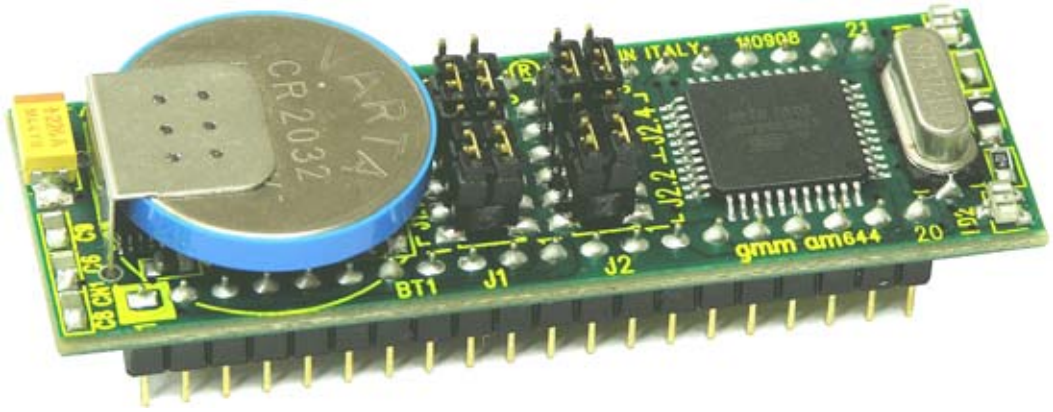
GMM AM1284

grifo® Mini Module AT mega 1284P

USER MANUAL



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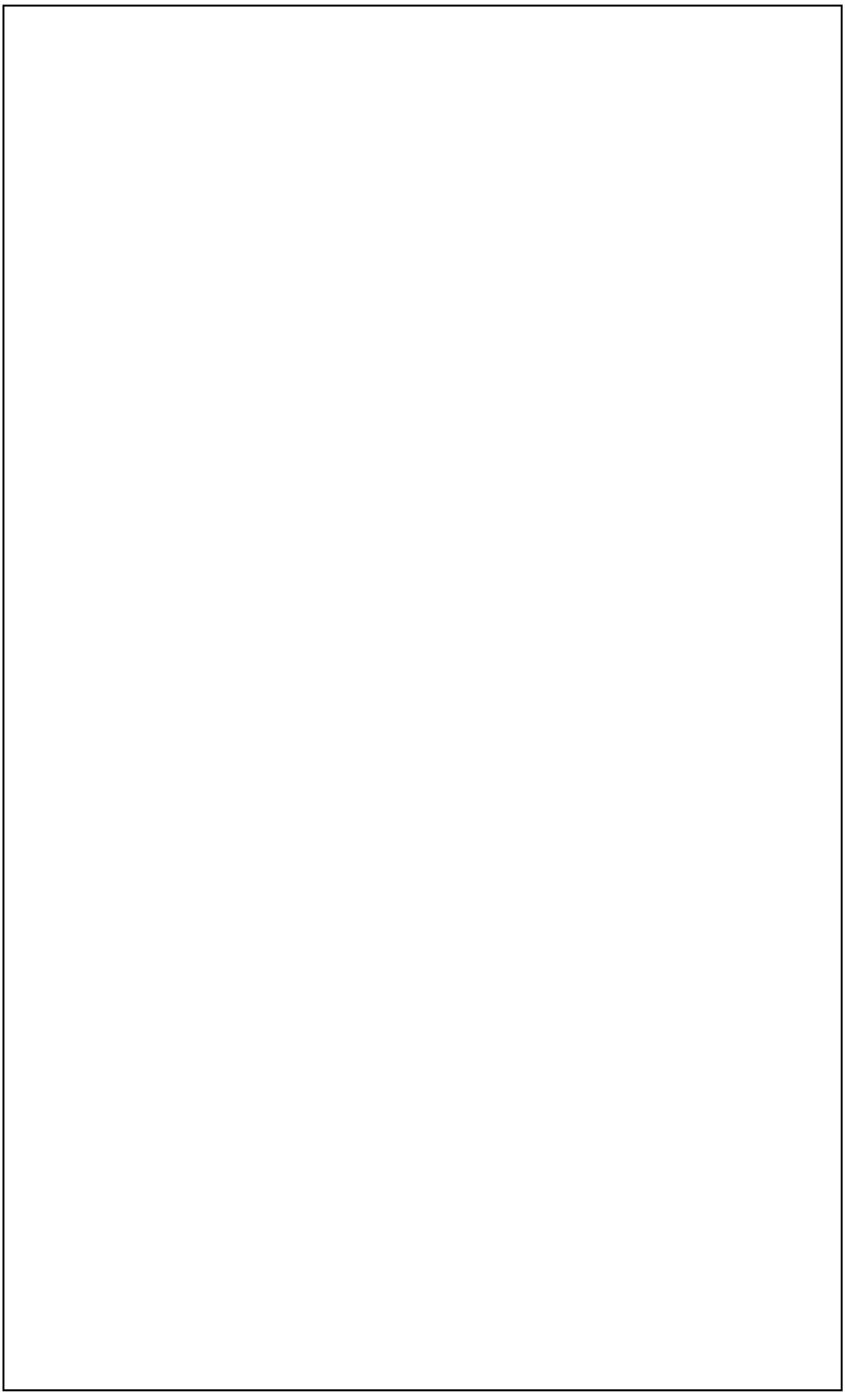
GMM AM1284 Rel. 5.00 *Edition 20 July 2011*



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GMM AM1284 is a **M**ini **M**odule based on microcontroller **Atmel ATmega1284P**, that is a powerful and complete system on chip provided with **CPU**, internal memories and a rich list of peripherals suitable for typical requirements of automation applications.
The module has already mounted inside its reduced size the components that exploit the main features of microcontroller and allows the use of all the operating modes; furtermore it includes some other components that simplify and increase the application fields.
GMM AM1284 can be used for many installations either in the **Industrial**, **Domestic**, **Automotive** and **Didactic** environments, as described in following paragraphs.
The card use is simplified by a wide range of software developement tools based either on low or high level programming languages which allow to work at the best conditions using only a standard **PC**. Noteworthy among these tools there are the **C**, **PASCAL**, **BASIC** compilers and a graphic programming environment based on logic contact (**LADDER**). Special care has been devoted to the application developing, by selecting tools which allow on board **FLASH** burning with user application program and **Remote Debug** directly on the card, always with the simple use of a standard **PC**.
The **GMM AM1284** is equipped with a normalized standard connector that allows immediate mounting on support cards as **GMM TST 3**, **GMB HR168** and **GMB HR246** or mounted directly on a board developed by the user, as a macro component. Both the solutions ensure a short time to market: the user can obtain a prototype or even a ready product **In One Week**.

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IMPORTANT

Although all the information contained herein have been carefully verified, grifo® assumes no responsability for errors that might appear in this document, or for damage to things or persons resulting from technical errors, omission and improper use of this manual and of the related software and hardware.
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

GENERAL INDEX

FIGURES INDEX

INTRODUCTION

The use of these devices has turned - **IN EXCLUSIVE WAY** - to specialized personnel.

This device is not a **safe component** as defined in directive **98-37/CE**.

Pins of module are not provided with any kind of ESD protection. Many pins of the card are directly connected to their respective pins of on board's components and these last are sensitive to electrostatic noises. So personnel who handles the product/s is invited to take all necessary precautions that 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, installation, etc. are destined - and then executable - always and in exclusive way from specialized warned and educated personnel, or directly from the AUTHORIZED TECHNICAL 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 information 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.

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VERSION

This handbook make reference to printed circuit version **110908** and following ones. The validity of the information contained in this manual is subordinated to the version number on the used card, and so the user must always verify the correct correspondence between the notations. The version number is reported in several places on the electronic part of the product, and following figure shows the most accessible one.

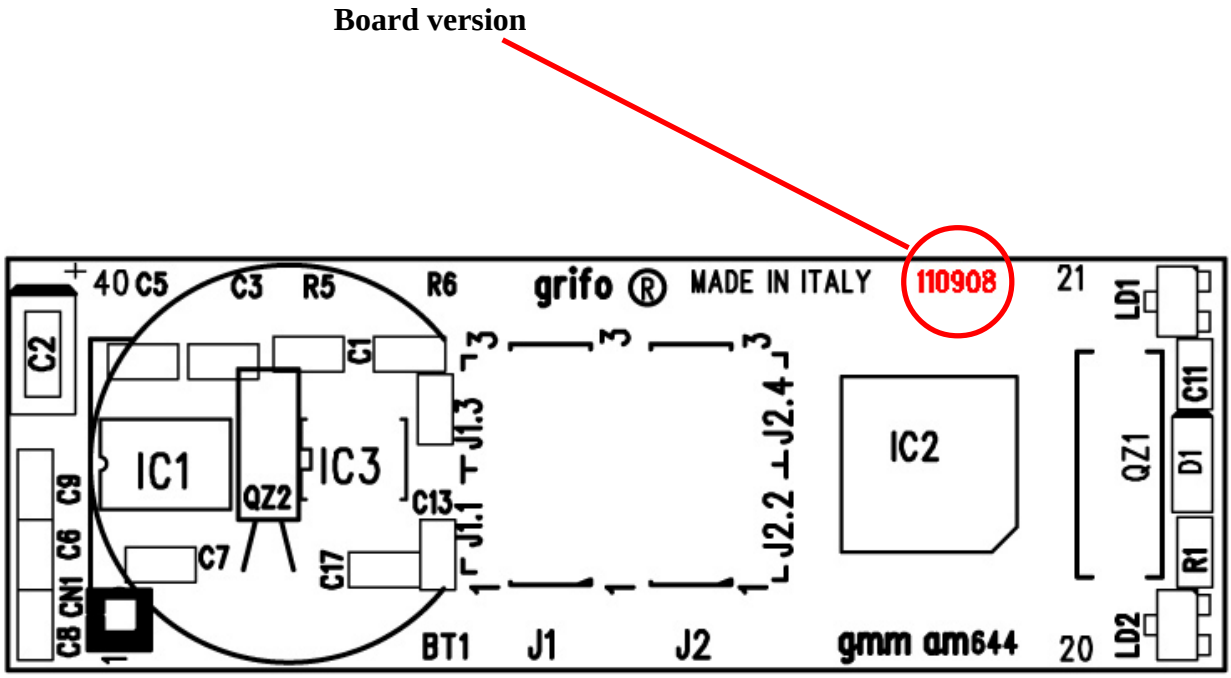


FIGURE 1: LOCATION OF PRINTED CIRCUIT VERSION

GENERAL INFORMATION

GMM AM1284 is a **M**ini **M**odule based on microcontroller **Atmel ATMega1284P**, that is a powerful and complete system on chip provided with **CPU**, internal memories and a rich list of peripherals suitable for typical requirements of automation applications.
The module has already mounted inside its reduced size the components that exploit the main features of microcontroller and allows the use of all the operating modes; furtermore it includes some other components that simplify and increase the application fields.
GMM AM1284 can be used for many installations either in the **industrial**, **domestic**, **automotive** and **didactic** environments, as described in following paragraphs.
The card use is simplified by a wide range of software developement tools based either on low or high level programming languages which allow to work at the best conditions using only a standard PC. Noteworthy among these tools there are the **C**, **PASCAL**, **BASIC** compilers and a graphic programming environment based on logic contact (**LADDER**). Special care has been devoted to the application developing, by selecting tools which allow on board **FLASH** burning with user application program and **remote debug** directly on the card, always with the simple use of a standard PC.
The **GMM AM1284** is equipped with a normalized standard connector that allows immediate mounting on support cards as **GMM TST 3**, **GMB HR168** and **GMB HR246** or mounted directly on a board developed by the user, as a macro component. 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 of **GMM AM1284** are:

- Standard format with **40** pins male socket, Dual In Line, 100 mils pitch, 600 mils width.
- **Very small dimension**: 20.8 x 61.5 x 16.3 mm.
- **4 layers** printed circuit board to obtain best noisy resistance and best **EMI** performances.
- Single power supply required **+5 Vdc** (the current consumption is 17 mA) or 3.0 for 5.0 Vdc the consumption can change in according with themodule connections and status).
- Availability of low consumtion modality as **Idle** and **Power Down Modes**.
- **Atmel ATMega1284P** microcontroller (AVR RISC) with **7.3728 MHz** crystal.
- **128K FLASH** for code, up to **8K FLASH** for **Boot Loader**, **16K** bytes **SRAM** for data, **4K bytes EEPROM** for data, **256 byte** for registers.
- **8K** bytes **FRAM** (non-volatile) for data.
- **8** A/D converter channels with **10** bits resolution, **20 μsec** conversion time.
- Some A/D converter inputs can be **differentiate** with an amplifier to **programmable gain x1, x10, x200**.
- **31** internal and external **interrupt** sources and up to **32 external** interrupt lines.
- **3 Timers Counters** up to 16 bits with compare, capture, frequances generator, PWM functions
- Multifunction **analogic comparator**, with different connection both for inputs and in outputs.
- Reference voltage of A/D section and for analogic comparator selectable by software.
- **Watch dog** section that ensure right work of the controlled system in any operating conditions.
- **32** digital **I/O** lines available on connector. Some of these have multiple functions.
- **2** asynchronous indipendent **serial** line with programmable Baud Rate up to 115200 Baud, at **TTL** level or **RS 232** buffered.

- RS 232 driver with protection against **±15 KV** discharges.
- **Reset** and power supply control circuit.
- Software **I2C BUS** line, available on connector.
- **SPI** interface, available on connector.
- **8** configuration **jumpers**, one of them can be acquired by software.
- **2** status **LEDs** managed by software through I/O lines.
- **Real Time Clock** able to manage day, month, year, or leap years, day of the week, hours, minutes and seconds and to generate pariodical interrupt.
- **RTC** back up with on board **battery**.
- **ISP** interface for direct programming on target circuit.
- **JTAG** interfaces for DEBUG on target circuit.
- Preinstalled **Bootloader** that allow to program FLASH and EEPROM with a PC trough a serial line.
- Internal FLASH and EEPROM can be managed through ISP (**In System Programming**), that is with the module already mounted, by using only the serial communication line using the **ISP** and **JTAG** interfaces.
- Possibility to make debugging the generated code with the JTAG interface, with all the brakpoint functionalities, performing step to step, variables inspection, examination memory zones, peripherals register check and set, etc.
- **Free software** for PC, that supports the ISP programmation of the generated code, inside the on board FLASH.
- Wide range of development tools that requires only a standard PC. Among the most diffused there are: **C** compilers (µC/51, MCC51, HTC51, SYS51CW, DDS Micro C51); **BASIC** compiler (BASCOM 8051); **PASCAL** compiler (SYS51PW); language with **contact logic** (LADDER WORK); etc.
- Long list of demo programs and user examples supplied under source form, duly remarked, 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 sections and verify their connections please refer to figure 2.

CLOCK

On **GMM AM1284** module there are two separate and indipendent circuits based on crystals, that generate the clock signals for the microcontroller and the RTC module.
The first generates a 7,3728 MHz while the second generates a 32768 Hz.
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 please remind that **GMM AM1284** has a RISC microcontroller on board, capable to execute in average one instruction per clock cycle.
So, considering the frequency of quartz installed, execution speed may be greater than 7 MIPS.

SERIAL COMMUNICATION

On **GMM AM1284** there is always availability of two hardware serial lines that are 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 the appendix of this manual.
The serial lines are 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 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 pratical 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, while for details to set for adjust the physical protocol in the register and manage the communication, please see the microcontroller communication in APPENDIX A of this manual.

SPI INTERFACE

Mini Module **grifo®** **GMM AM1284** is provided with a SPI serial inteface featured through a specific hardware section of the microcontroller.
Signals MISO, MOSI, SCK and /SS of SPI interface are available connector CN1 as shown in figure 6.
All interface parameters are managed through microcontroller inernal registers.
For further information please refer to component data sheet or appendix A of this manual.
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, communication peripherals (USB, ETHERNET,...), etc.
All these management parameters are defined setting the internal registers of microcontroller as described in the datasheet of the device or in the APPENDIX A of this manual.

