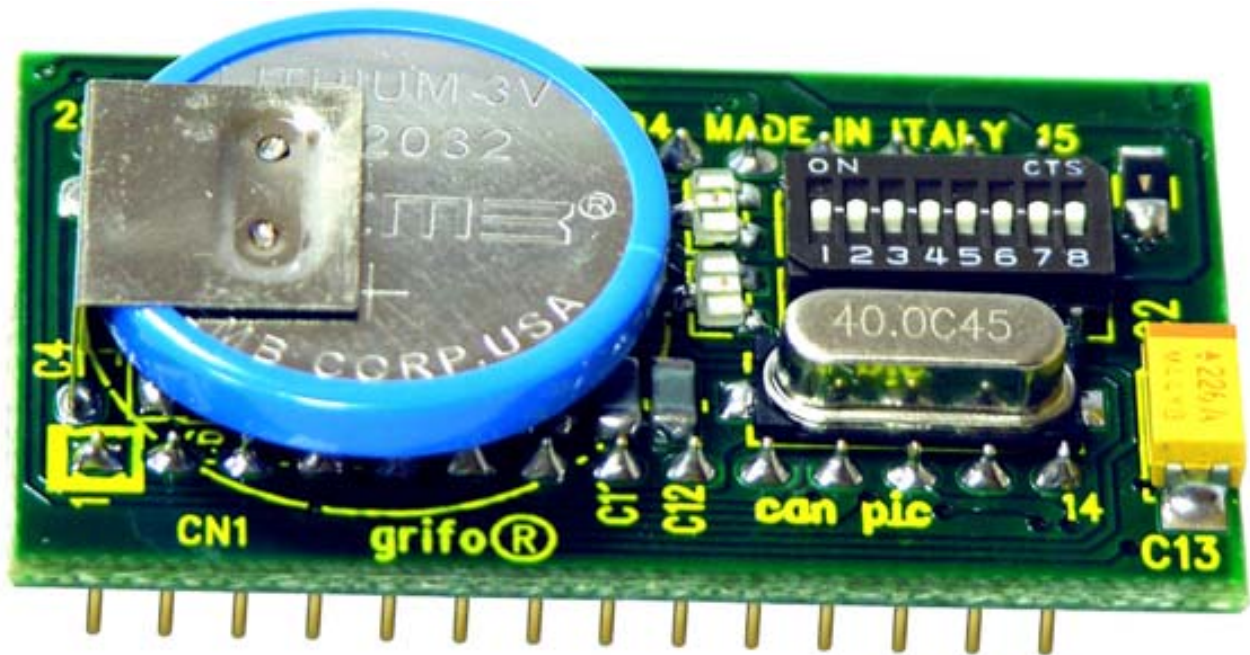


FIGURE 3: CAN PIC PHOTO

A/D CONVERTERS

Mini Module **CAN PIC** is provided with a ten channels A/D converter, multiplexed on signals of several port, with 10 bit of resolution.

Reference voltage can be fetched externally through a pin or internal reference generator can be used. Range of connectable signals is from 0 to +Vdc POW, analog signal generator must have a low impedance.

Conversion end can be used to trigger an interrupt, if enabled.

Peripheral management is performed by manipulating specific microcontroller internal registers.

For further information please refer to Appendix A or to comments in source code of our examples.

ANALOG COMPARATORS

Microcontroller Microchip PIC18F4680 features two analog comparators that can select as input both an internal reference voltage and several pins (signals from RD0 to RD3) through an internal multiplexer.

For further information, please refer to application notes on Microchip web site.

TIMER COUNTER AND PWM

Microcontroller is provided with four Timer/Counter (two featuring eight bits, two featuring sixteen bits) capable to count clock pulses (through a programmable prescaler), level transicions on specific pins and to generate interrupts.

There are also two PWM modules, to generatesignals of variable duty cycle and frequency set by software with eight or sixteen bits of resolution.

Typical applications of these signals are motor velocity control, in fact several motor control cards are provided with compatible inputs.

Another application is analog signals generation by simply adding an integrator.

WATCH DOG

Microcontroller Microchip PIC18F4680 features a hardware programmable watch dog capable to reset the CPU if it is enabled and the application program does not retrigger it in the activation time. This latter time can be programmed between 41 ms and 131 s.

REAL TIME CLOCK

Mini Module features an on-board Real Time Clock (in I²C BUS with slave address **A0**), capable to manage hours, minutes, seconds, year, month, day and weekday. It also features 240 bytes of SRAM This component can be completely managed by software and is backed through a back up battery that, if enabled, can warrant data validity in any operating condition.

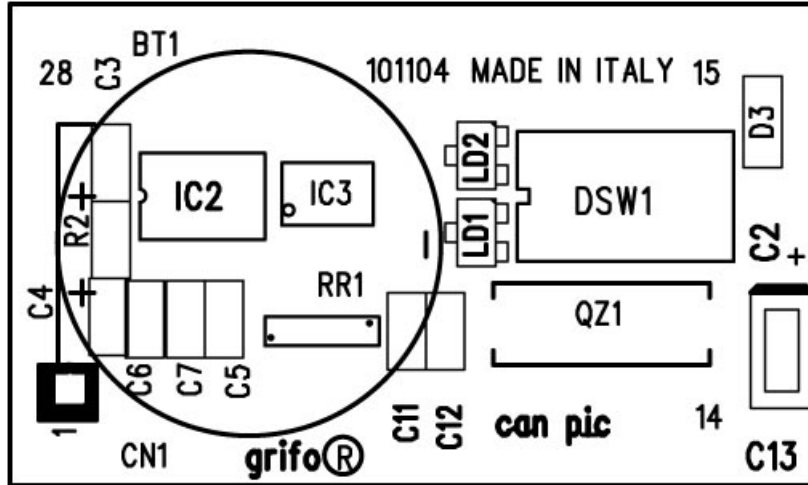


FIGURE 4: COMPONENTS MAP (COMPONENTS SIDE)

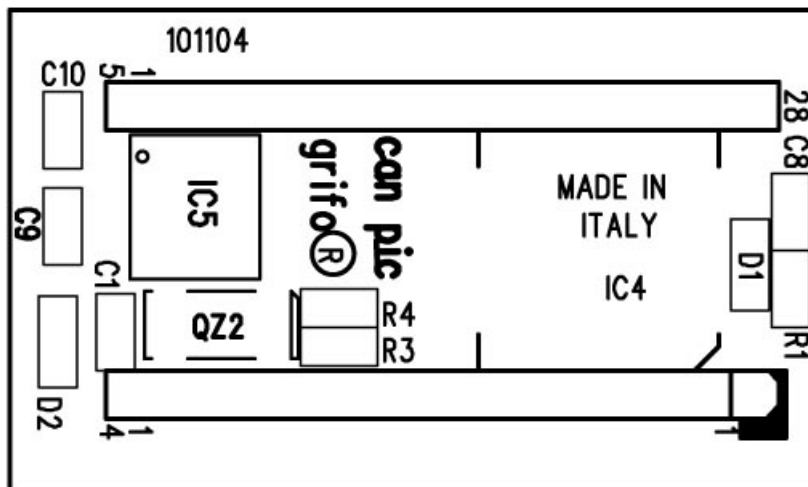


FIGURE 5: COMPONENTS MAP (SOLDER SIDE)

TECHNICAL FEATURES

GENERAL FEATURES

Resources:	24 TTL digital I/O lines 2 analog comparators 10 channels A/D converter 4 Timer/Counter 2 peripherals for compare, capture, PWM 1 Watch dog section 1 I ² C BUS and SPI interface 1 CAN interface 1 Real Time Clock section 32 interrupt sources 1 hardware serial line RS 232 or TTL 1 Dip switch 8 ways 2 status LEDs
Memories:	64K Bytes FLASH EPROM for code 3328 Bytes SRAM for data 1K Bytes EEPROM for data 240 Bytes external SRAM for data (on I ² C BUS)
CPU:	Microchip PIC18F4680
Clock frequency:	40 MHz (10 MHz quartz internally multiplied by PLL)
Counter maximum frequency:	quartz frequency divided by 4
Power on time:	from 1.43 ms to 69.6 ms, settable through configuration bits
Watch dog intervent time:	programmable from about 41 ms up to 131 s
A/D converter resolution:	10 bits
A/D conversion time:	min. 20 µsec (for 10 bits)

PHYSICAL FEATURES

Size: (W x H x D):	43 x 25 x 15 mm
Weight:	12 g
Connectors:	28 pins male socket DIL, 100 mils pitch, 600 mils width
Temperature range:	0÷50 °C
Relative humidity:	20%÷90% (without condense)

ELECTRIC FEATURES

Power supply voltage:	+Vdc POW = +5.0 Vdc
Current consumption:	minimum: 15 mA normal: 48 mA maximum: 60 mA
Back up battery voltage:	3.0 Vdc
Back up battery consumption:	battery 3.31 V -> consumption 3.4 µA battery 2.91 V -> consumption 2.0 µA
Impedance analog signals generators:	<2.5 kΩ
RS 232 protection:	±15 kVdc
PC BUS pull-up resistor:	4.7 kΩ
HLVD threshold:	programmable from 2.12 to 4.69 Vdc, with hysteresis

INSTALLATION

In this chapter there are the information for a right installation and correct use of the **CAN PIC** card. In detail there are the locations and functions of each connector, of the user settable dip switches, LEDs, and so on.

VISUAL SIGNALATIONS

CAN PIC features the LEDs described in the following table:

LED	COLOUR	PURPOSE
LD1	Green	Driven by signal RD0 , PSP0 , C1IN+ of Mini Module, it can be used as activity LED and can be managed by software.
LD2	Red	Driven by signal RD1 , PSP1 , C1IN- of Mini Module, it can be used as activity LED and can be managed by software.

FIGURE 6: 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 **CAN PIC** 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 POWER SUPPLY 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 synchronous and 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 7 shows the signals directly on the top view of the **CAN PIC**; moreover the serigraph reports the pins number on the four corner of the card both on bottom (solder) and top (component) side.