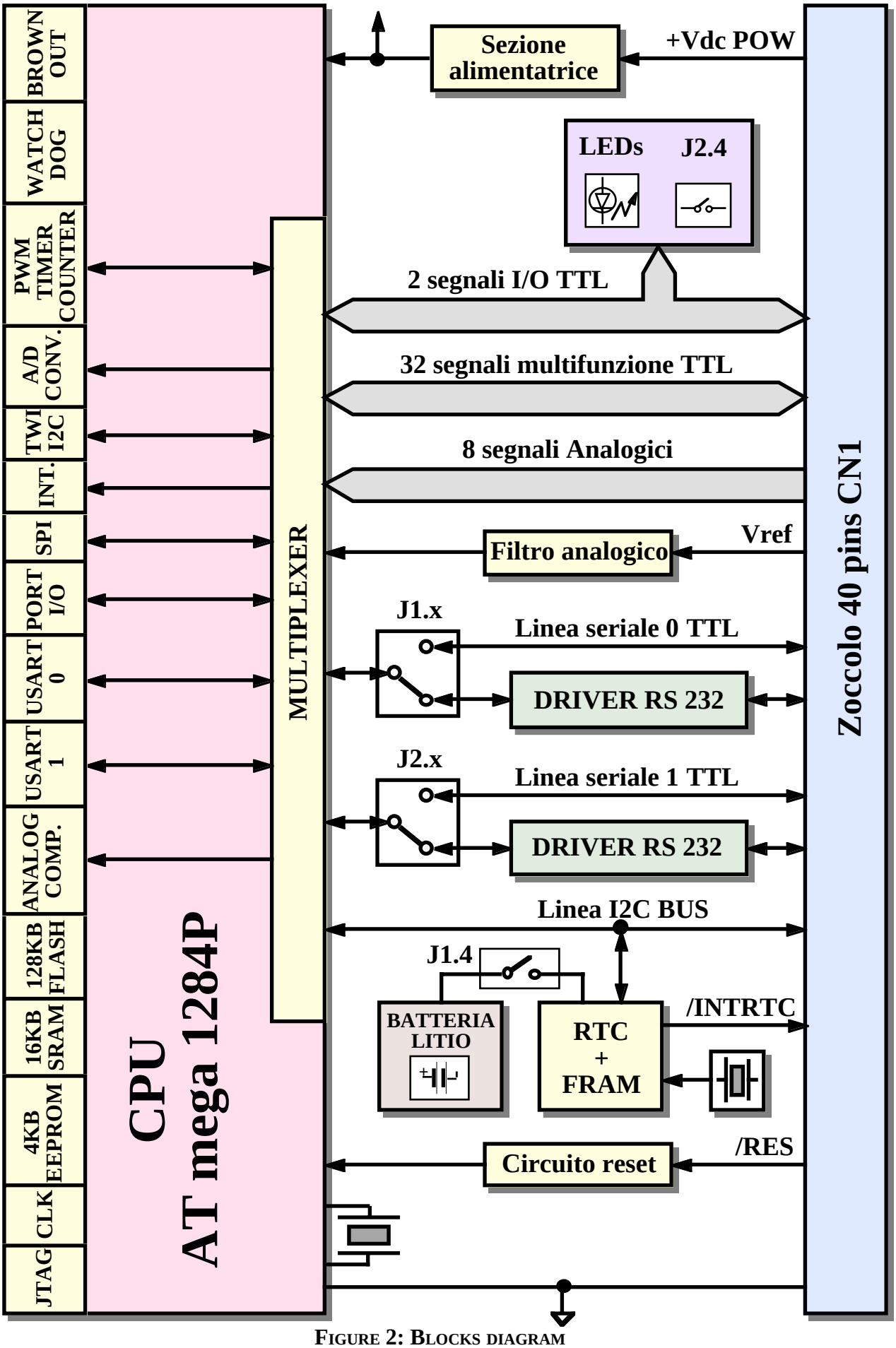


FIGURE 2: BLOCKS DIAGRAM

LINEA I2C BUS

On **GMM AM1284** connector are available the signals of a I2C BUS interface, managed by an hardware peripheral called TWI (Two Wire Interface), that can work both as master and as slave, in reception and transmission. For further information on this peripheral please see the CONNECTIONS and PERIPHERALS DEVICE SOFTWARE DESCRIPTION paragraph.
Thanks to this synchronous interface some devices with the same communication standard can be connected in order to locally enlarge the module possibility.
For this Mini Module, a rich serie of demo programs that explain how to use A/D and D/A converters, memories, temperature sensors, etc. by a complete and well commented code is available.
For these possibility it can be useful to see the **K51-AVR** manual and a complete example series available in various programming languages.
Remarkable is the possibility to connect the **grifo® QTP** operator panels serie through I^2C BUS. **QTP** are capable to manage alphanumeric and graphic display and several models of keyboards, according to the model selected.
Mini Modules support cards manufactured by **grifo®** (like **GMB HR168** and **GAB H844)** are provided also with a connector dedicated to I^2C BUS, to easy the field connections.

DIGITAL I/O TTL LINES

The Mini Module **GMM AM1284** is provided with 32 TTL digital I/O TTL lines, of the microprocessor Atmel ATmega644P, that are all the signals of 8 bit Ports (PA, PB, PC, PD).
For convention all Ports signals are designed with names P0.0÷7, P1.0÷7, P2.0÷7, P3.0÷7 e P4.0÷1.
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, I^2C BUS, SPI, etc.), simply programming some CPU internal registers.
One property that distinguish the **GMM AM644** is the possibily to generate interrupts with all the 32 I/O lines, that allow to realize the application where numerous events have to be simultaneously managed.
For further information please refer to paragraph CONNECTIONS and PERIPHERAL DEVICES SOFTWARE DESCRIPTION.

TIMER COUNTER AND PWM

Microcontroller is provided with three Timer/Counter (two featuring eight bits, one featuring sixteen bits) capable to count clock pulses (through a programmable prescaler), level transictions on specific pins and to generate interrupts and PWM.
With these last things the user can generate up to 6 analog signals, trough a simple integration circuitry, where it can manage motor velocity control and similar.

MEMORIES

The board is formed by a maximum of 78,25K of memory composed by:

- **128K** Bytes di FLASH EPROM;
- **256** Bytes of registers;
- **16K** Bytes of SRAM;
- **4K** Bytes of EEPROM;
- **8K** Bytes of FRAM.

In the space of 64K Bytes of FLASH can be reserved the last section for the Bootloader code, up to 8K Bytes. grifo® privides a proper version that uses the last 2K Bytes only, leaving 126K free.
All memories, except the registers, the FLASH for Bootloader and the lest 8 Bytes of EEPROM, can be used for code and data for user application.
Thanks to on board EEPROM and FRAM there is the possibility to keep data also when power supply is failed.
In this way the card is always able to keep 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 log in 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.

ANALOG LINES

Mini Module **GMM ACB Zero** provides 10 analog lines, 8 of them connected to A/D converter section and 2 to analog comparator of microcontroller. These lines can be connected to external sensors that convert many physical quantities (as temperature, pressure, speed, weight, etc.) or any other system that supplies a compatible voltage signal.
Main features of this section are: resolution 10 bits, 8 indipendent analog inputs, maximum accepted range 0÷5 V, conversion time on a single channel 20 μsec, very easy software management, end of conversion interrupt.
A/D conversions are performed using the successive approximations technique and are made through opportune manipulation of specific microcontroller internal registers.
In order to simplify the A/D converter management, some software packages are provided with specific procedures that manage all details of this section.
The analog comparator can select as input both an internal reference voltage and several pins through an internal multiplexer.
For further information please refer to data sheet of APPENDIX A of this manual or paragraph CONNECTIONS.

WATCHDOG

Microcontroller ATmega12844P includes an hardware Watch Dog capable to reset the CPU if the user program doesn't retrigger it before than the selected intervent time elapses. The main purpose of this section is to supply a real security to the system controlled by Mini Module in order to work correctly in any operating conditions and to avoid dangerous malfunctions not examined during develop phase.
The intervent time rangeof Watch Dog is rather wide, from a minimum of about 16 milliseconds to a maximum of 8 second.
For further information refer to microcontroller data sheet or to APPENDIX A of this manual.

BOARD CONFIGURATION

The **GMM AM1284** is provided with a 8 jumpers that allow to configure the module and its application program. One of these jumpers can be acquired by software and they let the user manages different conditions through a single program, with no renounce to other input lines (the typical applications are: languages selection, definition of program parameters, operating modes selection, etc.). The remaining 7 jumpers configure the Mini Module for hardware point of view, selecting the electric protocol for the asynchronous serial line and the connection og the back up battery.
In addition, the board is also provided with two signalation LEDs; these are software manageable,and can be used to signal the board status and configurations in a visual ways , as described in the specific paragraphs.
All the configuration resources described are completely software manageable by simply using few specific registers of the microcontroller.
For further information refer to paragraphs JUMPERS, VISUAL SIGNALATIONS and VISUALIZATION LEDS.

REAL TIME CLOCK

Mini Module features an on-board Real Time Clock capable to manage hours, minutes, seconds, years, leap years, months, days and weekdays. This section uses quality components and a dedicated quartz in order to obtain a temporization frequency with the minimum possible errors. 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. The used component as RTC is FM3130 of RAMTRON that includes 64K bits of FRAM, that are 8K Bytes already described in the MEMORIES paragraph.
The RTC+FRAM management is possible trough the I2C BUS line of Mini Module depending on the indidation reported in the paragraph of the SOFTWARE DESCRIPTION chapter or APPENDIX A.

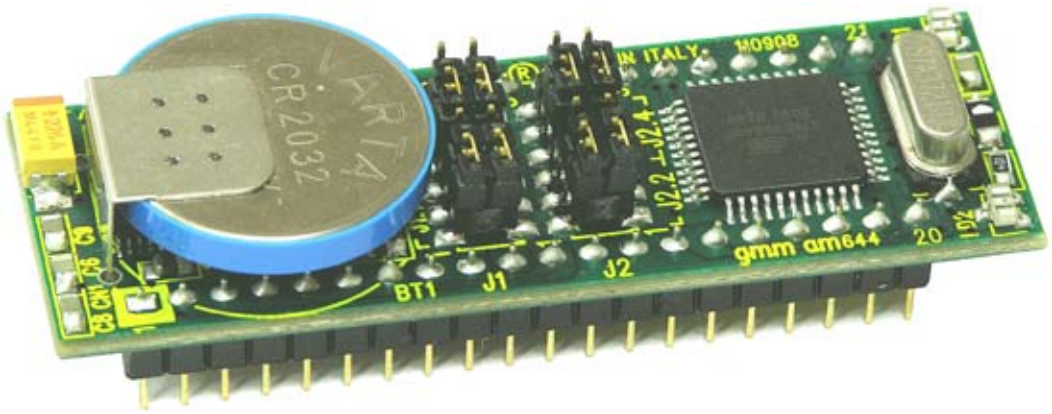


FIGURE 3: GLOBAL VIEW

USING SECTORS

Possible applications of **GMM AM1284** modules are several. The following example can be listed:

- **Smart intelligent nodes** with local functionalities as PID algorithms for controlling temperatures, motors, valves, etc.
- **Decentralized systems** as robots, automation of production line machines, big factory automations, etc.
- **Teleacquisition** and **telecontrol** on medium and low distances.
- Application in **home automation** where it performs tasks like lights turning ON/OFF, heating and cooling systems control, supervision of electric devices, security and acces control systems, gardens sprinkle, etc.
- **Car automations** (automotive) as lights turning ON/OFF, heating and cooling systems control, supervision services for drivers, anti-teft and acces control systems, functionality checks, etc.
- Also the **CAN applications** are possible, but only when the Mini Module is integrated with an external line driver. So it can be used again in automotive applications, in the connection to CAN networks based on propietary protocols or standard protocols as CANopen, DeviceNet, SDS, CAN Kingdom J1939, etc.
- Last but not least, the **didactics** use in fact **GMM AM1284** offers a very low cost system suitable to learn microcontroller with famous 8051 core and to develop the typical start applications for the students. For this purpose it is likewise interesting the **GMM TST3** support cards that solve the problems of power supply, of serial connection to development PC and of module lines connection. In the same support cards there are a matrix keyboard and a LCD display that allow to study and test some low cost user interface solutions.
- All the applications where it is necessary to reduce developing time and price: in fact the module can be mounted directly on the board developed by the user, as a ready to use **macro component**.

TECHNICAL FEATURES

GENERAL FEATURES

Resources:

32 TTL digital I/O lines
2 analog inputs on comparator
8 analog channels A/D converter
3 Timer/Counter for compare, capture, PWM
1 Watch dog section
1 Reset and power supply check circuitry
1 SPI interface
1 I^2C BUS interface
1 ISP interface
1 Real Time Clock section
31 interrupt sources
32 External interrupts
2 asynchronous serial lines RS 232 or TTL
8 configuration jumpers
2 status LEDs
1 Real Time Clock back up with Lithium battery

Memories:

128 KBytes FLASH for code	user program
16 KBytes SRAM for data	user data
4 KBytes EEPROM for data	user data (last 8 Byte reserved)
256 Bytes of registers	microcontroller management
8 KBytes FRAM	user data

CPU: Atmel ATmega1284P

Clock frequency: 7.3728 MHz

A/D converter resolution: 10 bits

A/D conversion time: up to 20 µsec (programmable)

A/D section gain: x1; x10; x200 (programmable)

Power on time: 35 µsec ÷ 67 msec (programmable)
80 msec (with **AVR Bootloader grifo(r)**)

Watch dog intervent time: programmable from about 6 msec to 8 sec

PHYSICAL FEATURES

Size (W x H x D):	20,8 x 61,5 x 16,3 mm	
Weight:	14 g	
Connectors:	CN1: 40 pins male socket, step 100 mils, large 600 mils	
Temperature range:	from 0 to 50 °C	
Relative umidity:	20% up to 90%	(without condense)

ELECTRIC FEATURES

Power supply:	+Vdc POW = +5 Vdc ± 5% from 3 to 5 Vdc		or
Current consumption on +5Vdc:	13 mA 17 mA	* *	(normal) (maximum)
Analog reference voltage:	Vref = external; 1,1 V; 2,56 V; 3,3 V		
External reference voltage:	0 ÷ +Vdc POW		
Analog analog input:	0 ÷ Vref		(programmable)
Analog inputs impedance:	100 MΩ		
Pover supply controller threshold:	1,8 ÷ 4,3 Vdc		(programmable with hysteresis)
RS 232 protection:	±15 KV		
Pull up I2C BUS resistor:	4,7 KΩ		
On board back up battery:	Lithium 3 V; 180 mAh; model CR 2032		
Back up current:	1,0 µA		

* Reported data are referred to a work with 20°C temperature (for further information, plase see the POWER SUPPLY paragraph).

INSTALLATION

In this chapter there are the information for a right installation and correct use of the **GMM AM1284** board. In detail there are the locations and functions of each connector, of the user settable jumpers, LEDs, and so on.

VISUAL SIGNALATIONS

GMM AM1284 features the LEDs described in the following table:

LED	COLOUR	MEANING
LD1	Green	If switch on, shows that the PD6 line (pin 36 of Mini Module) is at low level (zero volt)
LD2	Red	If switch on, shows that the PD7 line (pin 37 of Mini Module) is at low level (zero volt) or J2.4 is in position 1-2

FIGURE 4: 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 12. while for further information please refer to paragraph VISUALIZATION LEDS.

POWER SUPPLY

Mini Module nust be supplied with a stabilized +5 Vdc ± 5% voltage connected to proper pins 20 and 34 of CN1. Otherwise the power supply, defined +Vdc POW, can change in the range from 3,0 to 5,0 Vdc or assume other high values up to +20 Vdc. These voltages are not described in in this manual but they can be reach directly from grifo®.
On the board all the circuits and components have been chosen in order to obtain the best noisy immunity and the lowest consumption, including the possibility to use some different low power modalities; this feature is really important when the module is supplied by batteries for example in portable applications. In details it can be set the power down and the idle modes plus the machine cycle speed of the microcontroller, through some proper internal registers. The user application program can reduce supply consumption and eventually restore the normal working mode when a specific event occours, like an interrupt, a variation on an analog or digital input, a timeout, etc.
For further information please refer to paragraph ELECTRIC FEATURES.

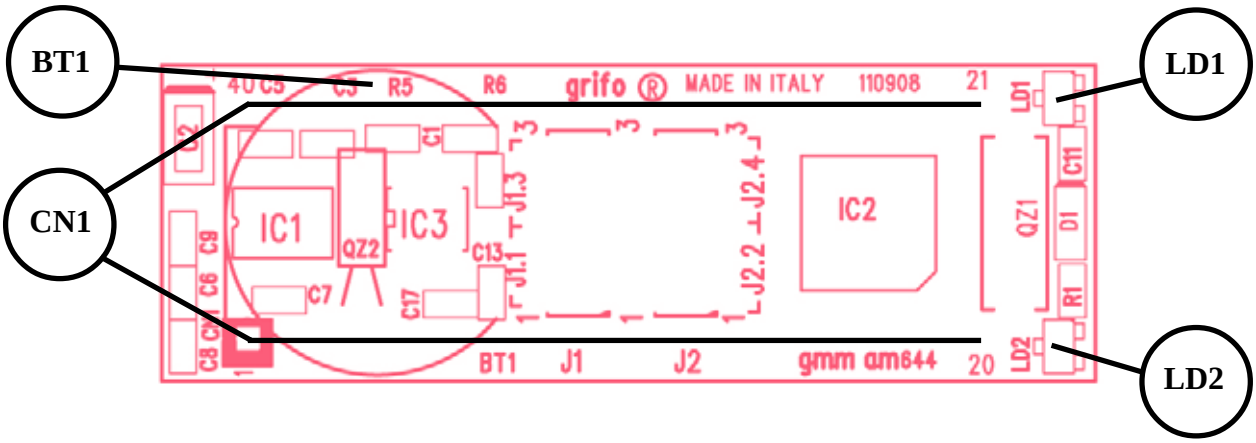


FIGURE 5: LEDS, CONNECTORS, BATTERY LOCATION

CONNECTIONS

The **GMM AM1284** module has 1 connector that can be linked 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 5) that simplify and speed the installation phase.
Some additional figures shows the pins functionalities and some of the most frequently used connections.
All the connectors of **grifo®** cards follows standard pin outs in order to obtain a modular electronics where each cards can be changed with many others, of the same or different type. This reduces times and costs when modules become obsolete or insufficient for the application requirements.

CN1 - CONNECTOR WITH MINI MODULE SIGNALS

CN1 is a 40 pins, male, dual in line, socket connector with 100 mils pitch and 600 mils width.
On this connector are available all the interfacement signals of the Mini Module as the power supply, the I/O lines, the asynchronous and synchronous communication lines, the on board peripheral devices signals, the expansion signals, analog signals, etc.
Many pins of the connector have multiple functions in fact, by software, some internal sections of microcontroller can be multiplexed with I/O signals and the following figure list all these possible functionalities. So the signals available on CN1 have different characteristics, as described in the following CONNECTOR SIGNALS INTERFACEMENT paragraph, and they follow **grifo®** Mini Module standard pin out.
In order to avoid problems on pin counting and numbers the figure 6 shows the signals directly on the top view of the **GMM AM1284**; moreover the serigraph reports the pins number on the four corners of the card both on bottom and top side.