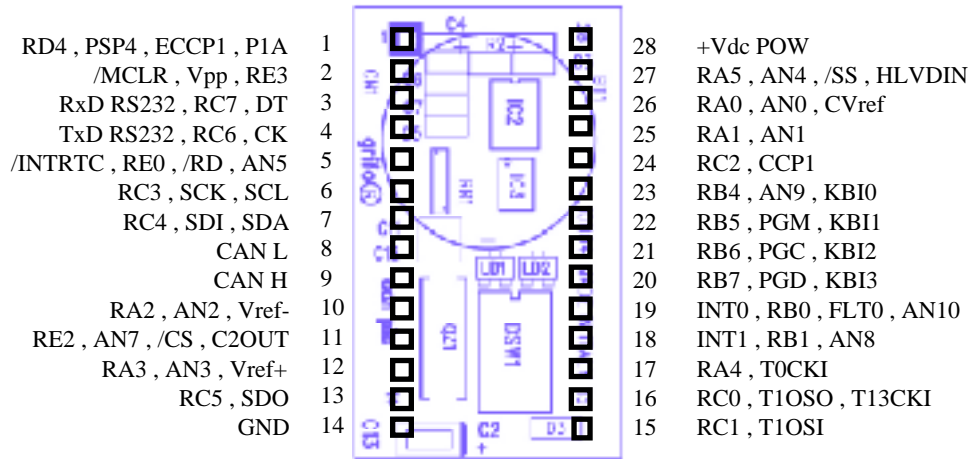


FIGURE 7: CAN1 - SOCKET WITH MINI MODULE SIGNALS

Signals description:

- RxD RS232** = I - Serial reception line; can be set as RS 232 or TTL
- TxD RS232** = O - Serial transmission line; can be set as RS 232 or TTL
- CAN L** = I/O - Differential L signal of CAN interface
- CAN H** = I/O - Differential H signal of CAN interface
- PDI** = I - ISP data output signal
- PDO** = O - ISP data input signal
- RAx,....REx** = I/O - Signal x of n-th digital I/O port of CPU
- SCK, SDI, SDO** = I/O - Signals of SPI interface
- /SS** = I - Slave select signal of SPI interface
- SCL** = O - Clock signal of I²C BUS interface
- SDA** = I/O - Data signal of I²C BUS interface
- INTn** = I - External n-th interrupt of CPU
- ANn** = I - A/D converter n-th analog input
- Vref+/-, CVref** = I - Input of reference voltages for A/D converter and comparators
- C2OUT** = O - Outout of 2nd analog comparator
- (E)CCP1, P1A** = I/O - Capture, Compare, PWM and enhanced PWM
- Vpp** = I - Programming voltage
- FLT0** = I - Input enhanced PWM fault
- CK, DT** = O - Clock and data output of synchronous serial line
- PGx** = I/O - Clock and data signals of ISP programming
- TnCKI** = I - External count triggers for timers 0, 1 and 3
- T1OSx** = I/O - Connections for external oscillator of timer 1
- /INTRTC** = I - Periodic interrupt generated by RTC PCF 8583
- /MCLR** = I - Reset
- +Vdc POW** = I - Power supply
- GND** = - Ground

MINI MODULE CONFIGURATION

On CAN PIC module there is an 8 ways dip switch that defines some configurations of the card. In the following figures is reported its list, position and functions in all the available connection modes. The * (asterisk) denotes the default connection, or on the other hand the connection set up at the end of testing phase, that is the configuration the user receives.

To recognize the configuration elements location, please refer to figure 8.

For further information about serial communication lines, please refer to paragraph SERIAL COMMUNICATION SELECTION.

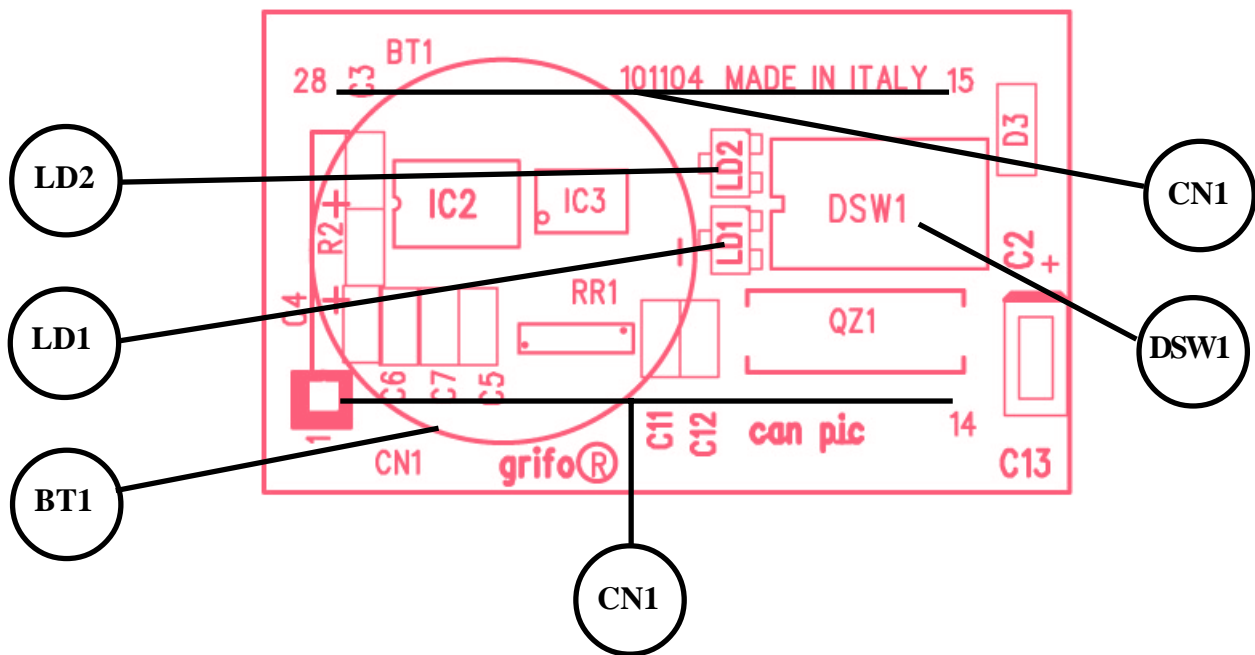


FIGURE 8: LEDs, DIP SWITCHED, ETC. LOCATION

SWITCH	POSITION	PURPOSE	DEF.
DSW1.1	ON	It connects the serial receive signal RC7 , RX , DT of the microcontroller to RS232 driver. Used in conjunction with DSW1.3,5.	*
	OFF	It does not connect the serial receive signal of the microcontroller to RS232 driver, thus allowing the direct connection to RxD RS232 , RC7 , DT signal on CN1. Used in conjunction with DSW1.3,5.	
DSW1.2	ON	It connects TxD RS232 , RC6 , CK signal on CN1 to RS232 serial driver. Used in conjunction with DSW1.4.	*
	OFF	It does not connect TxD RS232 , RC6 , CK signal on CN1 to RS232 serial driver thus allowing the direct connection to microcontroller. Used in conjunction with DSW1.4.	
DSW1.3	ON	It connects RxD RS232 , RC7 , DT signal on CN1 to RS232 serial driver. Used in conjunction with DSW1.1,5.	*
	OFF	It does not connect RxD RS232 , RC7 , DT su CN1 signal on CN1 to RS232 serial driver thus allowing the direct connection to microcontroller. Used in conjunction with DSW1.1,5.	
DSW1.4	ON	It connects TxD RS232 , RC6 , CK signal on CN1 directly to microcontroller, with no use of RS232 serial driver. Used in conjunction with DSW1.2.	
	OFF	It does not connect TxD RS232 , RC6 , CK signal on CN1 to microcontroller, thus allowing the use of RS232 serial driver. Used in conjunction with DSW1.2.	*
DSW1.5	ON	It connects RxD RS232 , RC7 , DT signal on CN1 directly to microcontroller, with no use of RS232 serial driver. Used in conjunction with DSW1.1,3.	
	OFF	It does not connect RxD RS232 , RC7 , DT signal on CN1 to microcontroller, thus allowing the use of RS232 serial driver. Used in conjunction with DSW1.1,3.	*
DSW1.6	ON	It connects on-board battery to RTC PCF 8583, allowing to keep date, time and SRAM content even when power supply is turned off.	
	OFF	It does not connect on-board battery to RTC PCF 8583, so date, time and SRAM content are lost when power supply is turned off.	*
DSW1.7	ON	It connects RD3 , PSP3 , C2IN- signal to GND signal. This switch can be a user input.	
	OFF	It does not connect RD3 , PSP3 , C2IN- signal to GND signal. RD3 , PSP3 , C2IN- is connected to +Vdc POW through a pull-up. This switch can be a user input.	*
DSW1.8	ON	It connects RD2 , PSP2 , C2IN+ signal to GND signal. This switch can be a user input.	
	OFF	It does not connect RD2 , PSP2 , C2IN+ signal to GND signal. RD2 , PSP2 , C2IN+ is connected to +Vdc POW through a pull-up. This switch can be a user input.	*

FIGURE 9: DSW1 8 WAYS DIP SWITCH TABLE

SERIAL COMMUNICATION SELECTION

Serial communication line of **CAN PIC** can be buffered as RS 232 or TTL.

By software, it is possible to define physical communication protocol for the line setting some microcontroller internal registers.

The serial interface has its own group of registers for configuration, and can work in total independence respect to the other peripherals.

Electric protocol is selected by hardware and requires the dip switches to be configured correctly, as described in previous tables; the user can set any configuration in autonomy following the below reported information:

- SERIAL LINE CONFIGURED AS RS 232 (default configuration)

DSW1.1	=	ON
DSW1.2	=	ON
DSW1.3	=	ON
DSW1.4	=	OFF
DSW1.5	=	OFF

- SERIAL LINE CONFIGURED AS TTL

DSW1.1	=	OFF
DSW1.2	=	OFF
DSW1.3	=	OFF
DSW1.4	=	ON
DSW1.5	=	ON

Figures 10 and 11 show how to connect a generic external system to both serial lines of **CAN PIC**.

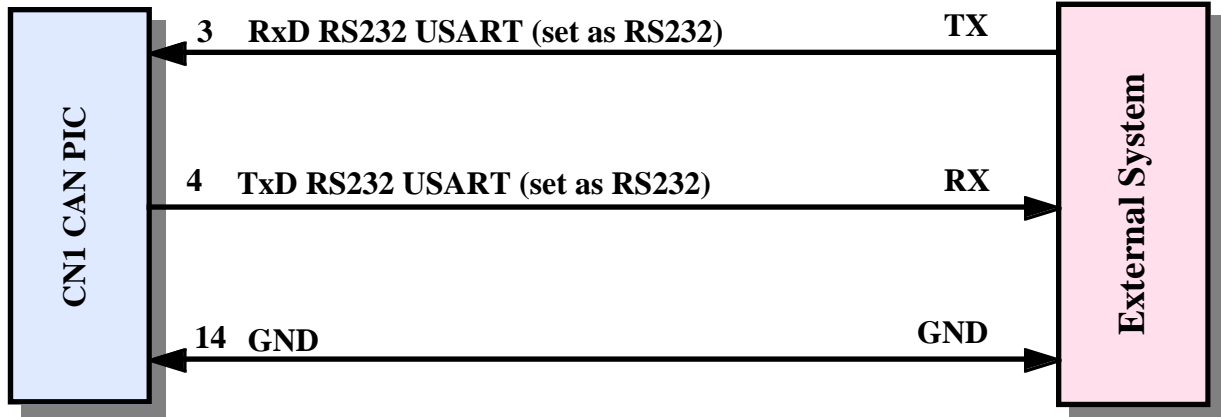


FIGURE 10: EXAMPLE OF RS 232 SERIAL CONNECTION

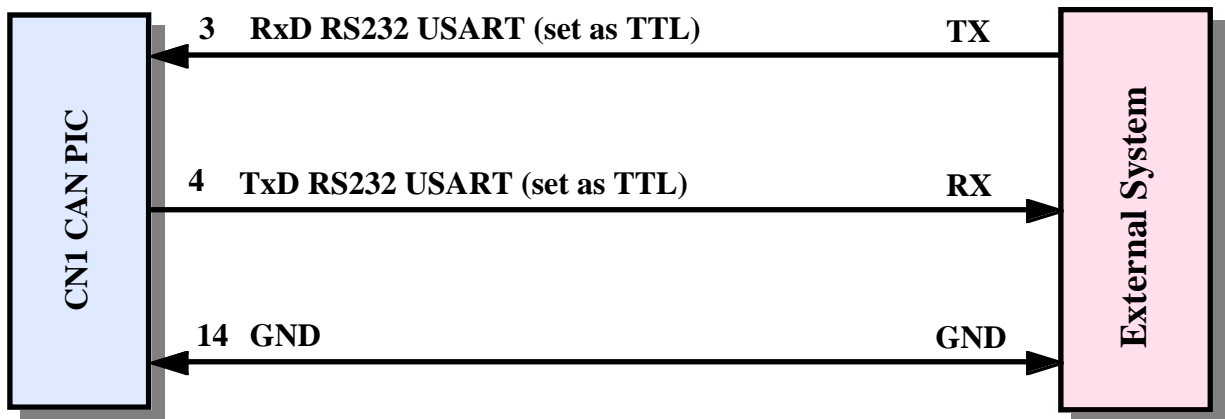


FIGURE 11: EXAMPLE OF TTL SERIAL CONNECTION

CONNECTOR SIGNALS INTERFACEMENT

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

- For RS 232 and CAN signals the user must follow the standard specifications of these protocols, defined by specific normatives.
- 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 state 0, while the +Vdc POW level corresponds to logic state 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 preferable 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 analog comparators must be connected to signals generators featuring a low impedance in the range from 0 to +Vdc POW, to assure greater stability and precision.
- The inputs for A/D converter must be connected to signals generators featuring a low impedance in the range from 0 to +Vdc POW, to assure greater stability and precision.
- PWM signals generated by CCP sections are TTL type so they must be buffered to interface the power circuitry. Typical interfaces can be current driver (if PWM signal is still required) or an intergrator circuit if analog voltage is required.
- Also I²C 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. On Mini Module, signals SDA and SCL are pulled-up to +Vdc POW through 4.7 kΩ resistors.

POWER SUPPLY

Mini Module can be supplied by a tension of +5 Vdc called +Vdc POW in this manual.

CAN PIC design adopted all the circuital and componentistic options that reduce sensibility to noise and reduce consumption, including the possibility to switch the microcontroller to low consumption modes.

In optimal situation, the minimum consumption (in power down mode) is lower than 1 mA, so it can, for example, increase battery life in case of portable applications.

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

INTERRUPTS

A remarkable feature of **CAN PIC** card is the powerful interrupt management.

Here follows a short description of which devices can generate interrupts and their modalities; for further information about interrupts management please refer to the microprocessor data sheet or APPENDIX A of this manual.

- Pin 19 of CN1 -> Generates an interrupt INT0 of microprocessor.
- Pin 18 of CN1 -> Generates an interrupt INT1 of microprocessor.
- CPU peripherals -> Generate an internal interrupt. In detail the possible microcontroller interrupt sources are: Timer Counter, CCP, EUSART, CAN, analog comparators, A/D converter, I²C BUS, SPI, EEPROM, HLVD, etc.

An interrupt management section, integrated in microcontroller, allows to enable, disable and mask so the user has the possibility to respond promptly and efficiently to any external event.

The microcontroller has an interrupt section that let the user manage the 32 interrupt sources. So the application program has always the possibility to react promptly to every event.

IN CIRCUIT DEBUGGER

The microcontroller on board of **CAN PIC** is provided with a hardware interface to perform the feature In Circuit Debugger designed to work with free utility MPLAB® IDE.

This feature is disabled from factory and can be enabled programming opportunely the DEBUG bit of microcontroller configuration.

Some resources of microcontroller are not available any more when In Circuit Debugger is enabled: 2 levels of stack, 10 Bytes of data memory, 512 Bytes of code memory and 3 I/O signals.

These latter must be connected to an interface for the In Circuit Debugger hardware module that can be purchased from Microchip or any third party, so the design must include this connection.

Above mentioned I/O signals are available on connector CN1 of Mini Module at pins 2, 14, 20, 21 and 28.

For further information please refer to data sheet or Appendix A of this manual.

SUPPORT CARDS

CAN PIC 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:

GMB HR84 allows easily to:

- to supply the Mini Module through on board power supply;
- to have eight TTL I/O signals of microprocessor ports optocoupled NPN and PNP at the same time and visualized through green LEDs; I/O signals are multiplexed with timer inputs, so developed functions like counters are immediatly available;
- to have four TTL I/O signals of microprocessor ports on buffered relays driving and visualized through red LEDs;
- to connect on **I²C BUS** and +5 Vdc power supply on a dedicated connector;
- to connect immediatly communication serial line through a comfortable 9 ways DB9 connector;
- to buffer easily TTL signals from microprocessor in RS 422, RS 485 or current loop;
- to connect PWM signal through a comfortable standard AMP connector;

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



FIGURE 12: IMAGE OF MODULE GMB HR 84 AND CAN PIC

USE WITH CAN GMT MODULE

Amongst **grifo**[®] cards, **CAN GMT** is the one designed specifically to be the prototyping board supporting **CAN GMx** 28 pins Mini Modules.

CAN GMT allows easily to:

- 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 compliant to standard **I/O ABACO**[®]
- to have I²C Bus and interrupt signals on a specific connector, to be able to expand the system with any I²C Bus device, driven both in polling and in interrupt
- to connect immediatly RS 232, TTL and CAN signals through two comfortable D type connectors
- to set and visualize the status of up to 6 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 any application taking advantage of the wide prototyping area provided with duplicated signals

The following configuration is suggested to use the couple **CAN GMT + CAN PIC** in their base version, that is RUN mode with serial line buffered in RS 232:

Configuration CAN PIC

DSW1.1	=	ON
DSW1.2	=	ON
DSW1.3	=	ON
DSW1.4	=	OFF
DSW1.5	=	OFF
DSW1.6	=	OFF
DSW1.7	=	OFF
DSW1.8	=	OFF

Configuration CAN GMT

J1	=	1-2
J2	=	1-2
J3	=	1-2
J4	=	1-2
J5	=	1-2
J6	=	1-2
J7	=	1-2
J8	=	not connected
J9	=	1-2

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

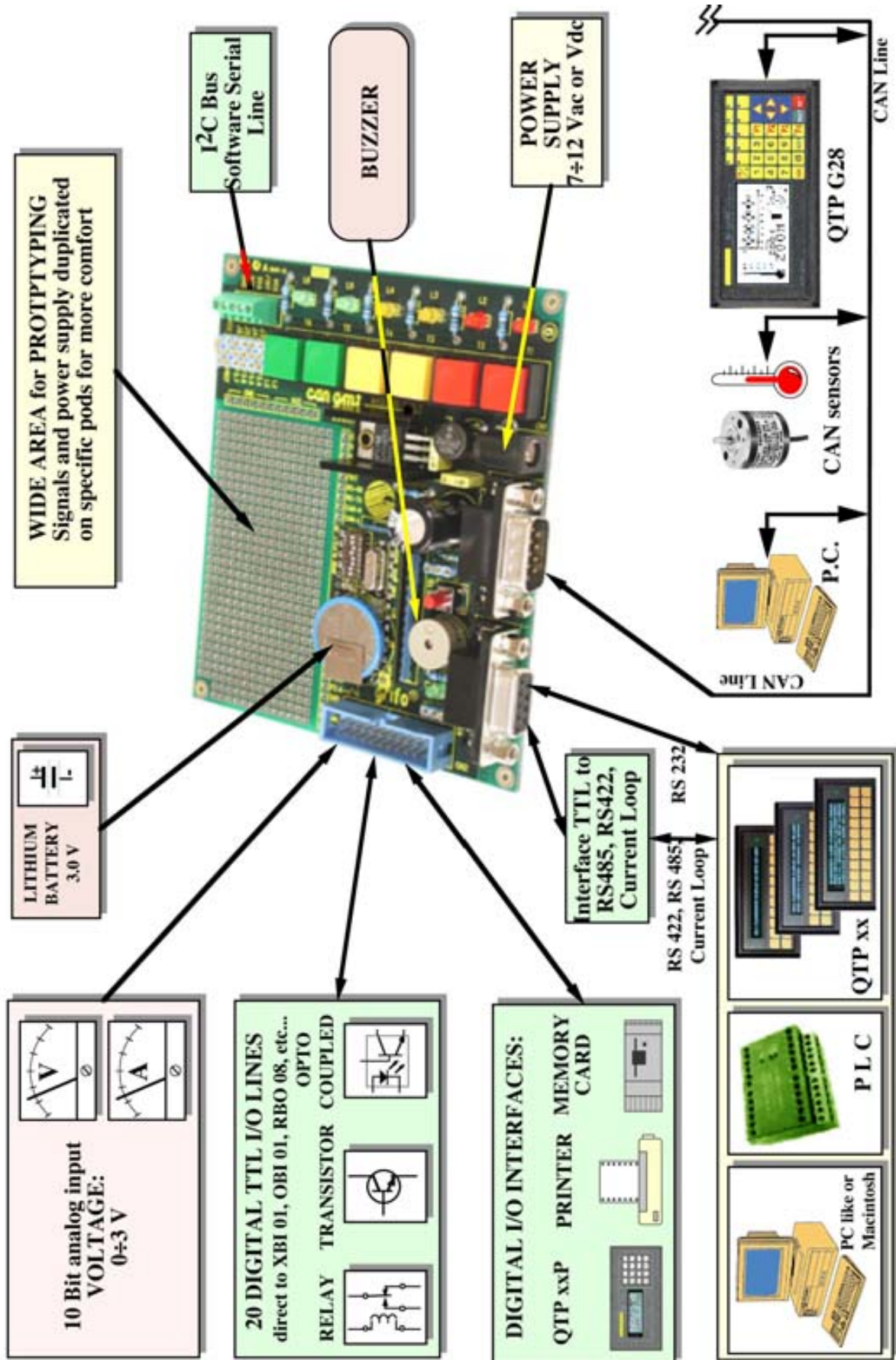


FIGURE 13: CONNECTION EXAMPLE OF CAN GMT + CAN PIC

HOW TO START

Un of the most intresting features is the possibility to program the FLASH of Microchip PIC18F4680 through specific tools manufactured by **grifo**® and Microchip.