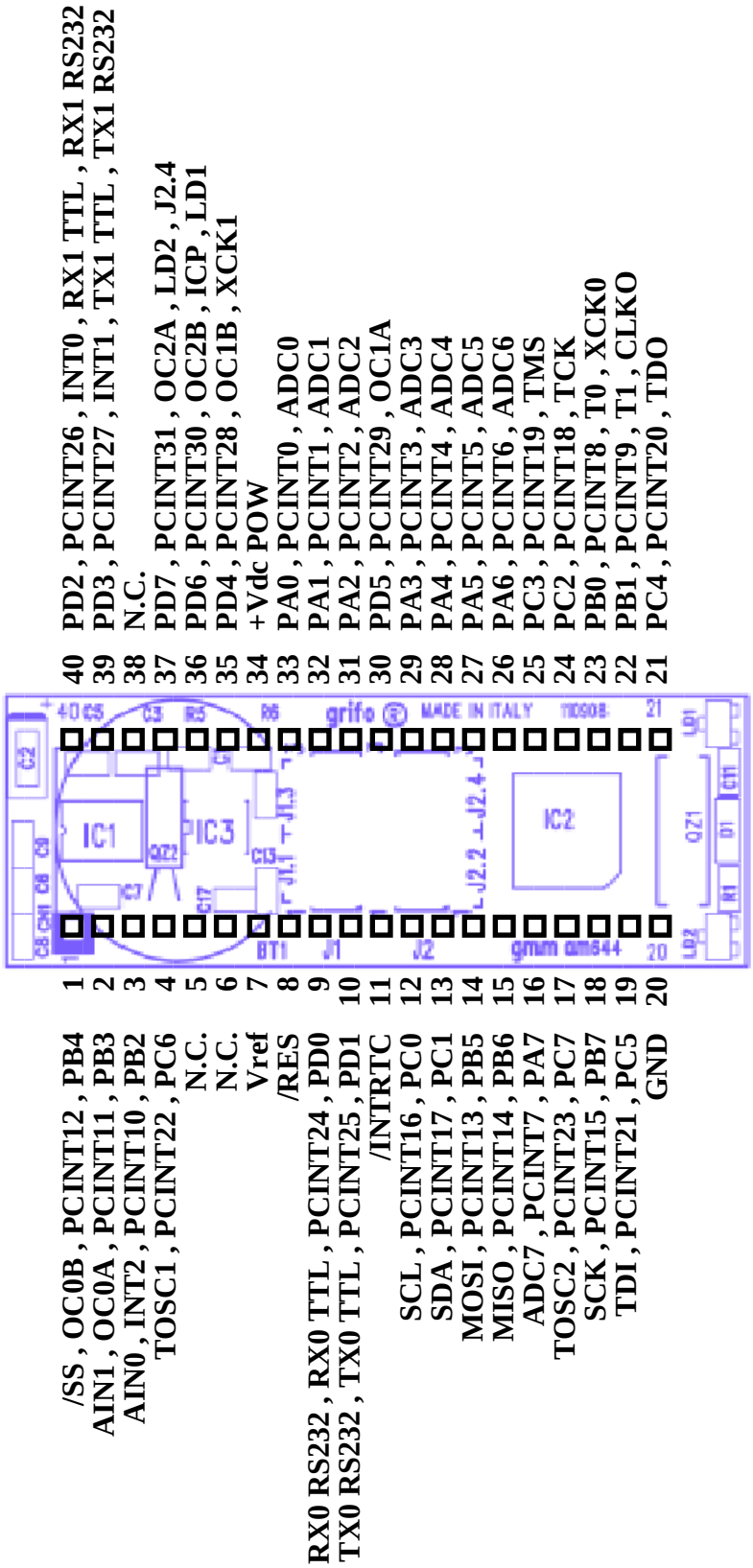


FIGURE 6: CN1 - SOCKET WITH MINI MODULE SIGNALS

Legend:

RX0 RS232	= I	- Receive serial line buffered in RS 232 (USART0)
TX0 RS232	= O	- Transmit serial line buffered in RS 232 (USART0)
RX0 TTL	= I	- Receive TTL serial line (USART0)
TX0 TTL	= O	- Transmit TTL serial line (USART0)
RX1 RS232	= I	- Receive serial line buffered in RS 232 (USART1)
TX1 RS232	= O	- Transmit serial line buffered in RS 232 (USART1)
RX1 TTL	= I	- Receive TTL serial line (USART1)
TX1 TTL	= O	- Transmit TTL serial line (USART1)
XCK.n	= I/O	- Clock signal n of signal n (USARTn)
PAn	= I/O	- Signal n of the Port A of digital I/O of microcontroller
PBn	= I/O	- Signal n of the Port B of digital I/O of microcontroller
PCn	= I/O	- Signal n of the Port C of digital I/O of microcontroller
PDn	= I/O	- Signal n of the Port D of digital I/O of microcontroller
LDn	= O	- Signal connected to visualization LED LDn
INTn	= I	- Interrupt lines n of microcontroller
Tn	= I	- Signal connected to section Timern of microcontroller
/RES	= I	- Reset signal
PCINTn	= I	- External interrupt signal n of microcontroller
SCL	= I/O	- Clock lines of software I2C BUS interface
SDA	= I/O	- Data lines of software I2C BUS interface
/SS	= I/O	- Unity selection for SPI mode signal
MOSI	= I/O	- ISP and SPI communication signal
MISO	= I/O	- ISP and SPI communication signal
SCK	= I/O	- Clock signal for ISP and SPI interfaces
Vref	= I	- A/D converter reference voltage
ADCn	= I	- Analog inputs connected to A/D converter section
AINn	= I	- Analog inputs connected to comparator section
TOSC1	= I	- Input signal for external oscillator connected to Timer 2
TOSC2	= O	- Output signal for external oscillator connected to Timer 2
OCnA	= O	- Signal connect to A section of comparation and capture of Timer n
OCnB	= O	- Signal connect to B section of comparation and capture of Timer n
TD1	= I	- Data reception signal for JTAG inteface
TD0	= O	- Data transmission signal for JTAG interface
TCK	= I	- Clock and synchro signal for JTAG interface
TMS	= I	- Control signal for JTAG interface
CLKO	= O	- Microcontroller clock
ICP	= I	- Input for event capture of Timer 1
J2.4	= I	- Signal connected to configuration jumper J2.4
An	= O	- High addresses signals of expansion BUS
+Vdc POW	= I	- Power supply voltage
GND	=	- Ground
N.C.	=	- Not connected

CONNECTOR SIGNALS INTERFACEMENT

To prevent possible connecting problems between **GMM AM1284** 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 state 0, while the +Vdc POW level corrisponds 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 preferible to adopt opto coupled interfaces that ensure an electric insulation between Mini Module electronic and external noisy, typically generated by power electronic.

- The Vref voltage has to be connected to a low impedance in the range1,0÷3,3 V, perfectly filtered and solid.

- 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 Timer Counter and OCM 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. On Mini Module, signals SDA and SCL are pulled-up to +Vdc POW through 4.7 kΩ resistors.

- SPI signals are TTLlevel , as defined from the same standard;this interface too, we remind that if you wanto to realize with a network, several devices with a certain length, you have to create with more attention the output field, several operative modalities and the bit rate in order to communicate in every condition of work.

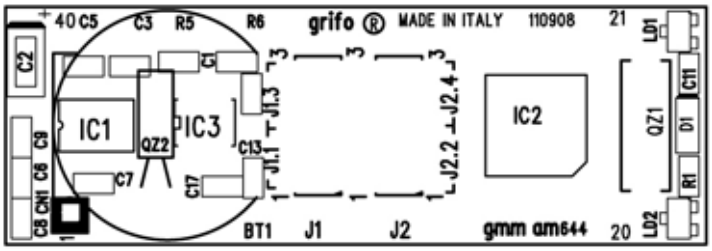


FIGURE 7: COMPONENTS (TOP VIEW)

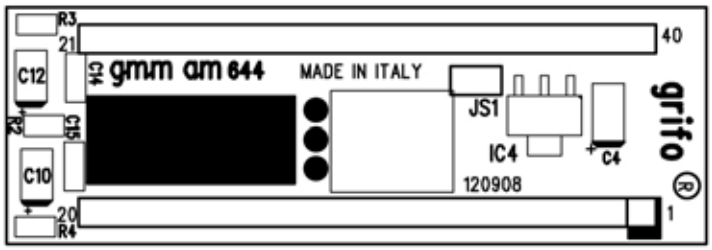


FIGURE 8: COMPONENTS MAP (BOTTOM VIEW)

JUMPERS

On **GMM AM1284** there are 8 jumpers for board configuration.
Here below is the jumpers list, number of ways and function:

DEVICE	CONFIG.	FUNCTION
J1.1 J1.2 J1.3	2-3	Configure the serial line 0 on CN1,for the electrical standard RS 232
J1.4	2-3	Not connect the lithium battery to back up circuitry of Real Time Clock.
J2.1 J2.2 J2.3	2-3	Configure the serial line 1 on CN1, for the electrical standard RS 232
J2.4	2-3	Not connect the pin 37 of the Mini Module leaving the PD7 of microcontroller, and LD2, user manageable
JS1	Not connected	Private use
FLASH for Boot Loader	Firmware AVR Bootloader grifo(r)	At the beginning allow to communicate with a PC that run the proper AVR Bootloader grifo(r) to manage ISP programming of memories FLASH and EEPROM.
FLASH for user	Demo program	Perform the blinking of LEDs and communicate with a console on RS 232 serial set to 19200 Baud, 8 bit x chr, None parity, 1 Stop bit, None handshake
EEPROM	Calibration data	The last 8 byte of this memory are reserved for all calibration data and they can't be changed. Both the program application program and the ISP management have to save these bytes for the a good yield of the Mini Module
FRAM	None data	None FRAM location is non-volatile is used for paticular functiones and is all available for user
RTC	None data	The date, the time and the calibration of the Real Time Clock are not set

FIGURE 9: JUMPERS SUMMARIZING TABLE (1 OF 2)

JUMPER	POSITION	USE	DEF.
J2.3	1-2	Not connect the reception signal of serial line 1 of microcontroller to RS 232 driver. Used in according with jumpers J2.1 and J2.2.	
	2-3	Connects the reception signal of serial line 1 of microcontroller to RS 232 driver. Used in according with jumpers J2.1 and J2.2.	*
J2.4	1-2	Connects the pin 37 of the Mini Modulo to ground. This condition makes to logic level 0 the PD7signal of microcontroller, as configuration input that you can get it via software. Moreover it switch on the LD2 LD2.	
	2-3	Not connect the pin 37 of Mini Module leaving the PD7 signal of microcontrollr and the LD2 LED, manageable by user.	*
JS1	Not connected	Private use.	*

FIGURE 10: JUMPERS SUMMARIZING TABLE (2 OF 2)

The following tables describe all the right connections of **GMM AM1284** jumpers with their relative functions.
To recognize these valid connections, please refer to the board printed diagram (serigraph) or to figures 10 of this manual, where the pins numeration is listed; for recognizing jumpers location.
The "*" denotes the default connection, or on the other hand the connection set up at the end of testing phase, that is the configuration the user receives.

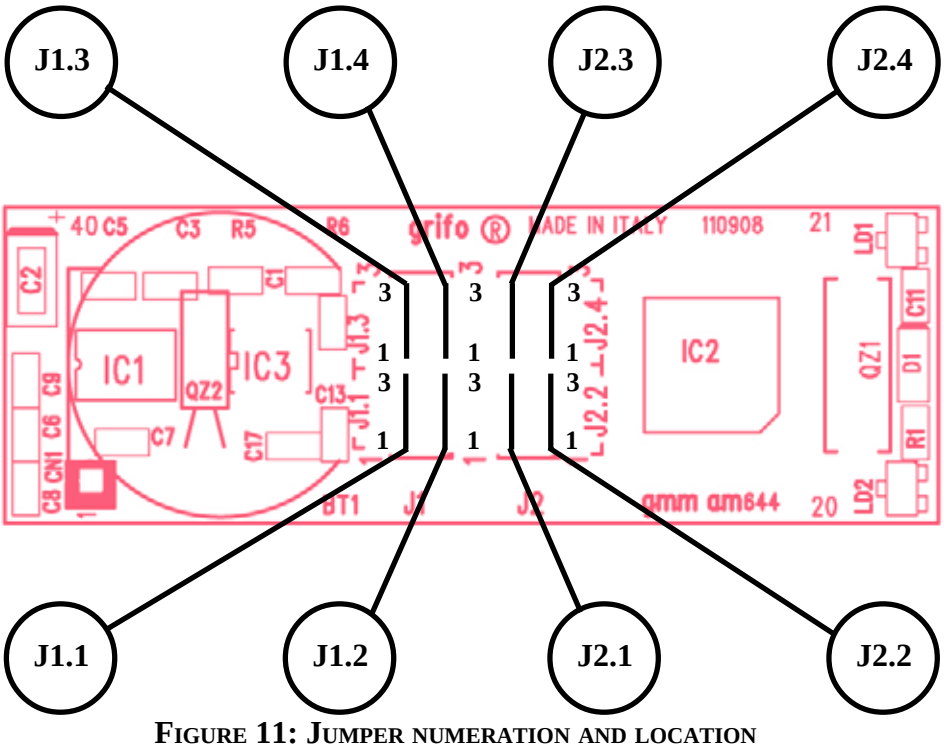


FIGURE 11: JUMPER NUMERATION AND LOCATION

SERIAL COMMUNICATION SELECTION

Asynchronous serial line of **GMM AM1284** can be buffered in RS 232 or TTL. In case it is buffered in RS 232, the line signals are protected against discharges up to ±15 KV.
By hardware can be selected which one of the electric protocols is used, through jumpers configuration, as described in the previous tables; the user can select autonomously one or the other type by following the information listed below.

- SERIAL LINE 0 (USART0) SET IN RS 232 (default configuration)

J1.1 = 2-3
J1.2 = 2-3
J1.3 = 2-3

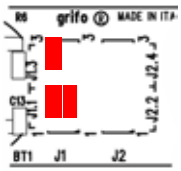


FIGURE 12: SERIAL 0 IN RS 232 CONFIGURATION

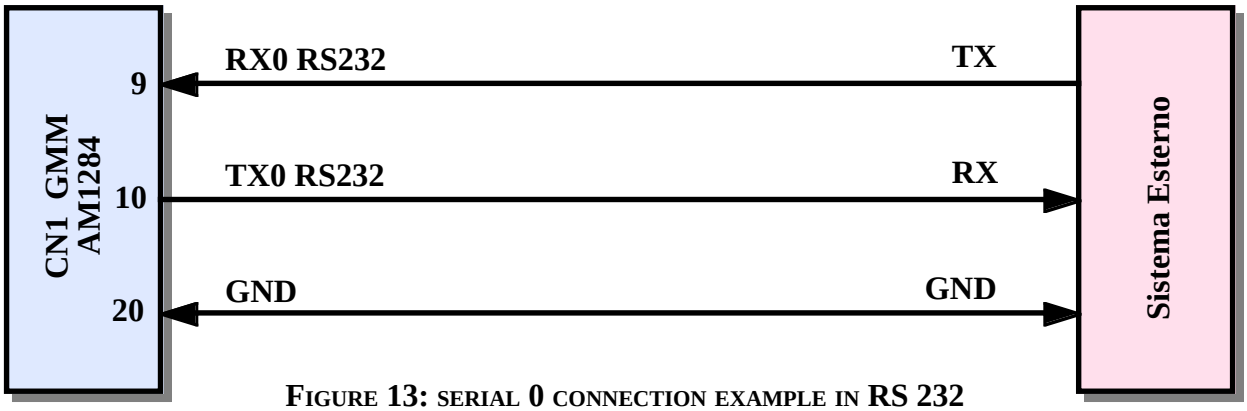


FIGURE 13: SERIAL 0 CONNECTION EXAMPLE IN RS 232

- SERIAL LINE 0 (USART0) SET IN TTL

J1.1 = 1-2
J1.2 = 1-2
J1.3 = 1-2

FIGURE 14: SERIAL 0 IN TTL CONFIGURATION

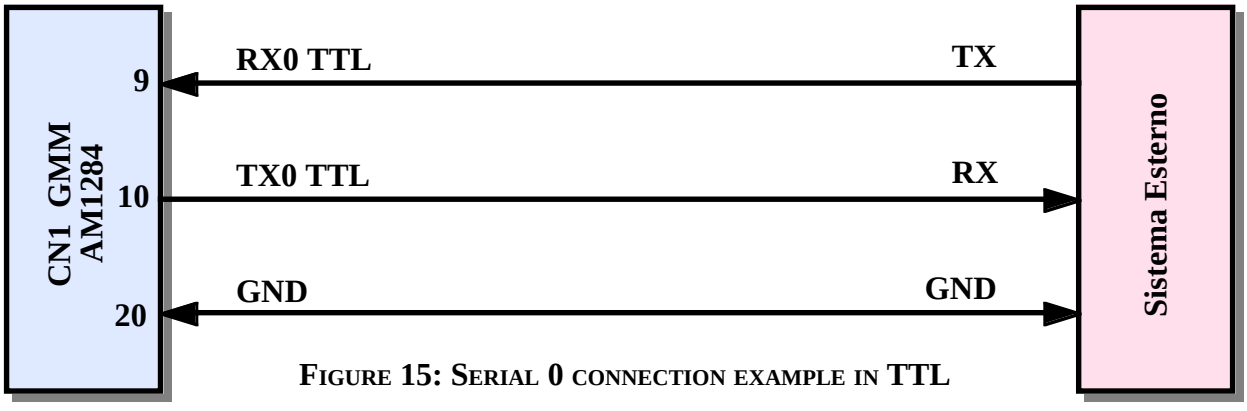


FIGURE 15: SERIAL 0 CONNECTION EXAMPLE IN TTL

- SERIAL LINE 1 (USART1) SET IN RS 232 (default configuration)