Across this chapter we presume that you have a **CAN GMT** or a **GMB HR84** where to install **CAN PIC**.

For further information please refer the specific manual of **GMB HR84 + CAN PIC**.

A) SERIAL CONNECTION BETWEEN CAN PIC AND PC

A1) To make the serial connection between **CAN PIC** and a PC, the structure described on figure 14 should be built.

The program delivered to the customer in the Mini Module performs the alternative blink of the on board LEDs, without using the serial interface. Demo program uses widely such interface, it also provides a section dedicated to it. So it is a good idea to make the serial connection as first thing.

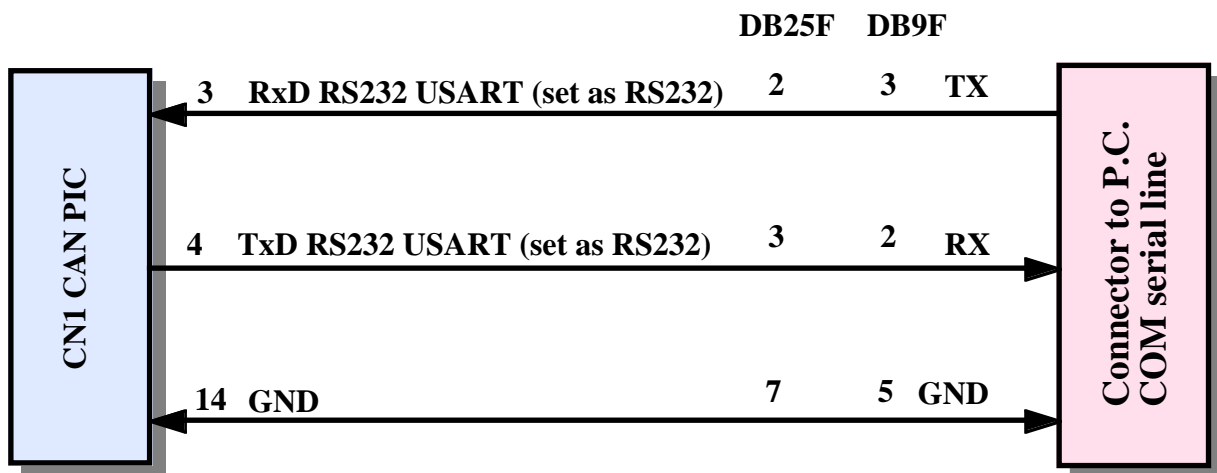


FIGURE 14: RS 232 SERIAL CONNECTION BETWEEN A CAN PIC AND A PC

A2) Keep ready for running a terminal emulator on PC, configure it to use the serial port where Mini Module is connected with 19200 baud, 8 data bits, 1 stop bit, no parity.

A3) Supply CAN GMT or GMB HR84. LEDs of Mini Module should start blinking alternatively about twice per second.

PROGRAMS FOR MINI MODULES AND MINI BLOCKS													
BOARD TYPE	GET	ASM	Ladder	Abaco® Link BUS	BASIC CB280	BASIC BASCOM 8051	BASIC BASCOM AVR	PIC BASIC	BASIC VARI	MCS® Basic 52	C	PASCAL	CPU / BLOCK TYPE
MISCELL.	-	-	-	-	-	●	-	-	-	-	-	-	-
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 15: EXAMPLES TABLE

B) FLASH REPROGRAMMING:

B1) Find on CD **grifo**[®] and save to a comfortable position on your hard drive the demo program "prCANPICuk.hex". It can be found starting from main page following the path: English | Examples tables | Mini Modules and Mini Block examples | CAN PIC (please refer to figure 15).

B2) 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.

B2 MPLAB[®]) Microchip MP LAB[®] ICD 2 and **grifo**[®] GMM PIC-PR.

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

B2 MPLAB[®] a) Download from Microchip website, if it has not already been done, the latest version of MP LAB[®] IDE.

B2 MPLAB[®] b) Please refer to Microchip documentation to correctly install MPLAB[®] IDE.

B2 MPLAB[®] c) Please refer to Microchip MP LAB[®] ICD 2 documentation to correctly install it.

B2 MPLAB[®] d) Select PIC18F4680 from MP LAB[®] IDE using menu Configuration | Select device.

B2 MPLAB[®] e) 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.

B2 MPLAB[®] f) Load file prCANPICuk.hex using menu File | Import.

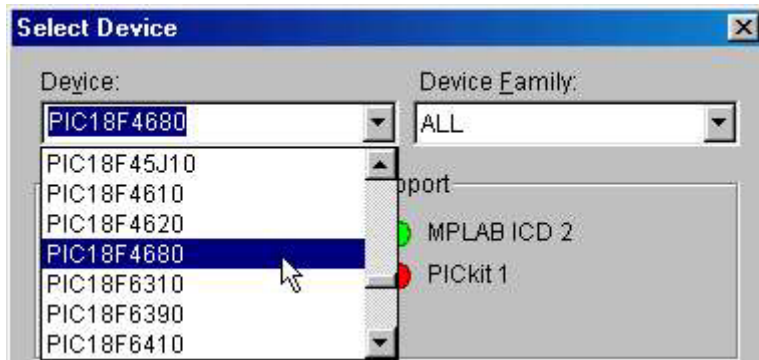


FIGURE 16: DEVICE SELECTION WITH MP LAB® ICD 2

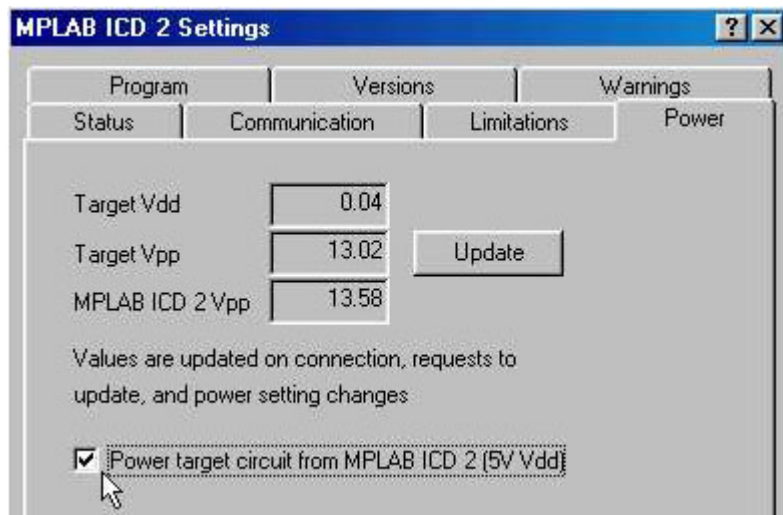


FIGURE 17: SETTING CONNECTION WITH MP LAB® ICD 2

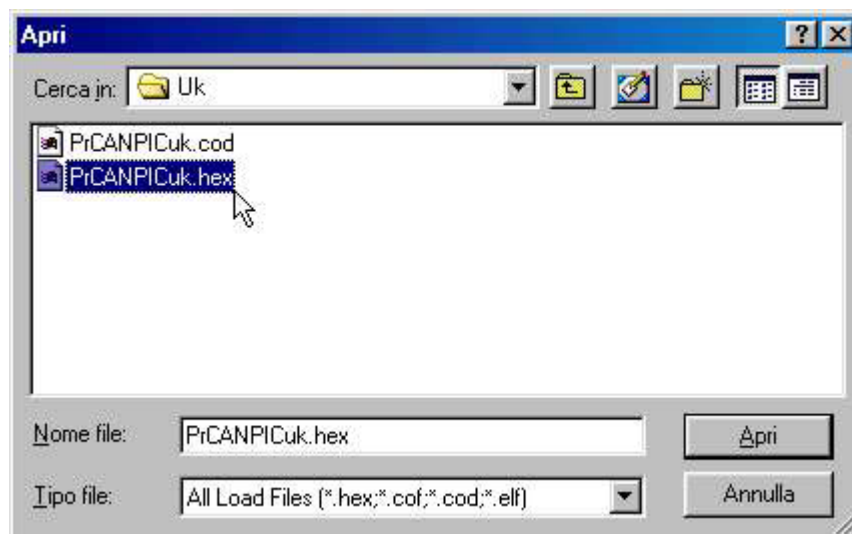


FIGURE 18: LOADING FILE TO PROGRAM WITH MP LAB® ICD 2

B2 MPLAB® g) In menu Configuration | Configuration Bits configure "Oscillator" as "HS-PLL enabled freq=4xFosc1" and "WatchDog" as "Off", "Brown Out" as "Enabled in hardware" and "Extended CPU Enable" as "Disabled".

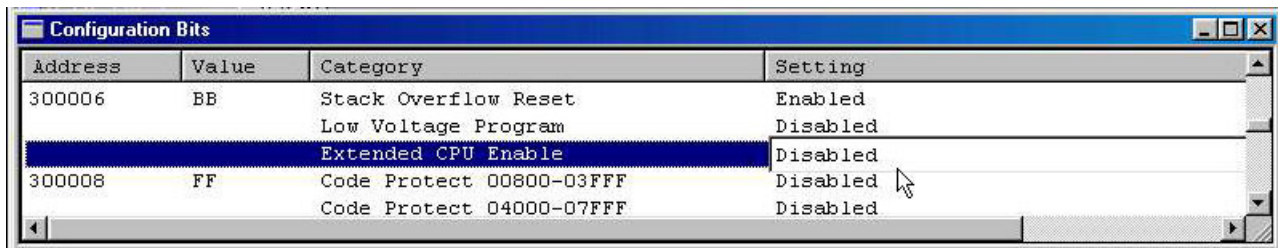
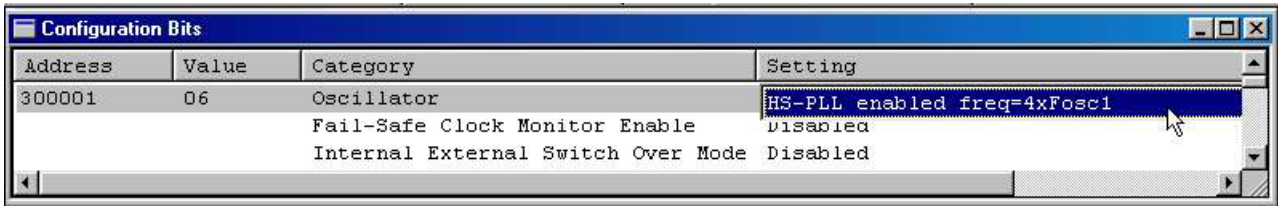


FIGURE 19: CONFIGURATION OF MP LAB® ICD 2

B2 MPLAB® h) Give the command to program (menu Programmer | Program).