J2.1 = 2-3
J2.2 = 2-3
J2.3 = 2-3

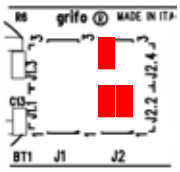


FIGURE 16: SERIAL 1 IN RS 232 CONFIGURATION

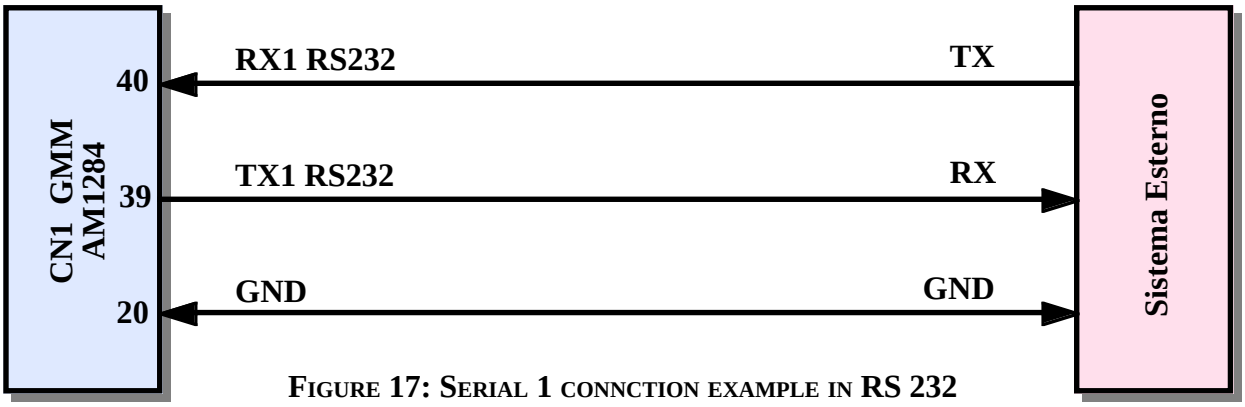


FIGURE 17: SERIAL 1 CONNCTION EXAMPLE IN RS 232

- SERIAL LINE 1 (USART1) SET IN TTL

J2.1 = 1-2
J2.2 = 1-2
J2.3 = 1-2

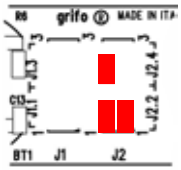


FIGURE 18: SERIAL 1 IN TTL CONFIGURATION

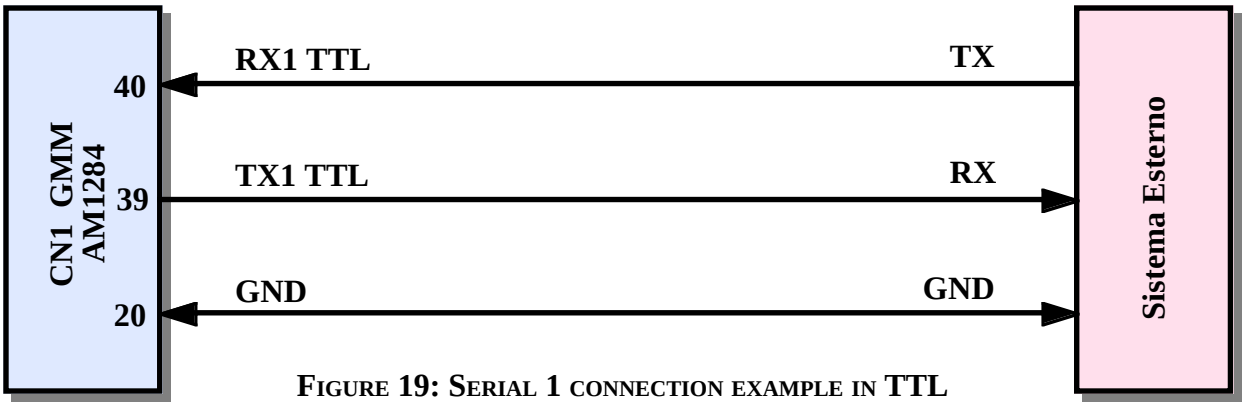


FIGURE 19: SERIAL 1 CONNECTION EXAMPLE IN TTL

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 defined by setting proper microprocessor's internal registers. Each serial interface (called USART0 and USART1) has an indipendent group of registers for programming and can work individually respect to the other.
The two protocols RS 232 and TTL are electrically compatible and user before to connect the synchronous serials to external system, has to verify the serial interface present on the the system and configure the jumpers properly. The RS 232 connection to **GMM AM 1284** configured in TTL mode can damage the line too.

BACK UP

GMM AM1284 is provided with a on board Lithium battery, named BT1, that keeps the Real Time Clock counting, also when power supply is switched off. Jumper J1.4 connects (1-2 position) or disconnects (2-3 position) the battery to preserve its duration whenever the card is not used or when back up is not required.
All the techical features of the back up circuit (useful also for selection of the external battery), are reported in ELECTRIC FEATURES paragraph; while the circuit components locations are described on figure 5 and 11.

I2C BUS LINES CONNECTION

On CN1 connecton I2C BUS synchronous communication lines are available, managed from TWI hardware peripheral (Two Wire Inteface) that can be connected to other devices with the same standard.
Following figures show some connection modalities and say that **GMM AM1284** can work both as master and as slave I2C BUS.
Some support boards produced by **grifo®** (as **GMB HRxxx** and **GAB H844**) are provided of a connector dedicated to I2C BUS too, in order to make easy connection with field.

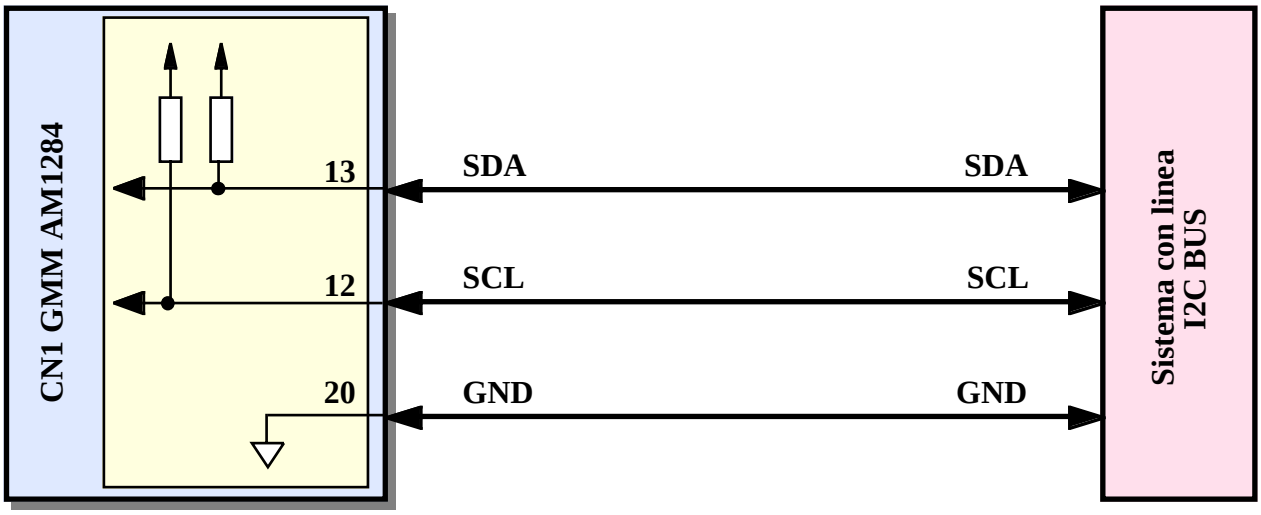


FIGURE 20: I2C BUS POINT TO POINT CONNECTION EXAMPLE

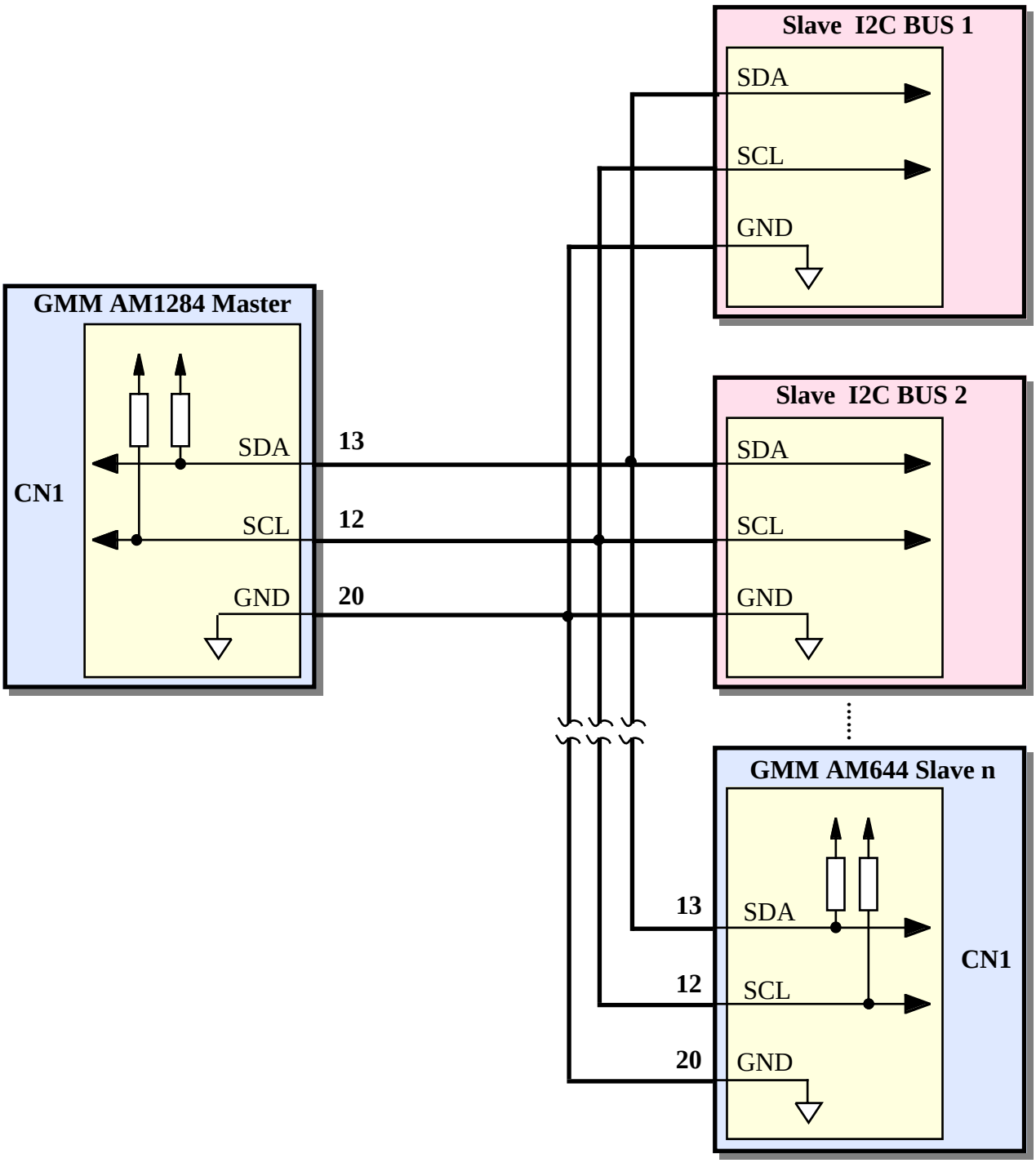


FIGURE 21: I2C BUS NETWORK CONNECTION EXAMPLE

Please remind that in a I2C BUS network must be connected two pull up resistors at the net extrems, respectevely near the master unit and the slave unit at the greatest distance from the master.
On **GMM AM1284** these resistors are always present, they have 4,7 KΩ value and are connected to pover supply of microcontroller at 3,3 Vdc, as described in ELECTRIC FEATURES paragraph.
The user must select or configure the I2C BUS devices to connect, by taking care of this feature.
For further information please refer to document "*THE I2C-BUS SPECIFICATIONS*", from PHILIPS semiconductors.

RESET, POWER SUPPLY CONTROL, WATCHDOG

On **GMM AM1284** are available three different reset sources, that can be so summarized:

1) Power supply control circuitry that enables the reset when the power supply voltage decreases down to the preselected threshold. This circuitry integrated in the microcontroller are called Brown-out Detector.

2) Signal connected to pin 8 of CN1, active low, that can be connected to a simple normally open push button; once the button is pressed it must short circuit the /RES signal to ground GND and consequently the reset is enabled. The main purpose of this signal is the forced exit from endless loop, especially during the debug phase, or the re-execution of the application program with no interruptions on the power supply of the card.

3) Watch Dog circuitry, inside the microcontroller, that is really efficient and easy to use by software. In details the main features of this circuit are the following ones:
   - astable functionality;
   - intervent time programmable by software from about 6 msec to about 1700 msec;
   - software enable through a double consecutive write operation on management registers;
   - software retrigger.

   In astable mode when intervent time is elapsed the circuit becomes active, it stays active for a short reset time and after it is deactivated. The main purpose of this section is to supply a real security about right execution of application program by the card. In fact when the program is no more executed correctly, it doesn't perform the periodic retrigger operation of the circuit and the card will be reset at the end of intervent time. For further information about Watch Dog section and retrigger operation, please refer to the microcontroller data sheet or APPENDIX A of this manual.

For the first two sources, the reset circuit stays enabled for the reset time (about 200 msec) and then it is disabled, while for the third source it is enabled only for few µsec. At this point all the sections of the card are reset, in order to warrant a complete reset status, and it resumes execution of the program stored on FLASH, at the address 0000H.
The reset circuit with these features ensures the right functionality of the card and of all the possible connected electronics, in each working condition and especially during the dangerous and difficult phases of power on and power off.

INTERRUPTS

A remarkable feature of **GMM AM1284** card is the powerful interrupt management.
Here follows a short description of which devices can geneate interrupts and their modalities; for further information about interrputs management please refer to the microprocessor data sheet or APPENDIX A of this manual.

- Pin 40 of CN1 -> Generates an interrupt INT0 of microprocessor.
- Pin 39 of CN1 -> Generates an interrupt INT1 of microprocessor.
- Pin 3 of CN1 -> Generates an interrupt INT2 of microprocessor.

Pin 1÷4, 9, 10, 12÷19, 21÷33,

35÷37, 39, 40 of CN1	->	Generates a PCINTn on microcontroller, with possibility to define masks, activation levels or fronts, and to be activared by on output signals (software interrupt).
- Pin 11 of CN1	->	It is generated by RTC and can generates periodical or preimposted interrupt. It can be got from microcontroller or has to be connected at one of available inputs on CN1, with a pull up resistor (i.e. 10 KΩ).
- CPU peripherals	->	Generate an internal interrupt. In detail the possible microcontroller interrupt sources are: Timer Counter, OCM, USART0, USART1, analog comparators, A/D converter, I^2C BUS, SPI, EEPROM.

An interrupt management section, integrated in microcontroller, allows to enable, disable and mask, so the user has the possibility to respond promptly and efficently to any external event.
The microcontroller has an interrupt section that let the user manage the 35 interrupt sources. So the application program has always the possibility to react promptly to every event.

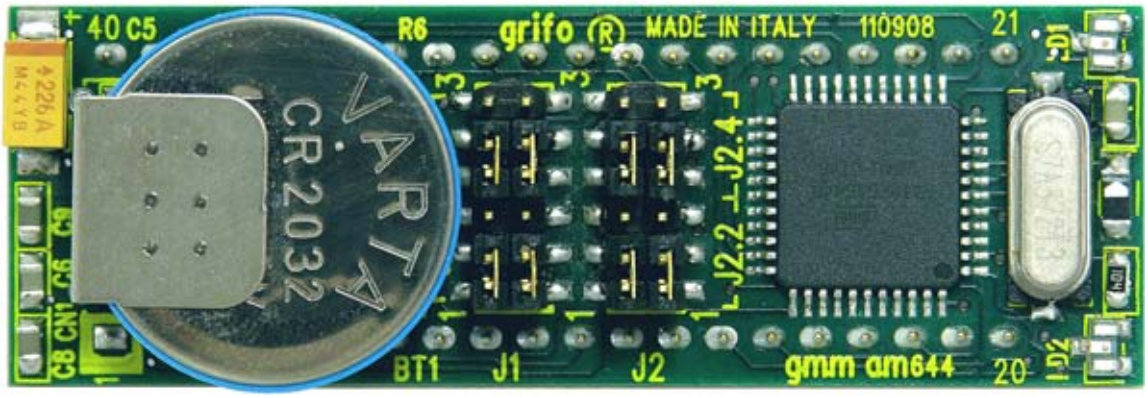


FIGURE 22: TOP VIEW

SUPPORT BOARDS

GMM AM1284 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.
For the first purchase are provided a rich serie of demo programs that allow to use both the Mini Module resources and those one of the support boards, immediately.

USING 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.
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 boards.

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 MOD II 8 pins connector;

- to buffer easily TTL UART0 signals from microprocessor in RS 422, RS 485 or current loop;

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

- to provide the reference voltage to A/D and connect the analog input;

- to wire all signals through a quick release screw connectors and standard connectors;

- to perform a mechanical mountind on omega rail.

FIGURE 23: GMB HR168 + GMM AM1284 COUPLE

The follow configuration allows to use the **GMB HR168** + **GMM AM1284** couple, with serial line in RS 232 and connected battery:

GMM AM1284 *configuration*		
J1.1	=	2-3
J1.2	=	2-3
J1.3	=	2-3
J1.4	=	1-2
J2.1	=	2-3
J2.2	=	2-3
J2.3	=	2-3
J2.4	=	2-3

GMB HR168 *configuration*		
J1 , J2	=	2-3
J3 , J4	=	not connected
J5	=	2-3
J6 , J7 , J8	=	2-3
J9	=	not connected
J10	=	1-2 , 4-5
J11	=	1-2
J12	=	not connected
J13 , J19 , J20	=	not connected
J14	=	1-2
J15	=	1-2
J16	=	2-3
J17	=	2-3
J18	=	2-3

Serial connection cable for development PC = **AMP8 Cable** with D9 type Female.

USING WITH GAB H844 MODULE

Among grifo® cards, **GAB H844** 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.
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.

GAB H844 allows easily to:

- to supply the Mini Module through on board power supply;

- to have four 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 have eight analog inputs and other eight signal that arrive from the field, through precision circuits. Thanks to these circuits, typical industrial sector signals (0÷20 mA, 4÷20 mA; 0÷10 V, etc) can be acquired.

- 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 MOD II 8 pins connector;

- to buffer easily TTL UART0 signals from microprocessor in RS 422, RS 485 or current loop;

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

- to provide the reference voltage to A/D and connect the analog input;

- to wire all signals through a quick release screw connectors and standard connectors;

- to perform a mechanical mounting on omega rail.

FIGURE 24: GAB H844 + GMM AM1284 COUPLE

The following configuration allows to use the **GAB H844** + **GMM AM1284** couple, with serial line in RS 232, battery connected to 8 analog inputs in the range 0÷Vref Mini Module:

GMM AM1284 *configuration*		
J1.1	=	2-3
J1.2	=	2-3
J1.3	=	2-3
J1.4	=	1-2
J2.1	=	2-3
J2.2	=	2-3
J2.3	=	2-3
J2.4	=	2-3

GAB H844 *configuration*		
J1 , J9	=	not connected
J2, J3 , J4	=	2-3
J5	=	2-3
J8	=	not connected
J10	=	2-3
J11	=	not connected
J13, J14	=	1-2
J15÷J29 odd	=	1-2
J16÷J30 even	=	1-2
J31÷J34	=	1-2
J35÷J38	=	1-2
JS1	=	connected

Serial connection cable for development PC = **AMP8 Cable** with D9 type Female.

USE WITH GMM TST3 MODULE

Among grifo® cards, **GMM TST3** is the one designed specifically to provide a first entry point to 28 and 40 pins Mini Modules, with suitable evaluation purposes. The complete description of the product is available in the relative data sheet and technical manual, is electric diagram is in appendix B of this manual. In this paragraph are listed the advantages obtained by using this pair of cards. The **GMM TST3** allows easily to:

- supply the Mini Module through on board AC, DC power supply;

- connect all the I/O signals of microcontroller ports on comfortable connectors compatible with **I/O ABACO®** standard pin out;

- have the analog lines of A/D converteron low profile connectors compatible with the **I/O ABACO®** standard, easy to connect to external sensors;

- connect immediately seial lines RS 232 through a comfortable 9 pins D type connector;

- set and show the status of 2 microcontroller I/O lines through push button and LEDs with different colours;

- generate audible feed back thanks to active buzzer mounted on board;

- supply the reference voltage for the A/D section;

- reset the installed Mini Module through the comfortable reset button;

- develop in a short time user interface applications by using the on board matrix keyboard with 4x4=16 keys and the backlite LCD display with 2 rows of 20 characters;

- develop easily a support card that satisfy customer requirements starting from the supplied electric diagrams;

- manage the Mini Module programming through external ISP programmers. ISP interface signals are reported on a compatible connector with the **AVR ISP mkII** of **ATMEL**, and the APPENDIX D describes several other possibility.

- manage the ISP Mini Module, through a simple serial RS 232 interface of a PC anf the management software **PonyProg** of **LANCOS**.

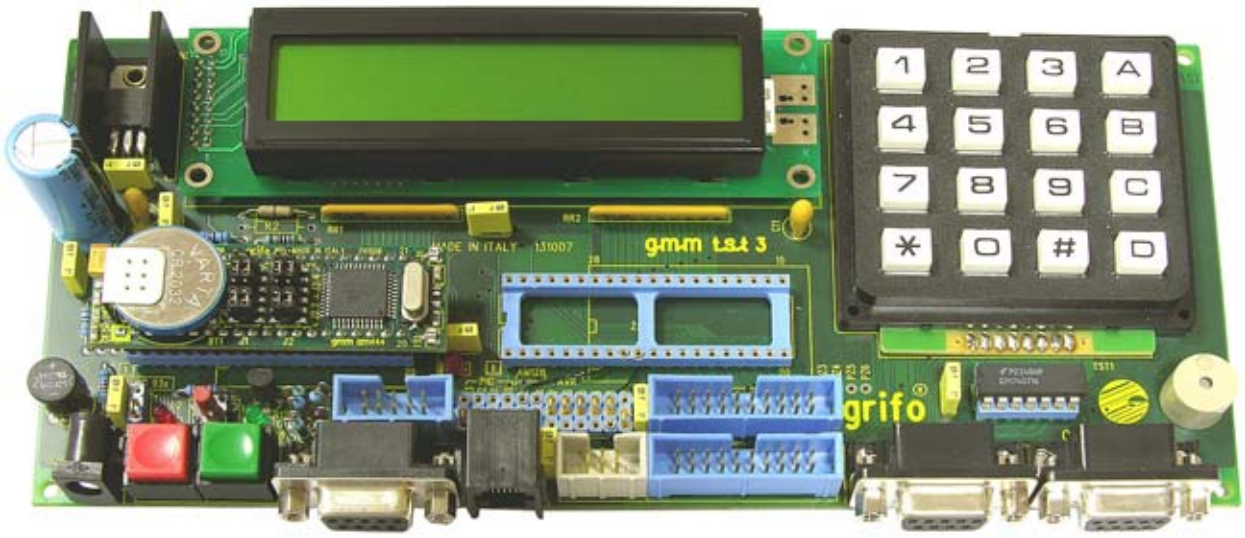


FIGURE 25: GMM TST3+GMM AM1284 COUPLE

The following configuration is suggested to use the couple **GMM TST3** + **GMM AM1284** in their base version, that is RUN mode with serial line buffered in RS 232:

***GMM AM1284** configuration*

J1.1	=	2-3
J1.2	=	2-3
J1.3	=	2-3
J1.4	=	1-2
J2.1	=	2-3
J2.2	=	2-3
J2.3	=	2-3
J2.4	=	2-3

***GMM TST 3** configuration*

J1	=	not connected
J2	=	1-2
J3	=	1-2
J4	=	2-3
J5	=	2-3
J6	=	2-3
J7	=	2-3
J8	=	2-3
J9	=	2-3
J10	=	1-2
J11	=	1-2
J12	=	1-2
J13	=	1-2

Serial connection cable for development PC = **CCR 9+9E** (that is a cable D9 type Female and D9 Male).

HOW TO START

In this chapter are listed the operations that must be performed to start using the **GMM GMM1284** in a pratical and fast way, solving the typical beginners problems.
The chapter includes some common sections and other parts that are different according with used development environment; all these paragraphs contains interesting information even for the users that already know the product, in fact there is the description of a fast and complete functional test. Moreover it is supposed that the user already have the accessories (power supplier and serial connection cable) and a PC provided of the necessary features in order to execute the programs described in the following points. This PC is identified with the name development PC and its minimum requirements are listed in the documentation of the used programs.

A) CONNECTIONS ARRANGEMENT

A1) Perform the serial connection between Mini Module **GMM AM1284** and development PC or on the other hand connect the two communication signals (TX RS232, RX RS232) and the reference ground signal (GND), to a free COMx serial port of PC. Obviously this connection changes according with possible support card used but generally it is described by following figure.

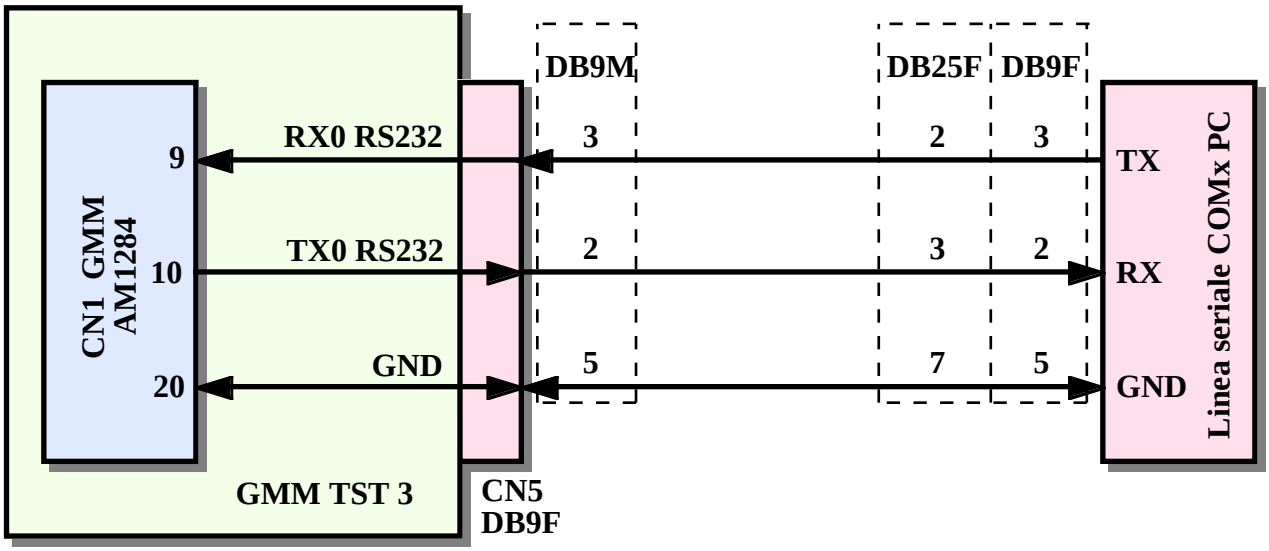


FIGURE 26: RS 232 SERIAL 0 CONNECTION BETWEEN GMM AM1284 AND PC

On figure 26 it can be easily discovered that the connection cable with **GMM TST 3 + GMM AM1284** is a normal serial extension cable (as those used for example for RS 232 modems) and it can be also ordered to **grifo®** with the code **CCR 9+9E**.

A2) Provide a suitable power supply: when the Mini Module is used alone this voltage must be applied as described in POWER SUPPLY paragraph, for example by using a laboratory bench model. Viceversa when a couple is used it can be used many different power sources, as described in technical manual of the support card where Mini Module is installed.

A3) If the user wants to use the second serial line of **GMM AM1284**, can connect it at this point. This connection is not necessary for the first use but the connection example is the same reported between serial line 1 and a PC. It needs two communication signals (TX RS232, RX RS232) and the reference ground signal (GND), to a free COMx serial port of PC. Obviously this connection changes according with possible support card used but generally it is described by following figure.

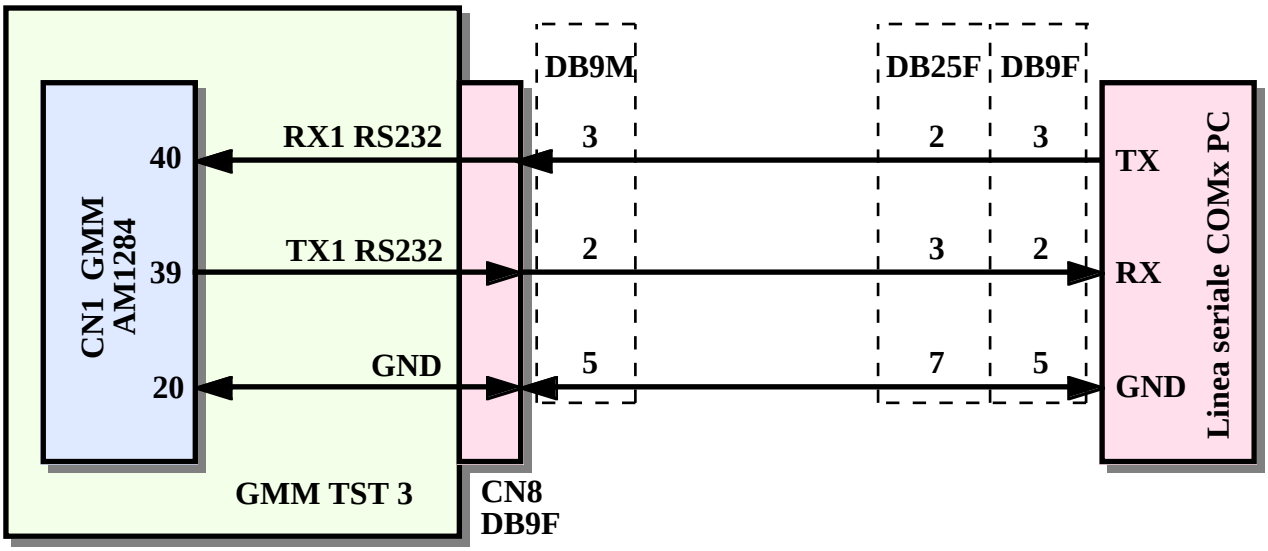


FIGURE 27: RS 232 SERIAL 1 CONNECTION BETWEEN GMM AM1284 AND PC

B) TEST OF DEMO PROGRAM SAVED ON MINI MODULE

B1) Found the **HYPERTERMINAL** communication program on the development PC, setup the communication parameters to:

Connect	*directly to COM x (those used at point A1)*
Bit rate	*19200*
Data Bits	*8*
Parity	*No*
Stop Bit	*1*
Flow control	*None*

We remind that **HYPERTERMINAL** normally is located on Windows menu: *Start* | *Program* | *Accessories* | *Communication*, execute it and through the properties windows. As an alternative it can be used any other serial communication program and also the terminal emulation integrated in **BASCOM AVR** and **ICC AVR**.

B2) Supply power voltage to Mini Module, or reset it.

B3) Check that its LED or LEDs continuosly blink; contemporaneously on development PC monitor appears the demo program presentation message. Each **GMM AM1284**, received for the first time, is delivered with its demo program already saved in FLASH and arranged to start automatically at power on, with the described functionalities.
If these results are not obtained, please check again the power supply, the serial connection and the jumpers configurations.

B4) Follow the instructions of the demo, test all the resources of Mini Module and verify the obtained effects directly on hardware: the user can interact with demo by using the development PC as a console.

B5) When demo execution is completed turn off **GMM AM1284** power supply.

B6) Exit from **HYPERTERMINAL** program on development PC.

C) FLASH REPROGRAMMING WITH DEMO PROGRAM

The generated code for the Mini Module can be executed once saved in its FLASH EPROM. We remind that the FLASH of **GMM AM1284** can be programmed in three different modalities (serial Bootloader, ISP interface, JTAG interface) described in the APPENDIX D of this manual.
In this paragraph, is been shown the comfortablest modality to use, the serial Bootloader **grifo®** that is the modality that not need for any other accessory.

C1) On the received **grifo®** disk find and then install the utility program **AVR Bootloader grifo(r)** on a comfortable folder of development PC hard disk. This one manages the ISP programming of FLASH EPROM on **GMM AM1284** and it interacts with the Boot Loader executed by the same module.
You can freely download and install the latest version of **AVR Bootloadre grifo(r)** directly from **grifo®** web sites.

C2) Create a new folder on hard disk of development PC that will be the place where the user saves all his files; up to now this folder is named working folder.

C3) On the received **grifo®** CD find the demo program of **GMM AM1284**: this file has the name visualized in the start up phase, at point B3, and it can be reached from the start page of CD by follwing the path: *English* | *Examples Tables* | *Grifo Mini Modules* | *GMM AM1284*. In the displayed table it must be clicked the red push button placed on the cross between the column with used programming language abd the row with the card neme. We are supposing to usethe D_AM644 demo developed through the BASIC BASCOM AVR compiler.

C4) Copy all the files found at previous point to working folder created at point C2. At the end, please ensure that all the files copied on hard disk have the *Read only* attribute disabled.

C5) Launch the **AVR Bootloadre grifo(r)** installed at point C1. It can be used the *Start* | *Programs* | *Grifo®* | *Avr Bootloadr grifo(r)* link, when the default setting have been used during installation of the same program.

C6) Close the showing window appeared pressing *close* button.

C7) At this point there is the main window of **AVR Bootloadre grifo(r)** on screen that, in case of first execution, are without any settings. Select the communication line of PC connected at point A1, in the the *Com Port* list.

C8) Check the FLASH (*application code*) item and then choose the file to program in FLASH of Mini Module, that is the file with .HEX extension selected at poin C3 (D_AM1284.HEXin this example). After the button *Browse* pressure, select the file, through the proper window appeared.