FIGURE 20: FLASH MEMORY PROGRAMMING WITH MP LAB® ICD 2



FIGURE 21: PIC MINI MODULE ON GMM PIC-PR AND CONNECTED TO MPLAB® ICD 2



FIGURE 22: PIC MINI MODULE ON GMM PIC-PR AND CONNECTED TO MP PIK+

B2 MP PIK+) Using *grifo*[®] MP PIK+ and *grifo*[®] GMM PIC-PR.

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

B2 MP PIK+ a) 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.

B2 MP PIK+ b) Connect the programmer and start the communication to the PC following the instructions of the manual on the Mini CD.

B2 MP PIK+ c) 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.

B2 MP PIK+ d) Select PIC18F4680 (ISP) using menu Device | Select device as shown in figure 23.

B2 MP PIK+ e) Open the programming options window (pressing ALT and letter "o"), uncheck the box "Low voltage programming" and check "Configuration" (see figure 24).

B2 MP PIK+ f) Load the file prCANPICuk.hex using the menu File | Load File as shown in figure 25.

B2 MP PIK+ g) Open the "Edit config." window (pressing key ALT and letter "s") then set "Oscillator" as "HS-PLL", "Watchdog" as "Disable", "Brown Out" as "Enabled in hardware" and "Extended CPU Enable" as "Disabled" like shown in figure 26.

B2 MP PIK+ h) Give the programming command as shown in figure 27.

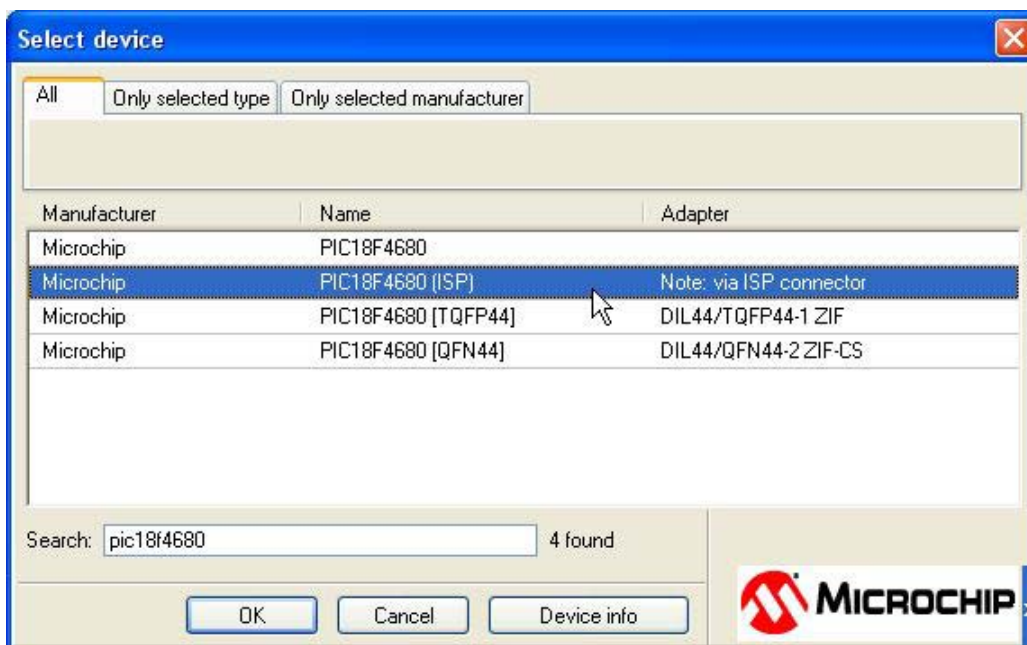


FIGURE 23: DEVICE SELECTION WITH MP PIK+

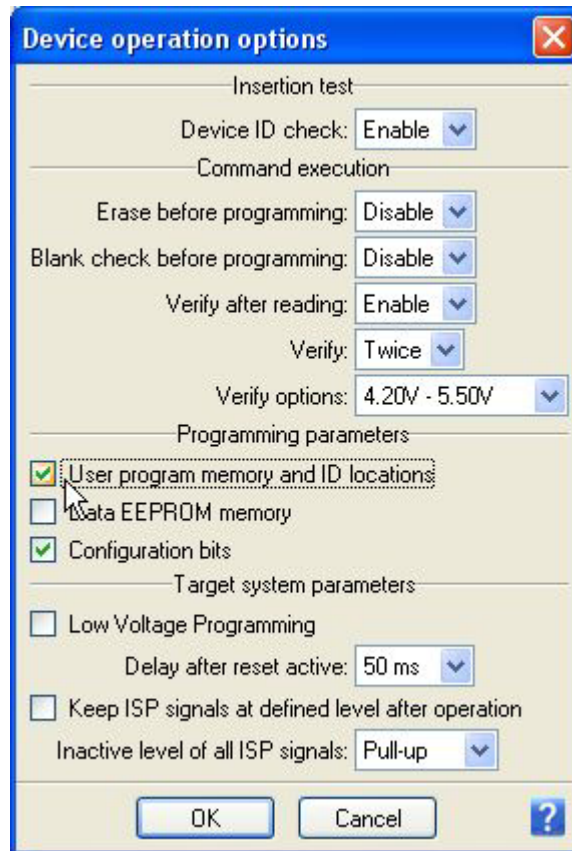


FIGURE 24: PROGRAMMER CONFIGURATION WITH MP PIK+

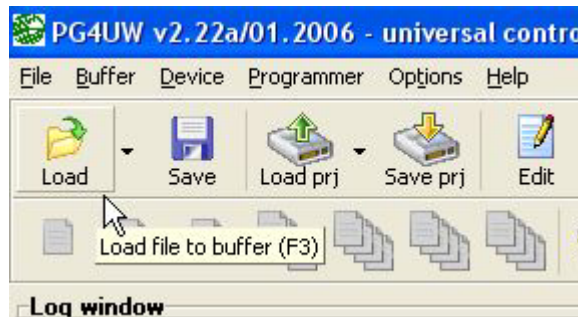


FIGURE 25: FILE LOADING WITH MP PIK+

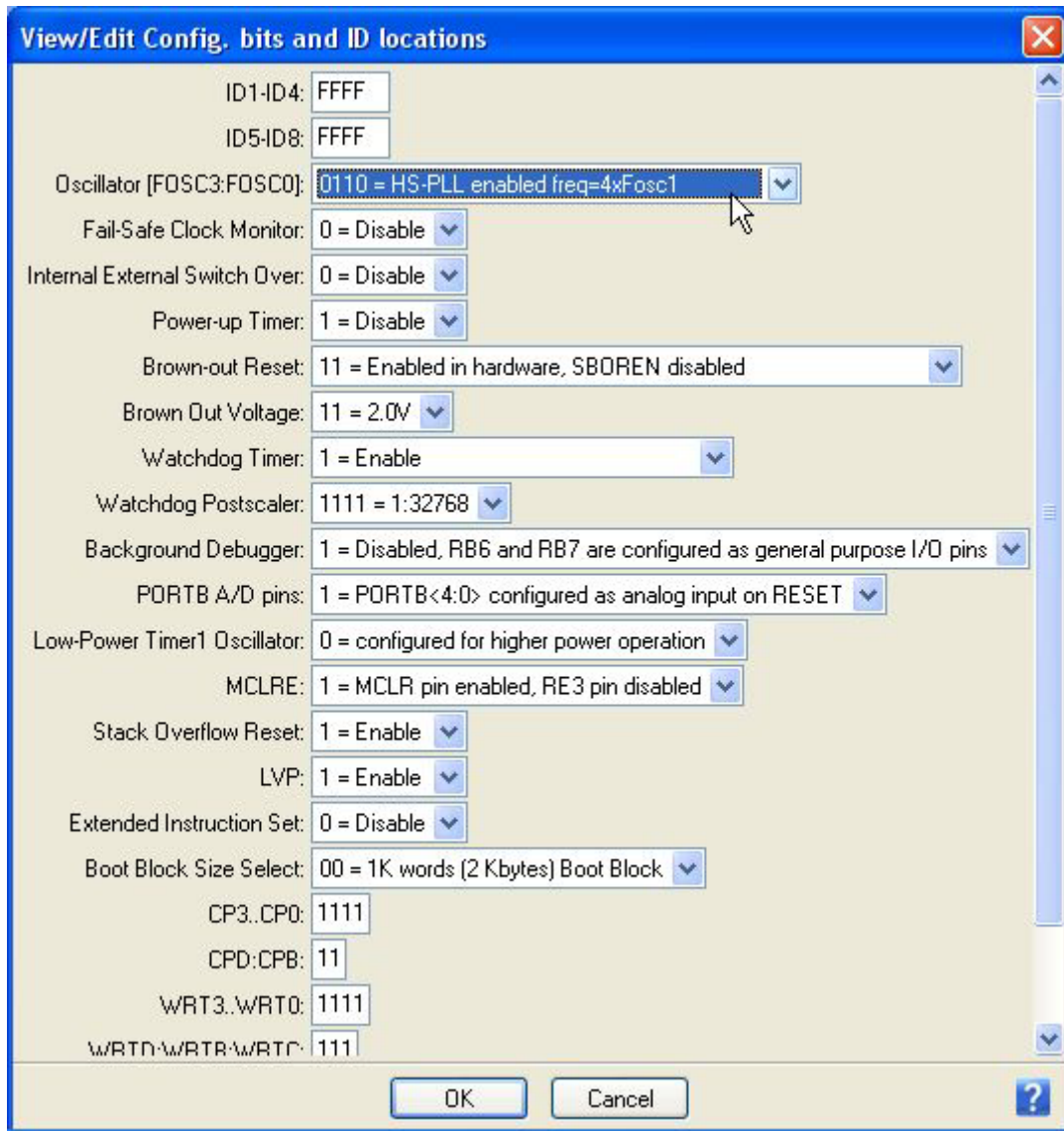


FIGURE 26: DEVICE CONFIGURATION WITH MP PIK+

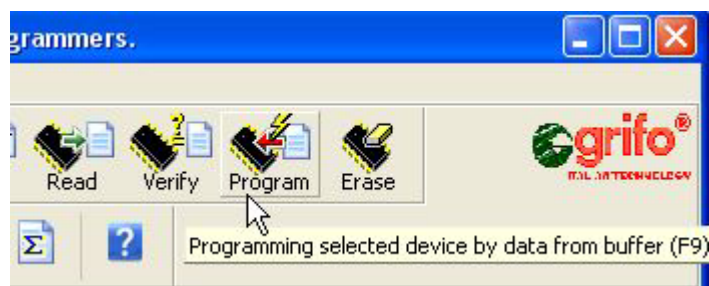


FIGURE 27: PROGRAMMER PIC18F4680 WITH MP PIK+

C) GENERATING DEMO EXECUTABLE CODE:

- C1) Install on the hard disk of the development PC 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 PICC 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 B1, there are also the source file of the same. These have an extension that identifies the used software development tools (for example prCANPICuk.bas for Microcode Studio + PIC BASIC PRO, prCANPICuk.c for HI Tech PICC18, prCANPICuk.pbas for mikroBasic, prCANPICuk.ppas for mikroPascal) and they are properly organized inside demo programs tables available on CD, together with possible definition file (prCANPICuk.mcp for HI Tech PICC18 + MP LAB® ICD 2, prCANPICuk.pbp for mikroBasic, prCANPICuk.ppp for mikroPascal). Once these files have been located they must be copied in a comfortable folder on the hard disk of development PC.
- C3) Compile the source file by using the selected software tools: the file prCANPICuk.hex must be obtained equal to those available on **grifo®** CD and already used at steps B. This operation is very different according to the programming environment selected, so here follows the details:

C3 PIC BASIC PRO) *Microcode Studio + PIC BASIC PRO.*

- C3 PIC BASIC PRO a) When in Microcode Studio IDE, select the target CPU from the specific list box. Target CPU for the source recompilation must be PIC18F4680:



FIGURE 28: SELECTING TARGET PROCESSOR WITH MICROCODE STUDIO + PIC BASIC PRO

C3 PIC BASIC PRO b) Load file prCANPICuk.bas, containing the source code to be recompiled, using the menu File | Open, as shown:



FIGURE 29: LOADING SOURCE FILE WITH MICROCODE STUDIO + PIC BASIC PRO

C3 PIC BASIC PRO c) Compile the source file by pressing the button on the right of the list box that selects target CPU:



FIGURE 30: COMPILING THE PROGRAM WITH MICROCODE STUDIO + PIC BASIC PRO

C3 mikroBasic) *Ricompilation with mikroBasic.*

C3 mikroBasic a) After starting mikroBasic IDE, open the project file prCANPICuk.pbp with menu Project | Open Project...:

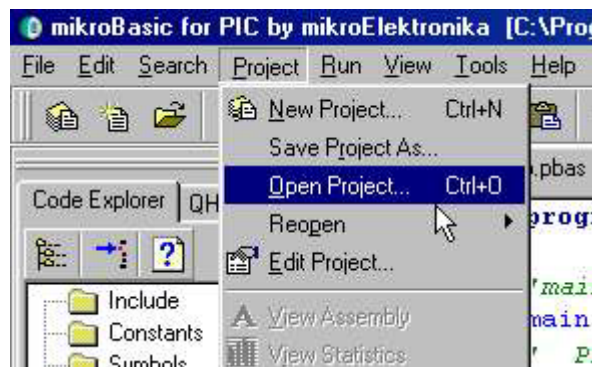


FIGURE 31: LOADING PROJECT FILE WITH MIKROBASIC

C3 mikroBasic b) 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.

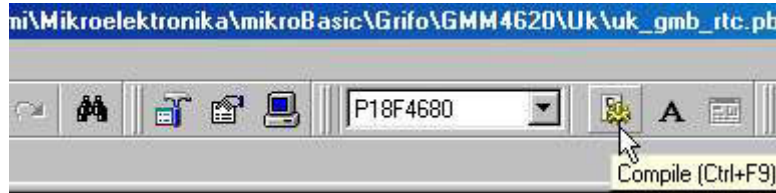


FIGURE 32: COMPILING WITH MIKROBASIC

C3 mikroPascal) *Ricompilation with mikroPascal.*

C3 mikroPascal a) After starting mikroPascal IDE, open the project file prCANPICuk.ppp with menu Project | Open Project....:

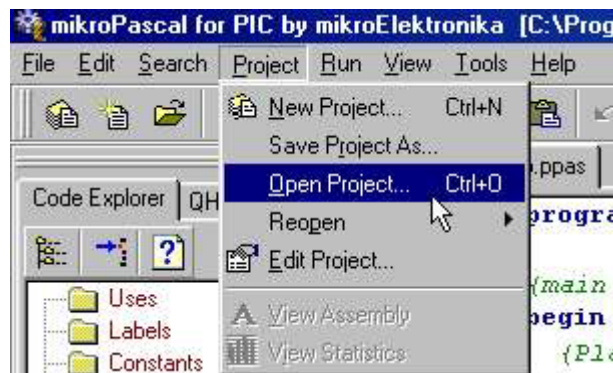


FIGURE 33: LOADING PROJECT FILE WITH MIKROPASCAL

C3 mikroPascal b) 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.

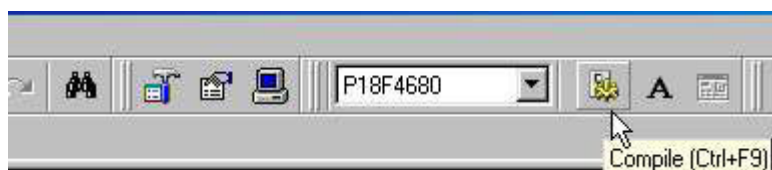


FIGURE 34: COMPILING WITH MIKROPASCAL

IV) Ricompilation with HI Tech PICC18 + MP LAB® IDE.

C3 HI-TECH C a) First of all, HI Tech PICC18 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 MPLAB® IDE.

C3 HI-TECH C b) Open the project file prCANPICuk.mcp using the menu Project | Open Project or pressing the button shown in the following figure:

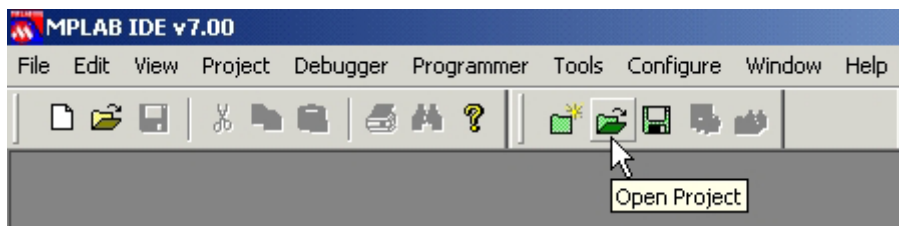


FIGURE 35: LOADING PROJECT FILE WITH HI TECH PICC 18 + MP LAB® IDE

- C3 HI-TECH C b) 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.

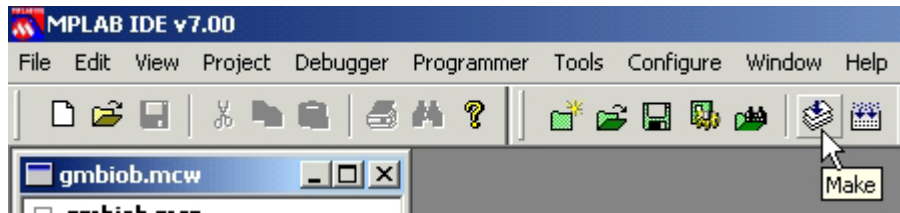


FIGURE 36: COMPILING WITH HI TECH PICC18 + MP LAB® IDE

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

D) FINAL APPLICATION

- D1) Close the Boot Loader PC utility.

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 **CAN PIC**.

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 B and C) in cyclic mode, until the developed application program is completely well running.

When this focus is reached the development PC can be eliminated, by obtaining a self running card, as below described:

Remember to reconfigure serial port of Mini Module, if required.

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 PICC18: 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 maintains 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 support the different version 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 especially 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 especially 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.