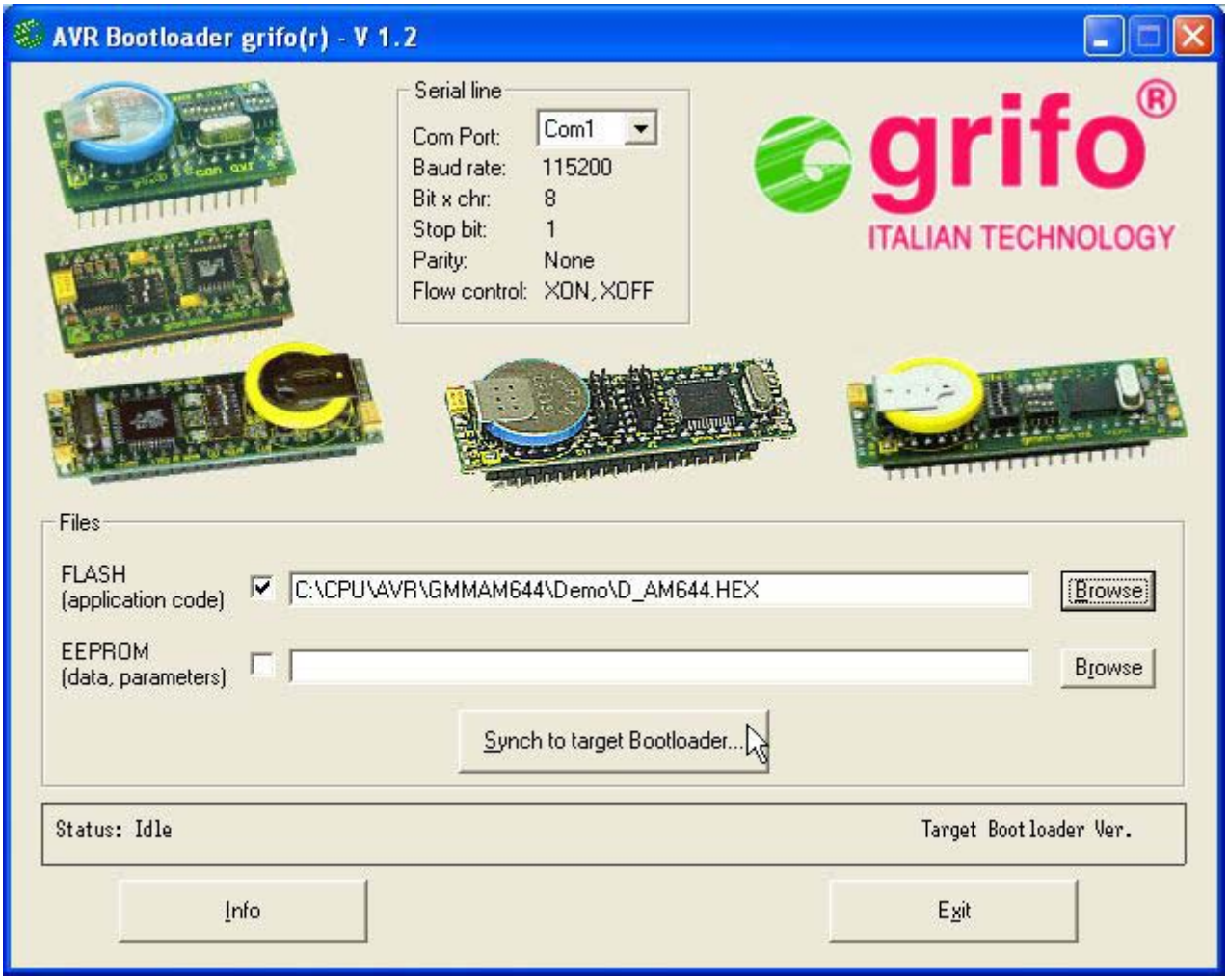


FIGURE 28: AVR BOOTLOADER GRIFO(R) SETTING TABLE

C9) Press the button "Synch to Bootloader..." or the key combination Alt+S on the PC, then reset the Mini Module or turn off and then on its supply. The file is dowloaded into the Mini Module. If this does not happen, and the program should indicate a "No repsonse from target bootloader", try to repeat the operation decreasing the time between pressure of button on the PC and reset of Mini Module. If the problem persists, check cable and connection.

C10) When the synchronuzation is done in the status window appear the indication *sending FLASH file - lines remaining xxxx* and the Bootloader performed version by Mini Module: *Target Bootloader Ver. x.x*. While the second indication stay constant, the first one change in decreasing the number of lines of HEX file to transmit. At this point the file is completely downloaded to Mini Module and if are not occured errors, is shown a window with the message *FLASH file succefully dowloaded*.

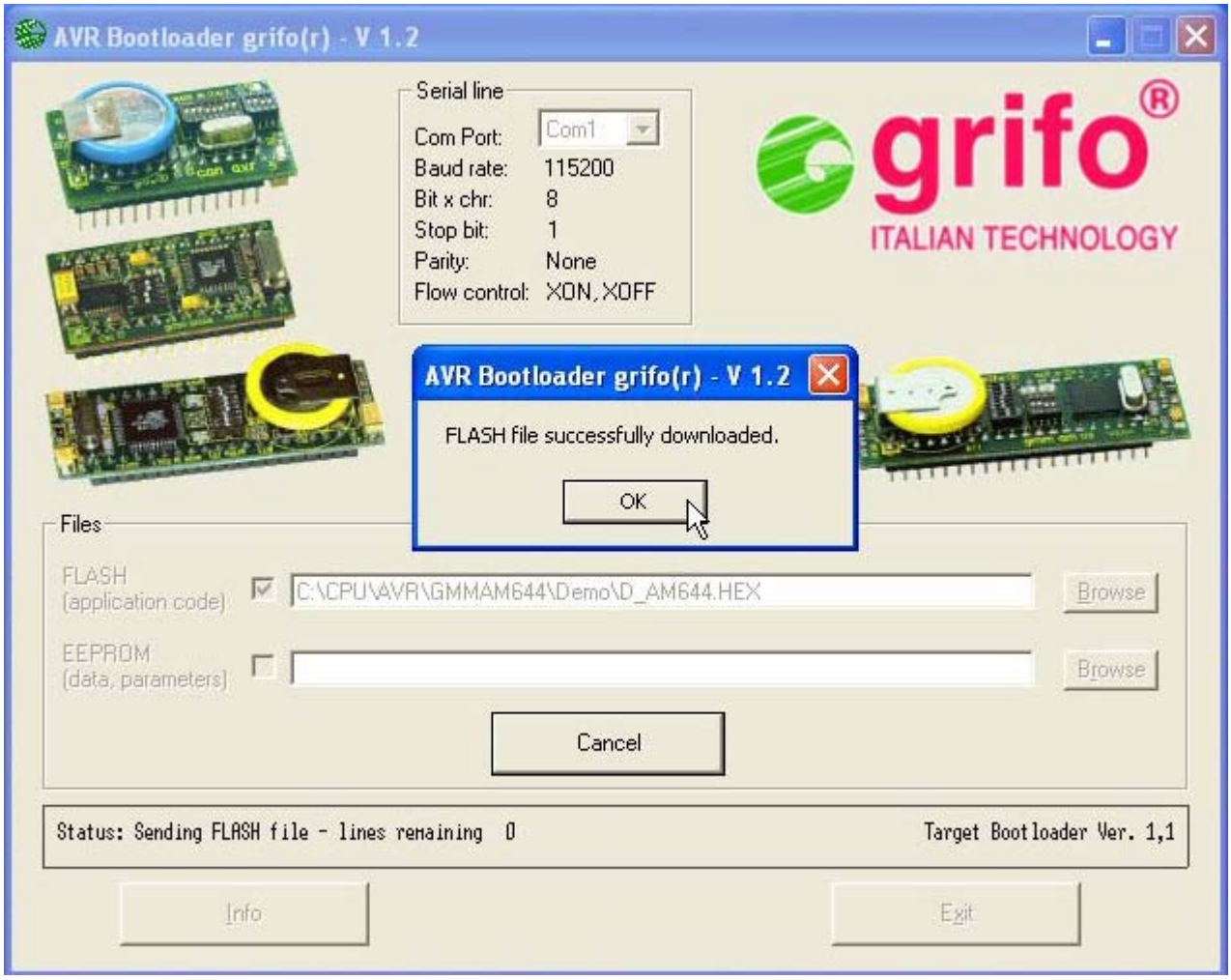


FIGURE 29: AVR BOOTLOADER GRIFO(R) RESULT WINDOW

C11) The endurance of the file transmission changes depending on length of available communication line on PC; for example if the used COM corresponding to a USB<->RS232 converter, the transfer take a long time. In any case the user has to wait the condition described before, or if it take too long time, stop the transmission with the cancel button.

C12) At this point the FLASH is programmed and the **AVR Bootloader grifo(r)** can be closed.

C13) Retry the demo program just reprogrammed repeating the B1÷B6 steps.

In order to make fast the operations described above we can use the command line mode of **AVR Bootloader grifo(r)**, described in detail in the APPENDIX D of this manual.

D) GENERATE EXECUTABLE CODE OF DEMO PROGRAM

D1) Install the software environment selected to develop the application program on the hard disk of the development PC. As described in the chapter DEVELOPMENT TOOLS there are many different software packages that satisfy any customers requirements but here we remind only the most diffused as the **BASCOM AVR** and **ICC AVR**. For detailed information on this products please refer to relative user manuals or the proper on line helps.

D2) Check that at point C4 from **grifo®** CD had been copied all the files of the demo program, not only the one with executable code. In detail in the working folder must be available the source file, the project file, the declaration files, provided of the following extensions according with the used development tools

Development tools	Language	Source	Project	Declaration	Environment
BASCOM AVR	BASIC	.BAS	-	.DAT	-
ICC AVR	C	.C	.PRJ	.H	.SRC

D3) Compile the source file by using the selected software tools in order to obtain the .HEX file identic to those received and already used, at point C. This operation is really different according with the selected development tools, so here follows the detailed steps properly divided and organized:

D3A) RECOMPILE WITH BASCOM AVR

D3A1) Copy the declaration file .DAT described at point D2 inside the installation folder of **BASCOM AVR**: *\MCS Electronics\BASCOM-AVR*.

D3A2) Execute the **BASCOM AVR** and when his IDE is opened, load the source file (with .BAS extension), through the menu *File* | *Open*:

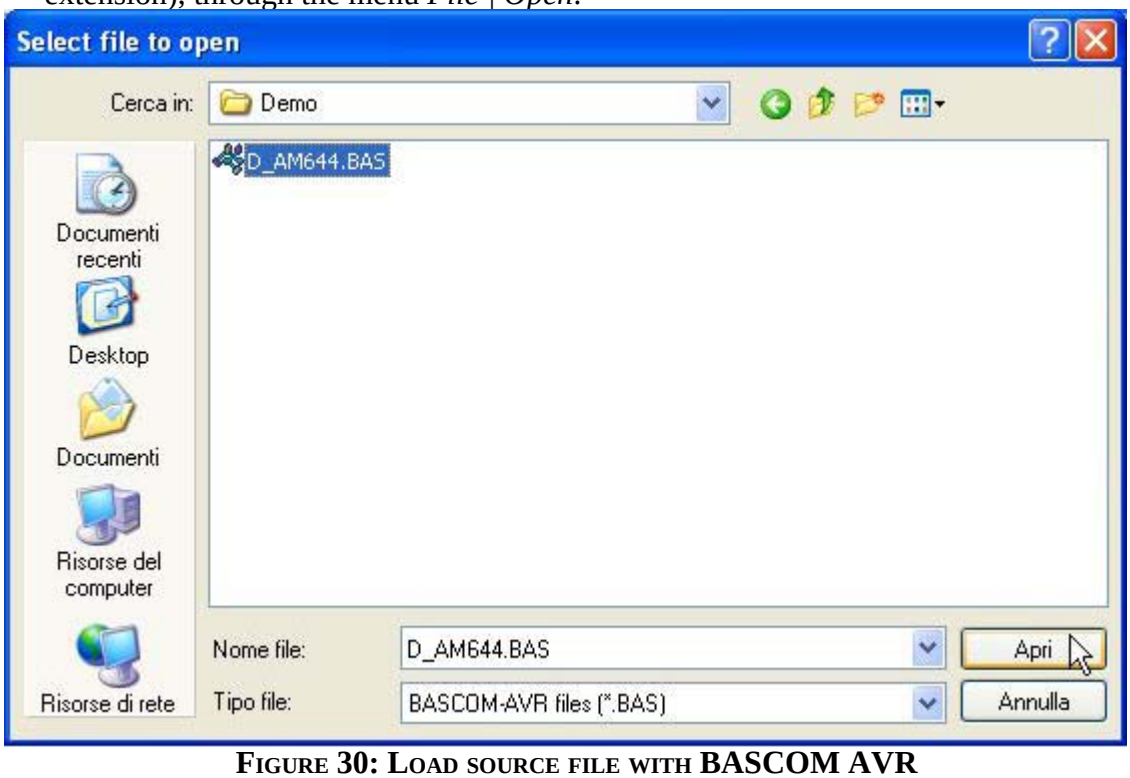


FIGURE 30: LOAD SOURCE FILE WITH BASCOM AVR

D3A3) Open the configuration window of **BASCOM AVR** compiler, by selecting the command *Option* | *Compiler* | *Chip*, then define the settings described in the following figure and finally confirm with *Ok* button.
The setting for *Chip* field must match the used microcontroller and it can be seleted only when the declaration files have been correctly copied, as described at point D3A1.

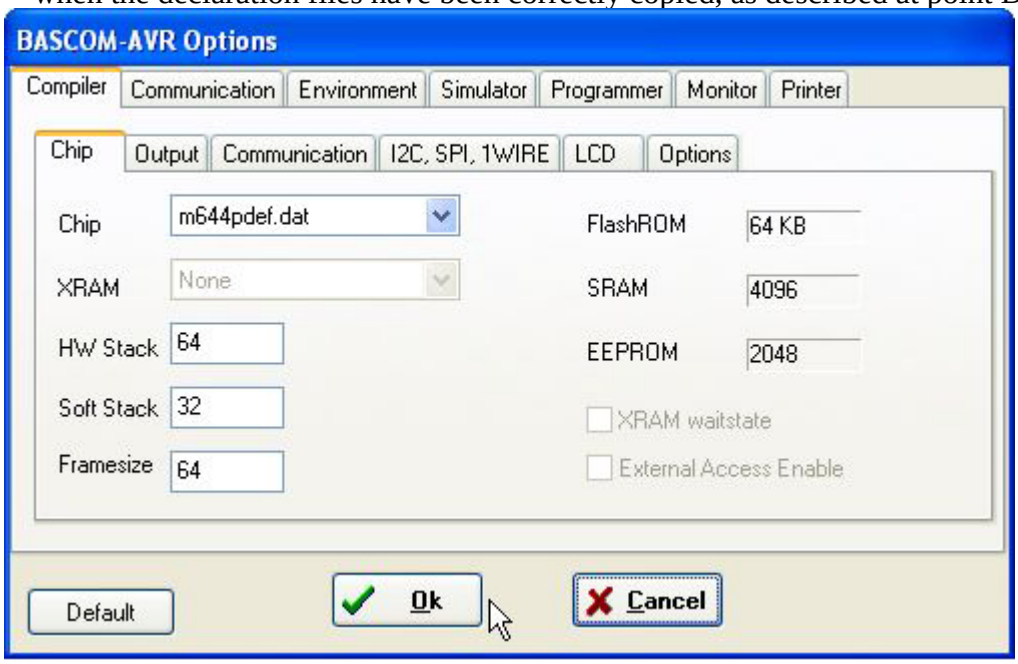


FIGURE 31: CONFIGURE COMPILER WITH BASCOM AVR

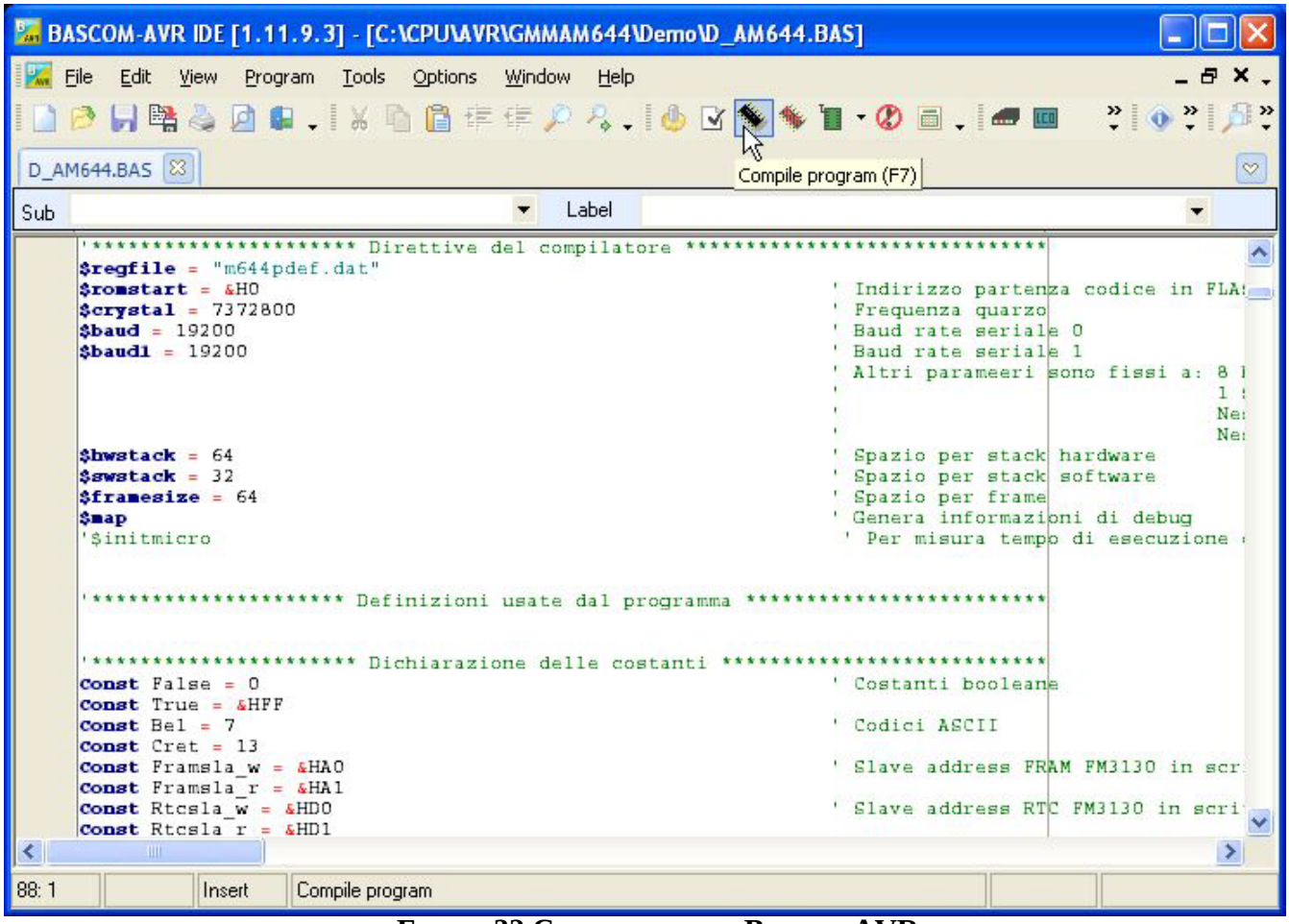


FIGURE 32 COMPILING WITH BASCOM AVR

D3A4) Compile the source file of demo program with the simple pressure of the hot key *F7*, or by selecting the command *Program* | *Compile*, and verify that no errors happens. An *.HEX* file must be obtained equal to those available on **grifo®** disk and already used at points C.
The compiling time change according to used development PC; anyway the user must wait that both the passes are completed, through a specific status window displayed during compilation, and then check that the bottom side of IDE doesn't show errors. In other words at the end of compilation it must be displayed a window similar to those reported in previous figure.