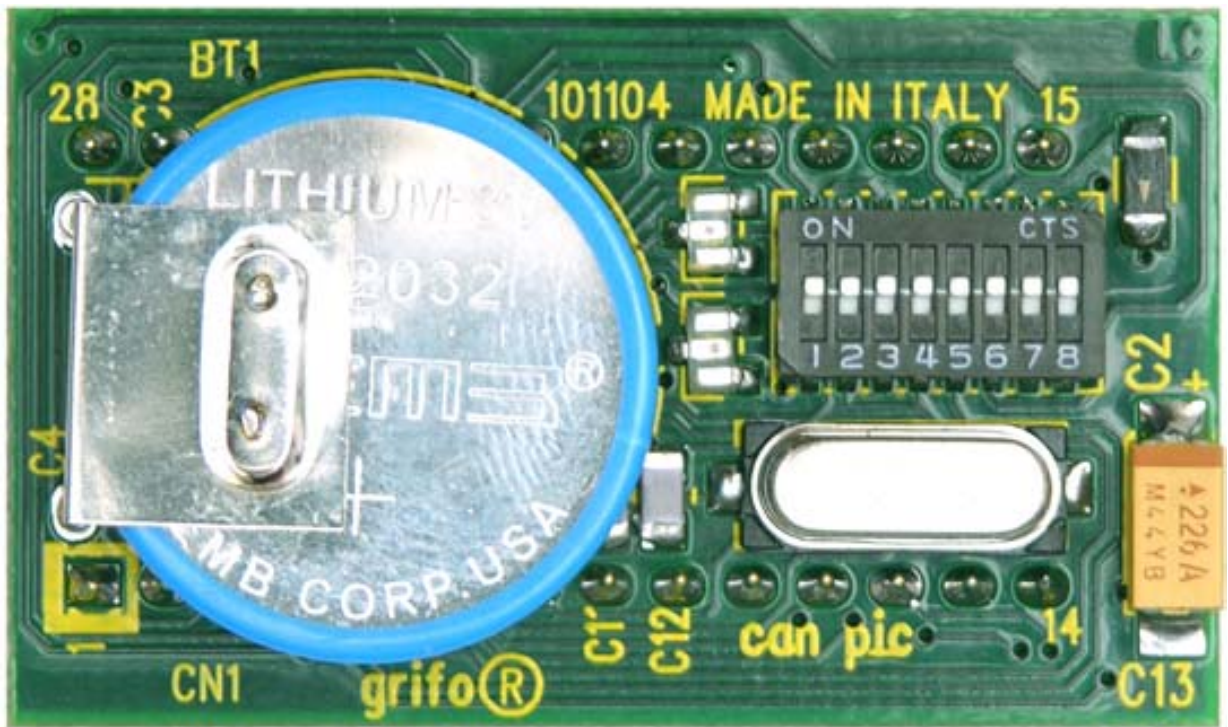


FIGURE 37: TOP VIEW VIEW OF CAN PIC

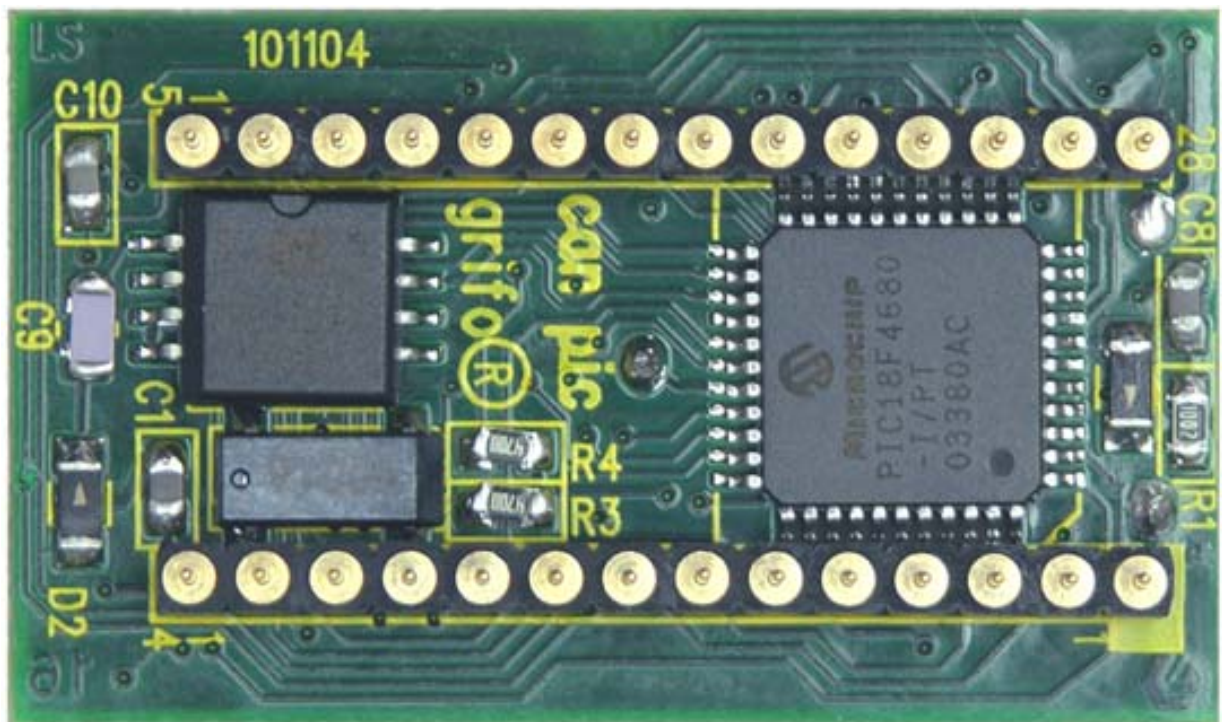


FIGURE 38: BOTTOM VIEW OF CAN PIC

PERIPHERAL DEVICES SOFTWARE DESCRIPTION

Below there is a specific description of the software managements of the on board peripheral devices. Whenever the reported documentation is not sufficient, please search a more detailed description of the devices in manufacturing company data sheets. Furthermore in this chapter the microcontroller internal peripheral devices are not described so if their programming is necessary, please refer to 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.

ACTIVITY LEDES

The **CAN PIC** allows software management of activity or status LEDs LD1 and LD2, through an I/O line of the microcontroller, with the following correspondence:

RD0 = 0	->	LD1 ON
RD0 = 1	->	LD1 OFF
RD1 = 0	->	LD2 ON
RD1 = 1	->	LD2 OFF

It is important to remind that RD0 and RD1 are not connected to CN1.

The signals RD0 and RD1 are set high after reset or power on, so during these phases LEDs are OFF or disabled.

DIP SWITCH

CAN PIC allows to read by software the status of two dip switches, DSW1.7 e 8, through two I/O signals of microcontroller:

DSW1.7 ON	->	RD3 is 0
DSW1.7 OFF	->	RD3 is 1
DSW1.8 ON	->	RD2 is 0
DSW1.8 OFF	->	RD2 is 1

It is important to remind that RD2 and RD3 are not connected to CN1.

BACKED SRAM + SERIAL RTC

Mini Module **CAN PIC** is provided with a complete Real Time Clock capable to manage hours, minutes, seconds, day, month, year and weekday in complete autonomy.

This module can be backed up through the back up circuitry to warrant data validity in any working condition and is completely managed by software.

RTC section can also generate periodic interrupts at software programmable time intervals, to switch the CPU out of normal operations or to awaken it from low consumption modes.

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 I²C bus standard protocol, through two I/O microprocessor pins. The only necessary information is the electric connection:

RC4 , SDI , SDA (input/output)	->	DATA line (SDA)
RC3 , SCK , SCL (input/output)	->	CLOCK line (SCL)

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

This means that RTC takes permanently the slave address **A0**, which is not available for user application.

The above mentioned module is capable to generate a programmable periodic signal, which is connected on-board to a 4.7 k Ω pull-up, and is available on pin 11 of Mini Module connector CN1, and is connected to signal RE0 of microcontroller.

CPU INTERNAL PERIPHERALS

Registers description and purpose for all internal peripherals (Analog COMPARATORS, A/D CONVERTER, Timer Counters, EUSART, CAN, I²C BUS, SPI, CCP, etc.) is available in the proper data sheet and user manual of the manufacturer.

Please refer to chapter BIBLIOGRAPHY and to appendix A of this manual to easily locate such documentation.

BIBLIOGRAPHY

In this chapter there is a complete list of technical books and notes, where the user can find all the necessary documentations on the components mounted on **CAN PIC** Mini Module.

Manual MAXIM:	<i>New Releases Data Book - Volume IV</i>
Manual MAXIM:	<i>New Releases Data Book - Volume V</i>
Technical paper MAXIM:	<i>True RS 232 Transceivers</i>
Manual PHILIPS:	<i>I2C-bus compatible ICs</i>
Data sheet Microchip:	<i>PIC18F2585/2680/4585/4680 Data Sheet</i>

The described manual can be requested directly to manufacturer or local dealers. Alternatively this information and/or upgrades can be found in specific internet web pages, of the listed companies.

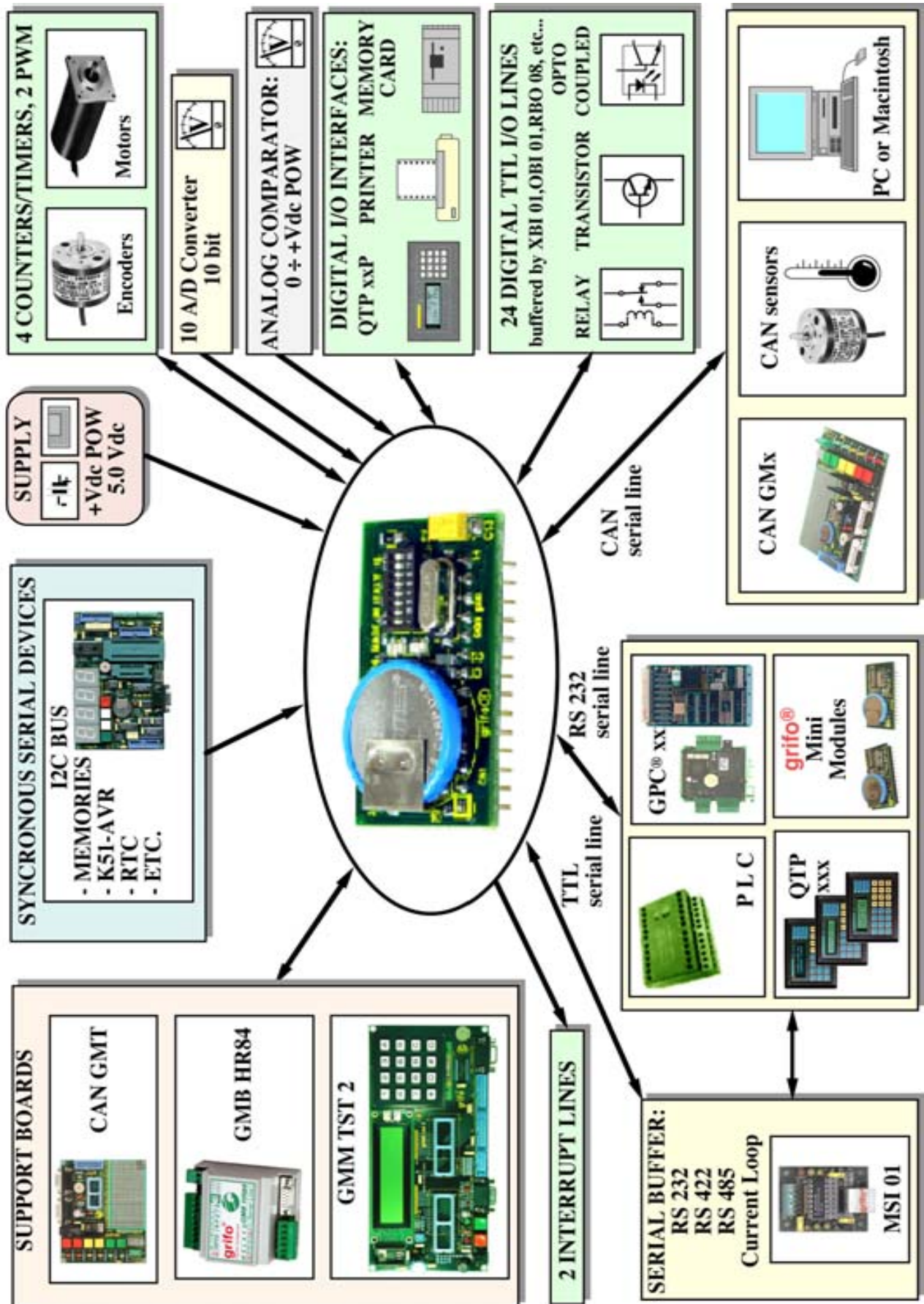


FIGURE 39: AVAILABLE CONNECTIONS DIAGRAM



APPENDIX A: DATA SHEETS

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.

PIC18F4680

Link: Home | Technical documentation Service | Microchip | Data-Sheet PIC18F4680
 URL: <http://www.grifo.com/PRESS/DOC/Atmel/PIC18F4680.pdf>



MICROCHIP PIC18F2585/2680/4585/4680

28/40/44-Pin Enhanced Flash Microcontrollers with ECAN™ Technology, 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 5.8 µA typical
- Sleep mode currents down to 0.1 µA typical
- Timer1 Oscillator: 1.1 µA, 32 kHz, 2V
- Watchdog Timer: 2.1 µA
- 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

Special Microcontroller Features:

- C compiler optimized architecture with optional extended instruction set
- 100,000 erase/write cycle Enhanced Flash program memory typical
- 1,000,000 erase/write cycle Data EEPROM memory typical
- Flash/Data EEPROM Retention: > 40 years
- Self-programmable under software control
- Priority levels for interrupts
- 8 x 8 Single Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT):
 - Programmable period from 41 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

Peripheral Highlights:

- High current sink/source 25 mA/25 mA
- Three external interrupts
- One Capture/Compare/PWM (CCP1) module
- Enhanced Capture/Compare/PWM (ECCP1) module (40/44-pin devices only):
 - One, two or four PWM outputs
 - Selectable polarity
 - Programmable dead time
 - Auto-Shutdown and Auto-Restart
- Master Synchronous Serial Port (MSSP) module supporting 3-wire SPI™ (all 4 modes) and I²C™ Master and Slave modes
- Enhanced Addressable USART module:
 - Supports RS-485, RS-232 and LIN 1.3
 - RS-232 operation using internal oscillator block (no external crystal required)
 - Auto-Wake-up on Start bit
 - Auto-Baud Detect
- 10-bit, up to 11-channel Analog-to-Digital Converter module (A/D), up to 100 Ksps
 - Auto-acquisition capability
 - Conversion available during Sleep
- Dual analog comparators with input multiplexing

ECAN Module Features:

- Message bit rates up to 1 Mbps
- Conforms to CAN 2.0B ACTIVE Specification
- Fully backward compatible with PIC18XXX8 CAN modules
- Three modes of operation:
 - Legacy, Enhanced Legacy, FIFO
- Three dedicated transmit buffers with prioritization
- Two dedicated receive buffers
- Six programmable receive/transmit buffers
- Three full 29-bit acceptance masks
- 16 full 29-bit acceptance filters w/ dynamic association
- DeviceNet™ data byte filter support
- Automatic remote frame handling
- Advanced error management features

Device	Program Memory		Data Memory		I/O	10-Bit A/D (ch)	CCP1/ ECCP1 (PWM)	MSSP		EUSART	Comp.	Timers 8/16-bit
	Flash (bytes)	# Single-Word Instructions	SRAM (bytes)	EEPROM (bytes)				SPI™	Master I²C™			
PIC18F2585	48K	24576	3328	1024	28	8	1/0	Y	Y	1	0	1/3
PIC18F2680	64K	32768	3328	1024	28	8	1/0	Y	Y	1	0	1/3
PIC18F4585	48K	24576	3328	1024	44	11	1/1	Y	Y	1	2	1/3
PIC18F4680	64K	32768	3328	1024	40/44	11	1/1	Y	Y	1	2	1/3



PCF 8583

Link: Home | Technical documentation Service | I²C BUS | Data-Sheet PCF8583
 URL: <http://www.grifo.com/PRESS/DOC/PHILIPS/PCF8583.pdf>

Philips Semiconductors

Product specification

clock/calendar with 240 × 8-bit RAM

PCF8583

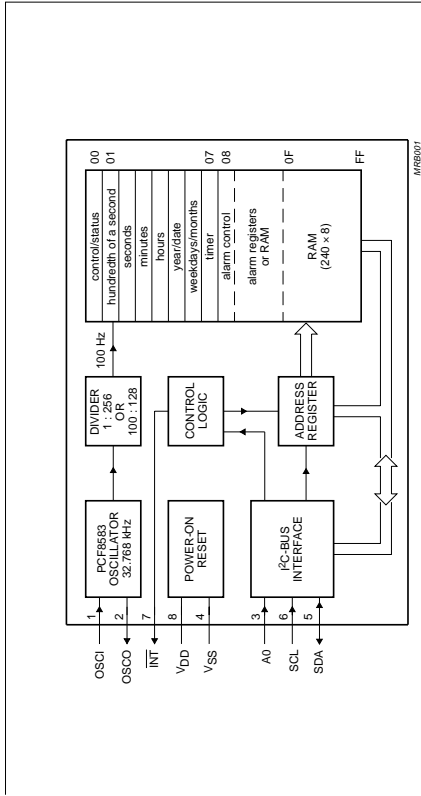
BLOCK DIAGRAM


Fig.1 Block diagram.

PINNING

SYMBOL	PIN	DESCRIPTION
OSC1	1	oscillator input, 50 Hz or event-pulse input
OSC0	2	oscillator output
A0	3	address input
VSS	4	negative supply
VDD	5	serial data line
SCL	6	serial clock line
INT	7	open drain interrupt output (active LOW)
VDD	8	positive supply

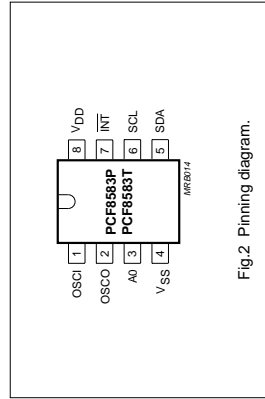


Fig.2 Pinning diagram.

2 GENERAL DESCRIPTION

The PCF8583 is a clock/calendar circuit based on a 2048-bit static CMOS RAM organized as 256 words by 8 bits. Addresses and data are transferred serially via the two-line bidirectional I²C-bus. The built-in word address register is incremented automatically after each written read data byte. Address pin A0 is used for programming the hardware address, allowing the connection of two devices to the bus without additional hardware.

The built-in 32.768 kHz oscillator circuit and the first 8 bytes of the RAM are used for the clock/calendar and counter functions. The next 8 bytes may be programmed as alarm registers or used as free RAM space. The remaining 240 bytes are free RAM locations.

FEATURES

- I²C-bus interface operating supply voltage: 2.5 V to 6 V
- clock operating supply voltage (0 to +70 °C): 0 V to 6.0 V
- 40 × 8-bit low-voltage RAM
- data retention voltage: 1.0 V to 6 V
- operating current (at f_{SCL} = 0 Hz): max. 50 μA
- clock function with four year calendar
- universal timer with alarm and overflow indication 4 or 12 hour format
- 2.768 kHz or 50 Hz time base
- serial input/output bus (I²C)
- automatic word address incrementing
- programmable alarm, timer and interrupt function
- slave address:
- READ: A1 or A3
- WRITE: A0 or A2.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT
D	supply voltage operating mode	I ² C-bus active	2.5	—	6.0	V
D	supply current operating mode	I ² C-bus inactive	1.0	—	6.0	V
D	supply current clock mode	f _{SCL} = 100 kHz	—	—	200	μA
D	operating ambient temperature range	f _{SCL} = 0 Hz; V _{DD} = 5 V	—	10	50	μA
D	storage temperature range	f _{SCL} = 0 Hz; V _{DD} = 1 V	-40	2	10	μA
D	operating ambient temperature range		-65	—	+85	°C
D	storage temperature range		-65	—	+150	°C

ORDERING INFORMATION

TYPE NUMBER	PACKAGE NAME	DESCRIPTION	VERSION
PCF8583P	DIP8	plastic dual in-line package; 8 leads (300 mil)	SOT197-1
PCF8583T	S08	plastic small outline package; 8 leads; body width 7.5 mm	SOT176-1

APPENDIX C: GMM TST2 ELECTRIC DIAGRAM

In this appendix are reported the electric diagram of **CAN GMT** support card that shows the connection modes for Mini Module signals. Detailed information on the board are available in the relative technical manual and the user can use them freely, for example to develop his own card that use the **CAN PIC** as a macro component.

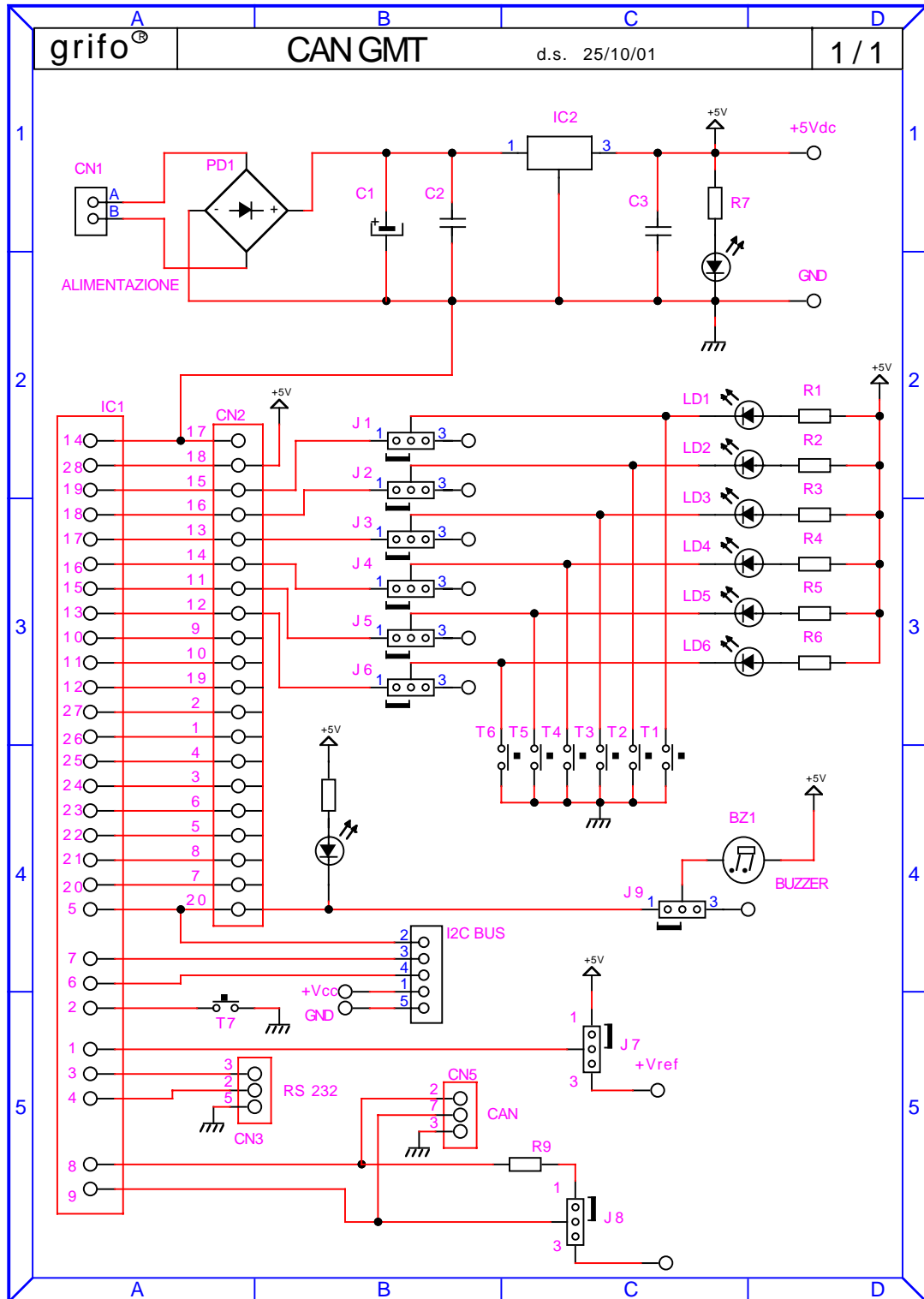


FIGURE B-1: CAN GMT ELECTRIC DIAGRAM



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