D3B) RECOMPILE WITH ICC AVR

D3B1) The **ICC AVR** software package includes two separated development tools. It is a C compiler that has got several functionality as an editor, a three depending rapresenter, a projects manager, a terminal emulator, a code generator for internal perupherals, an on-line help, etc.
The following steps list the basic operations required by each tools of **ICC AVR**, while for detailed information about all the described programs, please read the complete documentation included in the software package.

D3B2) Execute the ICC AVR once inside in its IDE, load the project file (with extension .PRJ), by using the *File|Open* menu;

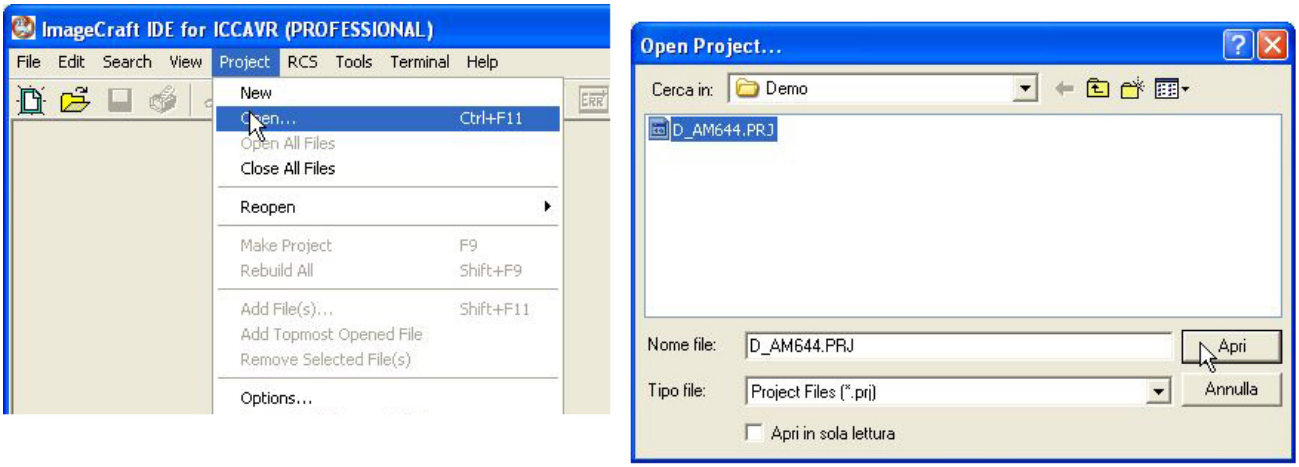


FIGURE 33: PROJECT LOADING WITH ICC AVR

D3B3) In the project three hierarchy shown in the project window on the right, click the of the source file (D_AM1284.C in the example)in order to view it in the editor window on the left.

D3B4) **ICC AVR** compiler in order to create the right code for the microcontroller installed on **GMM AM1284** has to be properly configurated. That configuration is done performing the settings reported in the folling figure, in the *compiler options* window, opened through the menu *Project* | *Options*... With the project loading the settings have to be already corrected and once checked it is sufficient to close the OK but butt windows with *OK* button.

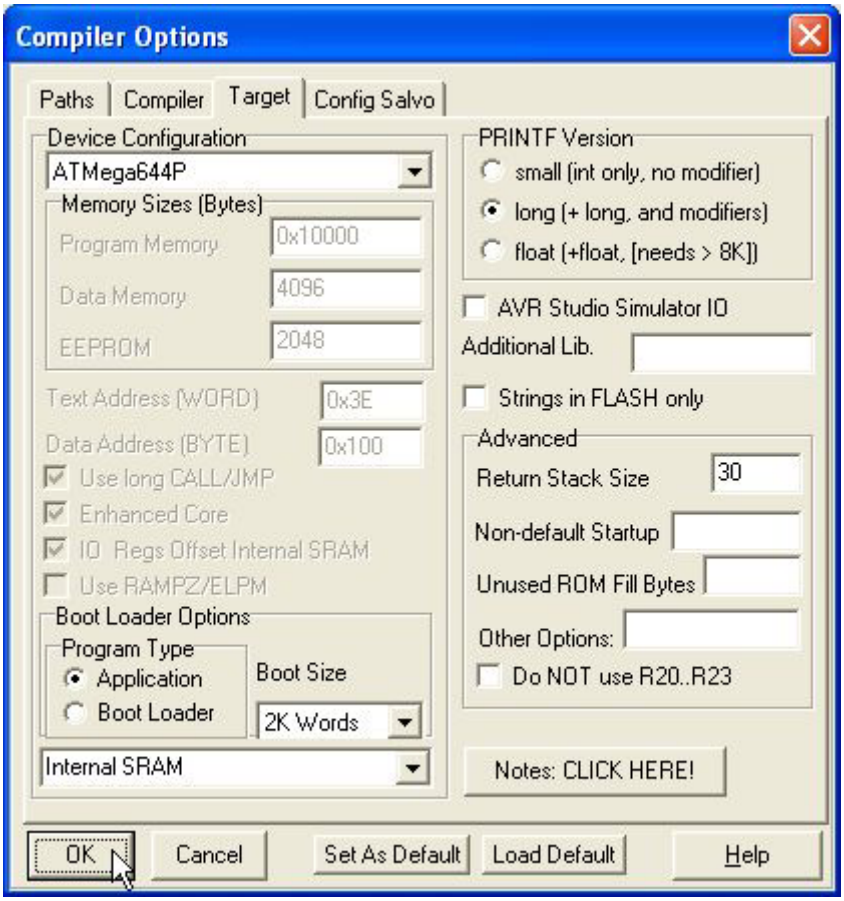


FIGURE 34: CONFIGURE ICC AVR COMPILER

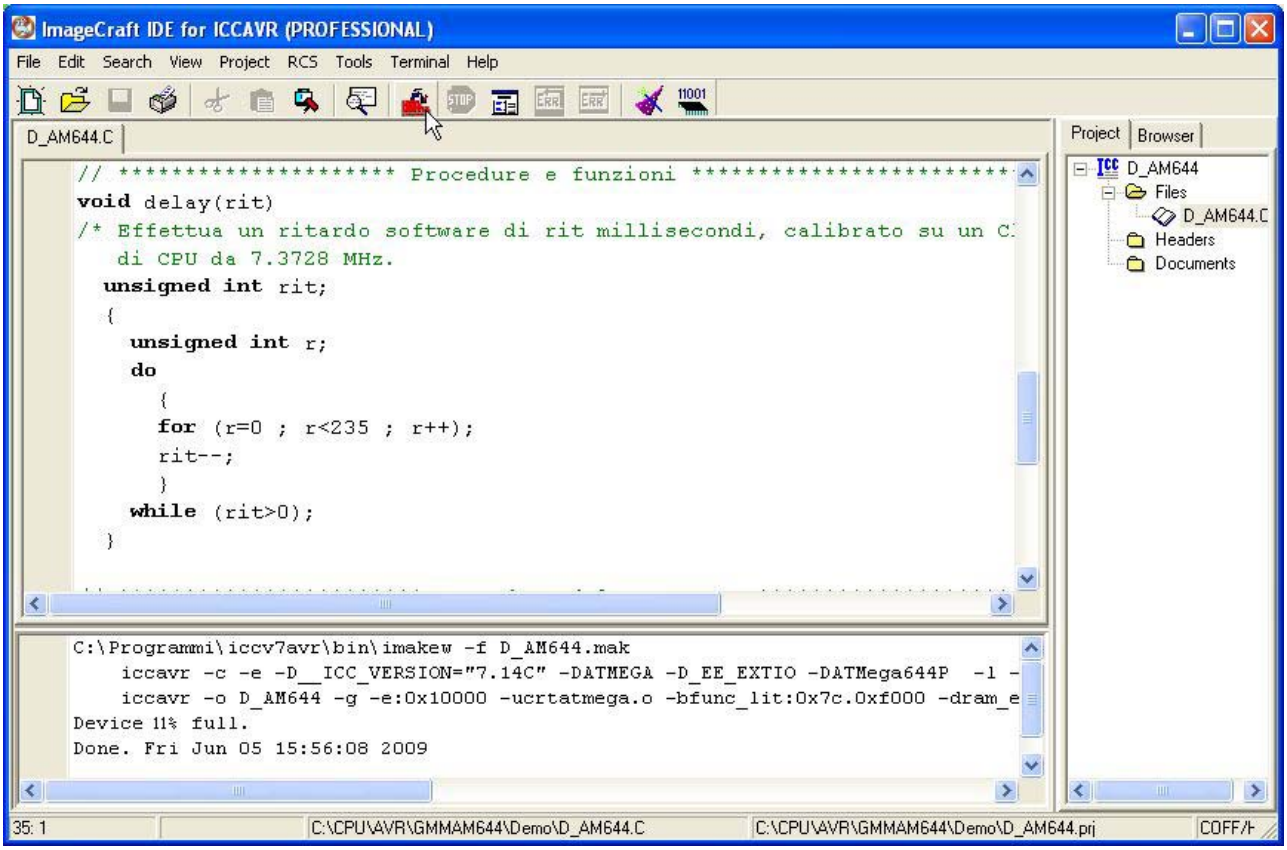


FIGURE 35: COMPILE ICC AVR

D3B5) At this point all is ready to create the executable code of demo program and is sufficient to press the *Build project* button or selects the *Project | Rebuild All menu*, checking if there are no errors that appear as shown in the previous figure.

D4) Re-perform the saving of and the trying of the obtained .HEX file , repeating the points from C5 to C13.

D5) If during the execution of the steps described above, a problem occuring, we suggest to user to re-read and repeat the steps carefully and if the error remains, please contact the **grifo®**.
In case of correct executionof the all phases the user has been realized his first demo program that meet the **GMM AM1284** Mini Module demo.
At this point is possible to modify the source of the demo program in order to satisfy the application to realize and re-compile it, re-program and re-try it in cycling mode, in order to have a proper working version.
About to the **AVR Bootloader grifo(r)** settings we remind that these things can be done only the first time, in facts the same programs keeps the last used settings;
it can be used the command line too, that moreover can be integrated in the development tool, in orger to make fast the programming and trying program phases.
So we are arrived at target and we can close the develop, that is:

E) FINAL PREPARATION OF APPLICATION

E1) Disconnect the development PC. At each power on of the board or at each reset, the **GMM AM1284** will perform the last saved program in FLASH, that is the application program developped by user.

DEVELOPMENT TOOLS

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 **AVR** family, can be used.
Software packages purchased from **grifo®** are always provided with example programs that show how to use each section of the board and a complete use documentation.
Remarkable are:

BASCOM AVR
It is a powerfull new integrated development environment for AVR microcontroller. The toolset incorporates an editor, optimising BASIC compiler, assembler and HEX creator. The BASIC compiler produces very tight AVR machine code by virtue of the fact it translates the BASIC source into actually run timeassembly code wich is optimised to run as fast as possible. The target AVR microcontroller therefore runs true assembly code rather than tokenised code wich is found in many other BASIC compilers. It is also provided with integrated simulator for source level debugging and optional external libraries to drive or simulate several external devices (likebadge readers, PS/2 keyboards, graphic and alphanumeric displays, etc.).

ICC AVR PRO
Cross compiler for C source program. It is a powerfull software tool that includes editor, ANSI C compiler, assembler, linker, library management program and project manager included in an easy to use integrated development environment for Windows and other P.C. operating systems. Library sources, floating point, integration with AVR studio, on line help and ANSI terminal emulator for target communication are provided too. The compiler can be integrated with **AVR Studio** bundle to perform the debugger at source level for the user application in C and with external programs for ISP programming.
This one is provided on CD with its technical handbook and using example.

DDS MICRO C AVR
Low cost ross compiler for C source program. It is a powerful software tool that includes editor, C compiler (integer), assembler, optimizer, source linker and library in one easy to use integrated development environment. There are also included the library sources and many utilities programs. The default IDE can be replaced by a new one named **Micro IDE**, that is more powerfull, for Windows operating system and provided of many utility functions.

AVR Studio
It is a development tool for AVR family of microcontroller that fully control execution of program on AVR in circuit emulator or on the built in AVR instruction set simulator. AVR Studio supports source level execution of assembly and C programs generated by external compilers and assemblers. The tolls is based on a set of windows for source, watch, registers, memory, peripherals, message and

processor that enable the user to have full control of the status of every element in the execution target. It also features an "application builder" to easy the generation of code to initialise all hardware peripherals (USART, SPI, Port, ADC, ect.) starting from a graphic interface.
There is also the remarkable possibility to drive the JTAG interface called "JTAG ICE" manufactured by Atmel that You can see in the APPENDIX D of this manual.
It is provided included the using documentation, on CD or it can be free downloaded by the ATMEL web site.

FLOWCODE

It is a comfortable system to create automation programs with the popular technics of flow charts. It includes a graphic editor that allow to place and connects the chart diagram (input, output, control, cycles, hw peripheral management, etc) as on a paper sheet and to define the properties, a power compiler tha tconverts the diagram into executable code and utility for the downloading of that code to the board. All is integrated in a IDE for Windows.
It is provided in a CD that includes examples and using documentation.

FIGURE 36: BOTTOM VIEW

PERIPHERAL DEVICES SOFTWARE DESCRIPTION

Below there is a specific description of the software managements of the on board peripheral devices. Whenever the reported information is not sufficient, please search a more detailed description of the devices in manufacturing company data sheets. Furthermore in this chapter the microprocontroller internal peripheral devices (Timer, Counter, PCA, I/O Port s, A/D, UART, Interrupt, Watch Dog, CAN controller, etc.) are not described; so if their programmation 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.

CONFIGURATION INPUTS

The status of jumper J2.4 on **GMM AM1284** can be obtained by software, through a simple read operation of the relative bits on Port D:

J2.4 -> PD7

When the jumper is in 1-2 position corresponds to logic level **0** and the 2-3 or not connected position corresponds to logic level **1**. During the development of application program the user must consider that the configuration inputs preclude the use of the other functionalities available on pin 37 of the Mini Module. When one of these functionalities (I/O linesPD7, PCINT31, OC2A, LED LD2) are required the jumper J2.4 must absolutely be in 2-3 position.
The using of the same line both for obtaining of jumper J2.4 that the visualization LED LD2, make the jumper status is shown by the LED too.

J2.4		LD2		PD7		Other functionalities
1-2	->	active	->	0	->	not available
2-3	->	disactive	->	1	->	available

VISUALIZATION LEDS

The LEDs LD1 and LD2 can be software driven and their status can be defined by simple operations on relative bits of Port D:

LD1 (green) -> PD.6
LD2 (red) -> PD7

Driving is in inverted logic, in fact LED is **ON** when bit is **0** and LED is **OFF** when the corresponding bit is **1**.
All signals of Port D are kept at logic level 1 during the reset or the power on, so when one of these phases happen, both LEDs are disabled.
The configuration jumper J2.4 uses the same line PD7 of the LED LD2 and, as describedin previous paragraph, can keep it active.

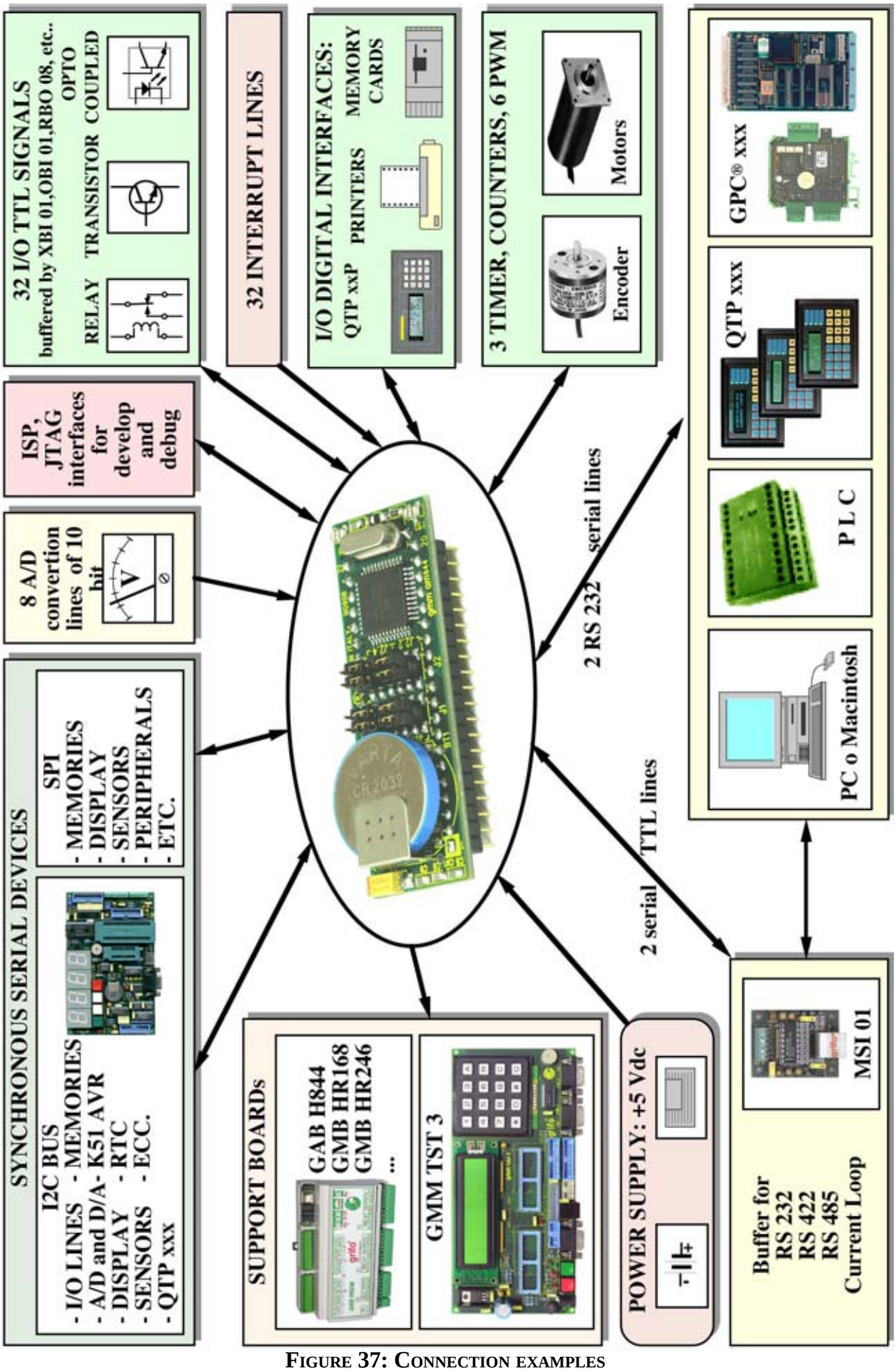


FIGURE 37: CONNECTION EXAMPLES

MULTIFUNCTIONS SIGNALS

Numerous signals connected to CN1 can be used with different functionalities that are software selectable by developed application program. The specializations of the multiplexed signals is performed through proper settings of internal registers of microcontroller, as described in the component data sheet. For example the pins 16, 26÷29, 31÷33 can operate as analog inputs (ADCn) or as digital I/Os (PA.n) according with setting of DIDR0 register; 12 and 13 pin pins can operates as digital I/O (PC0 and PC1) or as I2C Bus communication signals (SDA and SCL), when the peroper TWI peripheral is active; etc.

MEMORY ACCESS

On **GMM AM1284** Mini Module are available different memory types that can be easily managed by user application program, as below described:

Memory	*Allocation*	*Access*	*Management*
128K bytes of FLASH (*1)	progam memory	R W	Instructions for area reading for ISP only
256 bytes of registers	data memory	R/W	Instructions for internal registers for normal and extended addressed
16K bytes of SRAM	data memory	R/W	Instructions for data area access with all the possibility of addressing (direct, indirect, with offset, increased, etc)
4K bytes of EEPROM	dedicated area	R/W	Through dedicated Special Function Registers
8K bytes of FRAM	external	R/W	I2C Bus communication

(*1) Part of 128K Bytes of FLASH can be reserved for the Bootloadr code, up to 8K Bytes maximum. **grifo®** provide a personal version that use the last 2K bytes only so it leave 126K bytes free.

The addressing modalities and the instructions for memory access of the microcontroller are explained in the data sheets of the device, so please consult them or the APPENDIX A at the end of this manual. This know how become necessary when the user program is coded in assembly, viceversa when an high level development tools is used the memories are located and managed automatically and confortably by using specific format specifiers in the variables declarations.
It is is important remind that the last 8 bytes of on board EEPROM are reserved for calibration data and they must can't be modified. Both the user application program and the ISP management of EEPROM must preserve these bytes in order to avoid malfunctions of Mini Module.
The FRAM memory is able to keep the written data in total absence of power supply too (without +Vdc POW and without back up battery). That memory is to prefer from EEPROM in any cases you have to save and keep data in changing frequently, in fact FRAM has no limit in writing such as EEPROM, and it is faster.

RTC+FRAM

Mini Module **GMM AM1284** is provided with a complete Real Time Clock capable to manage hours, minutes, seconds, day, month, year (leap year too) and weekday in complete autonomy.
This module can be backed up through the back up circuitery 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. This line is called /INTRTC and is connected to pin 11 of CN1.
Add to RTC, the FM3130 device, include 8K Bytes of FRAM too (ferromagnetic RAM memory) with features decribed in previous paragraph.
About the serial RTC+FRAM module management, please see the documentation of the device. 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:

PC0 , PCINT16 , SDA (input/output)	->	CLOCK line (SCL)
PD1 , PCINT17 , SCL (input/output)	->	DATA line (SDA)

Please remark that RTC+FRAM work permanently with the slave address **A0H** and **D0H**, so user applications can not connect devices at these I2C Bus addresses.
For details we report an alectrical information for RTC+SRAM of **GMM AM1284**; the communication I2C Bus lines (SDA and SCL) are connected to proper pull up resistors of 4,7KΩ to 3,3 power supply voltage, while the interrupt signal (/INTRTC) has no pull up.In case od using of this signal, it has to be connected to an external pull up. for example to Mini Module power supply voltage +Vdc POW.

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 AM1284**.

ATMEL manual:	*Data sheet ATmega1284P/V*
ATMEL manual:	*Data sheet AVR Instruction Set*
MAXIM manual:	*True RS 232 Transceivers*
NATIONAL manual:	*Low-Dropout Linear Regulator*
PHILIPS manual:	*I2C-bus compatible ICs*
RAMTRON manual:	*FM3130 Integrated RTC/Alarm and 64Kb F-RAM*

The described manuals can be requested directly to manufacturer or local dealers. Alternatively this information and/or their upgrades can be found in specific internet web pages, of the listed companies.
Many manuals in electronic format are available also in our technical documentation service, as described in APPENDIX A.

APPENDIX A: DATASHEETS

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.

ATMEGA1284P

Features

- High-performance, Low-power Atmel® AVR® 8-bit Microcontroller
- Advanced RISC Architecture
  - 131 Powerful Instructions – Most Single-clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 20MIPS Throughput at 20MHz
  - On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory segments
  - 16/32/64/128KBytes of In-System Self-programmable Flash program memory
  - 512/1K/2K/4KBytes EEPROM
  - 1/2/4/16KBytes Internal SRAM
  - Write/Erase Cycles: 10,000 Flash/ 100,000 EEPROM
  - Data retention: 20 years at 85°C/ 100 years at 25°C(1)
  - Optional Boot Code Section with Independent Lock Bits
    - In-System Programming by On-chip Boot Program
    - True Read-While-Write Operation
  - Programming Lock for Software Security
- QTouch® library support
  - Capacitive touch buttons, sliders and wheels
  - QTouch and QMatrix acquisition
  - Up to 64 sense channels
- JTAG (IEEE std. 1149.1 Compliant) Interface
  - Boundary-scan Capabilities According to the JTAG Standard
  - Extensive On-chip Debug Support
  - Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
  - One/two 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
  - Real Time Counter with Separate Oscillator
  - Six PWM Channels
  - 8-channel, 10-bit ADC
    - Differential mode with selectable gain at 1x, 10x or 200x
  - Byte-oriented Two-wire Serial Interface
  - Two Programmable Serial USART
  - Master/Slave SPI Serial Interface
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - On-chip Analog Comparator
  - Interrupt and Wake-up on Pin Change
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated RC Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby
- I/O and Packages
  - 32 Programmable I/O Lines
  - 40-pin PDIP, 44-lead TQFP, 44-pad VQFN/QFN/MLF
  - 44-pad DRQFN
  - 49-ball VFBGA
- Operating Voltages
  - 1.8 - 5.5V
- Speed Grades
  - 0 - 4MHz @ 1.8 - 5.5V
  - 0 - 10MHz @ 2.7 - 5.5V
  - 0 - 20MHz @ 4.5 - 5.5V
- Power Consumption at 1MHz, 1.8V, 25°C
  - Active: 0.4mA
  - Power-down Mode: 0.1µA
  - Power-save Mode: 0.6µA (Including 32kHz RTC)

Note: 1. See "Data Retention" on page 9 for details.

ATMEL

8-bit Atmel Microcontroller with 16/32/64/128K Bytes In-System Programmable Flash

ATmega164A
ATmega164PA
ATmega324A
ATmega324PA
ATmega644A
ATmega644PA
ATmega1284
ATmega1284P

Summary

8272CS–AVR–06/11

ATMEL

FM3130

Integrated RTC/Alarm and 64Kb F-RAM

Features

High Integration Device Replaces Multiple Parts
- Serial Nonvolatile Memory
- Real-time Clock (RTC) with Alarm
- Clock Output (Programmable frequency)

64Kb Ferroelectric Nonvolatile RAM
- Internally Organized as 8Kx8
- Unlimited Read/Write Endurance
- 10 year Data Retention
- NoDelay™ Writes

Fast Two-wire Serial Interface
- Up to 1 MHz Maximum Bus Frequency
- Supports Legacy Timing for 100 kHz & 400 kHz
- RTC & F-RAM Controlled via 2-wire Interface

Real-time Clock/Calendar
- Backup Current under 1 µA
- Seconds through Centuries in BCD format
- Tracks Leap Years through 2099
- Uses Standard 32.768 kHz Crystal (12.5pF)
- Software Calibration
- Supports Battery or Capacitor Backup

Easy to Use Configurations
- Operates from 2.7 to 3.6V
- 8-pin "Green" SOIC (-G) and TDFN (-DG)
- Low Operating Current
- Industrial Temperature -40°C to +85°C

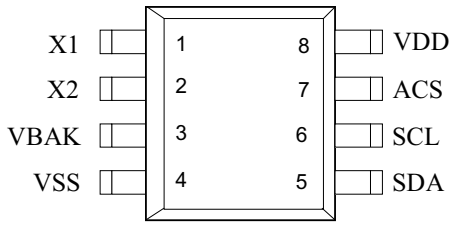
Description

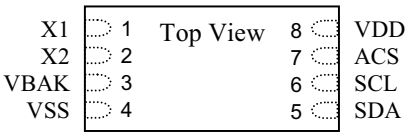
The FM3130 integrates a real-time clock (RTC) and F-RAM nonvolatile memory. The device operates from 2.7 to 3.6V.

The FM3130 provides nonvolatile F-RAM which features fast write speed and unlimited endurance. This allows the memory to serve as extra RAM for the system microcontroller or conventional nonvolatile storage. This memory is truly nonvolatile rather than battery backed.

The real-time clock (RTC) provides time and date information in BCD format. It can be permanently powered from external backup voltage source, either a battery or a capacitor. The timekeeper uses a common external 32.768 kHz crystal and provides a calibration mode that allows software adjustment of timekeeping accuracy.

Pin Configuration





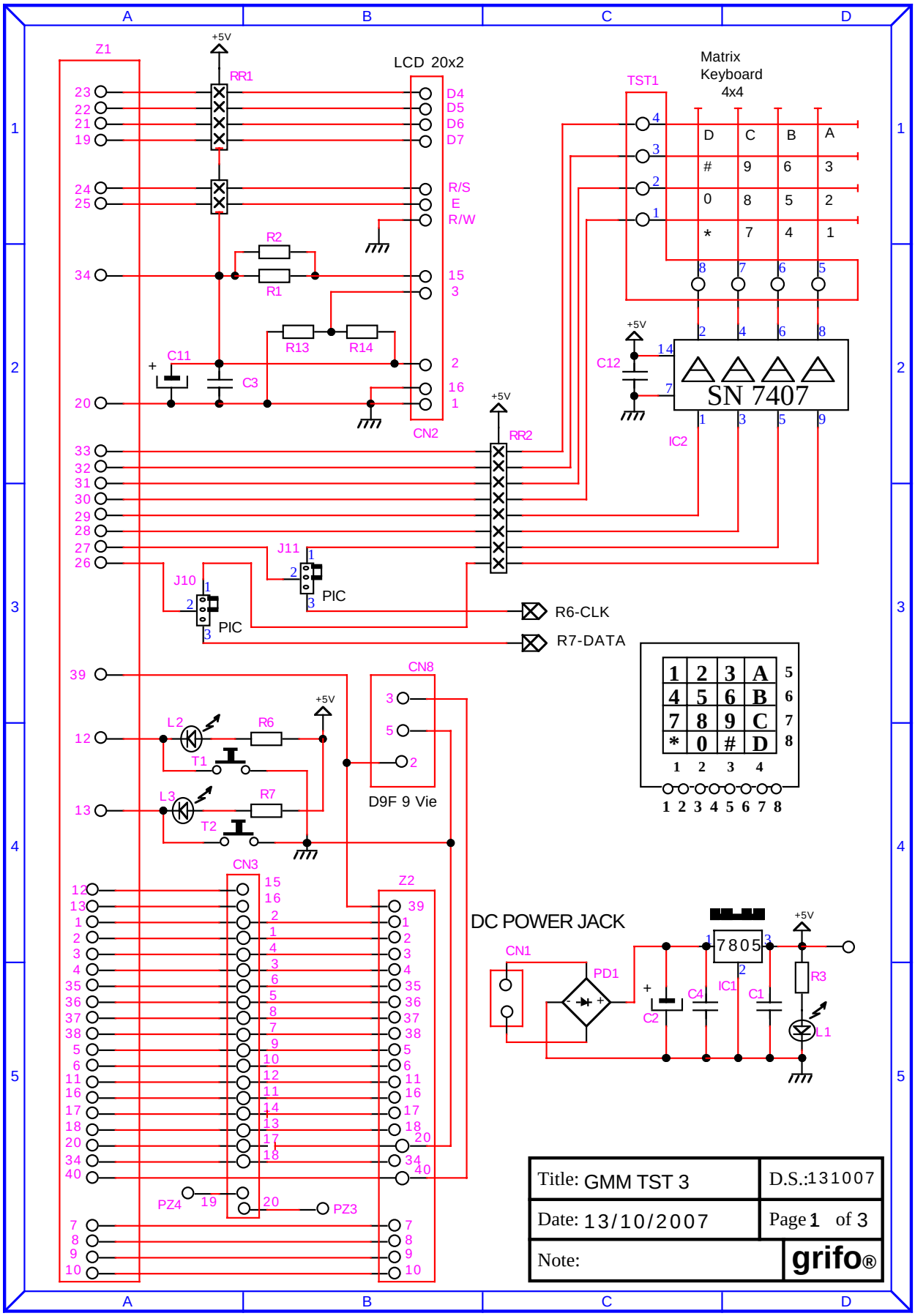
Pin Name	Function
X1, X2	Crystal Connections
ACS	Alarm/Calibration/SqWave
SDA	Serial Data
SCL	Serial Clock
VBAK	Battery-Backup Supply
VDD	Supply Voltage
VSS	Ground

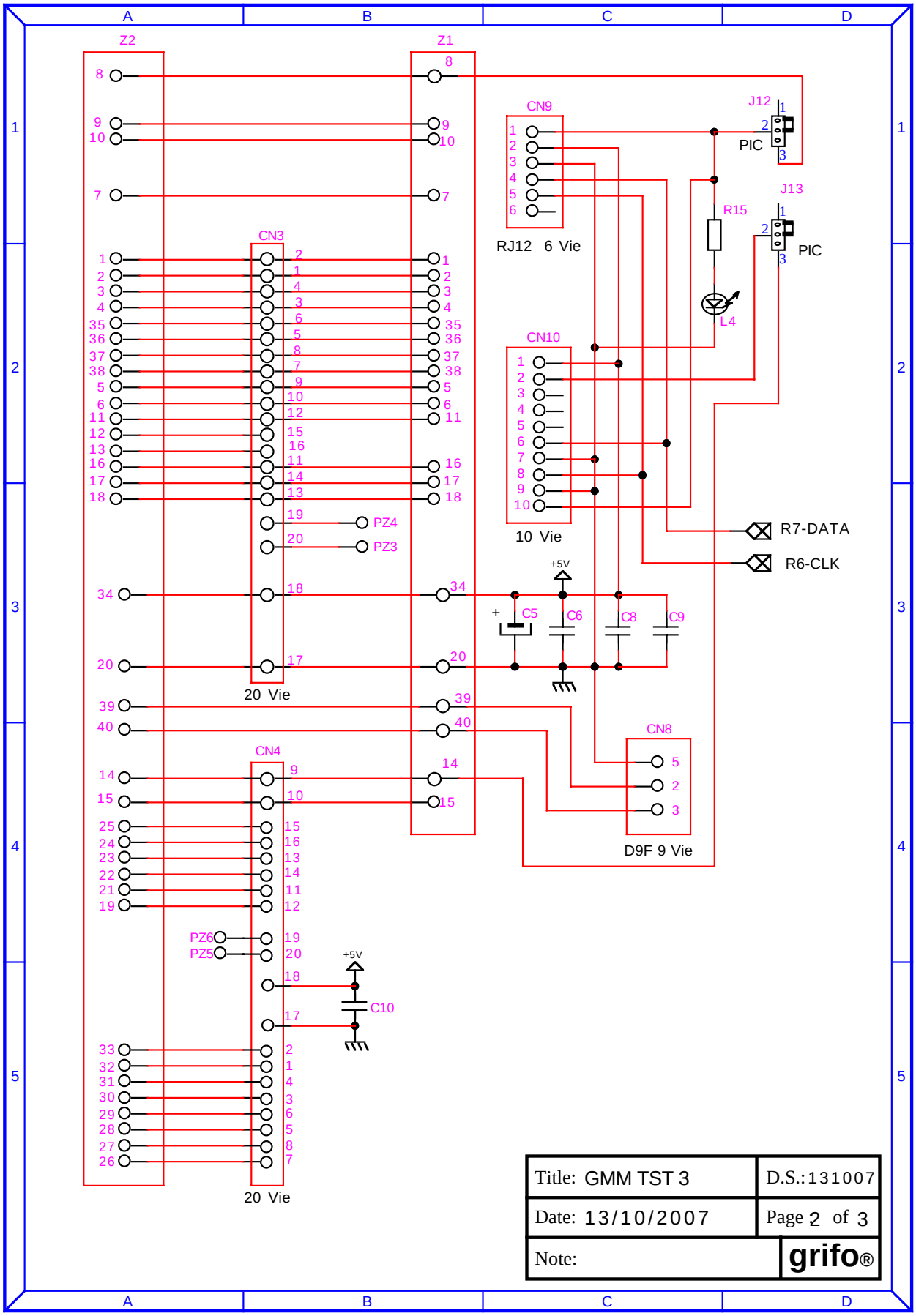
Ordering Information	
FM3130-G	"Green"/RoHS 8-pin SOIC
FM3130-DG	"Green"/RoHS 8-pin TDFN

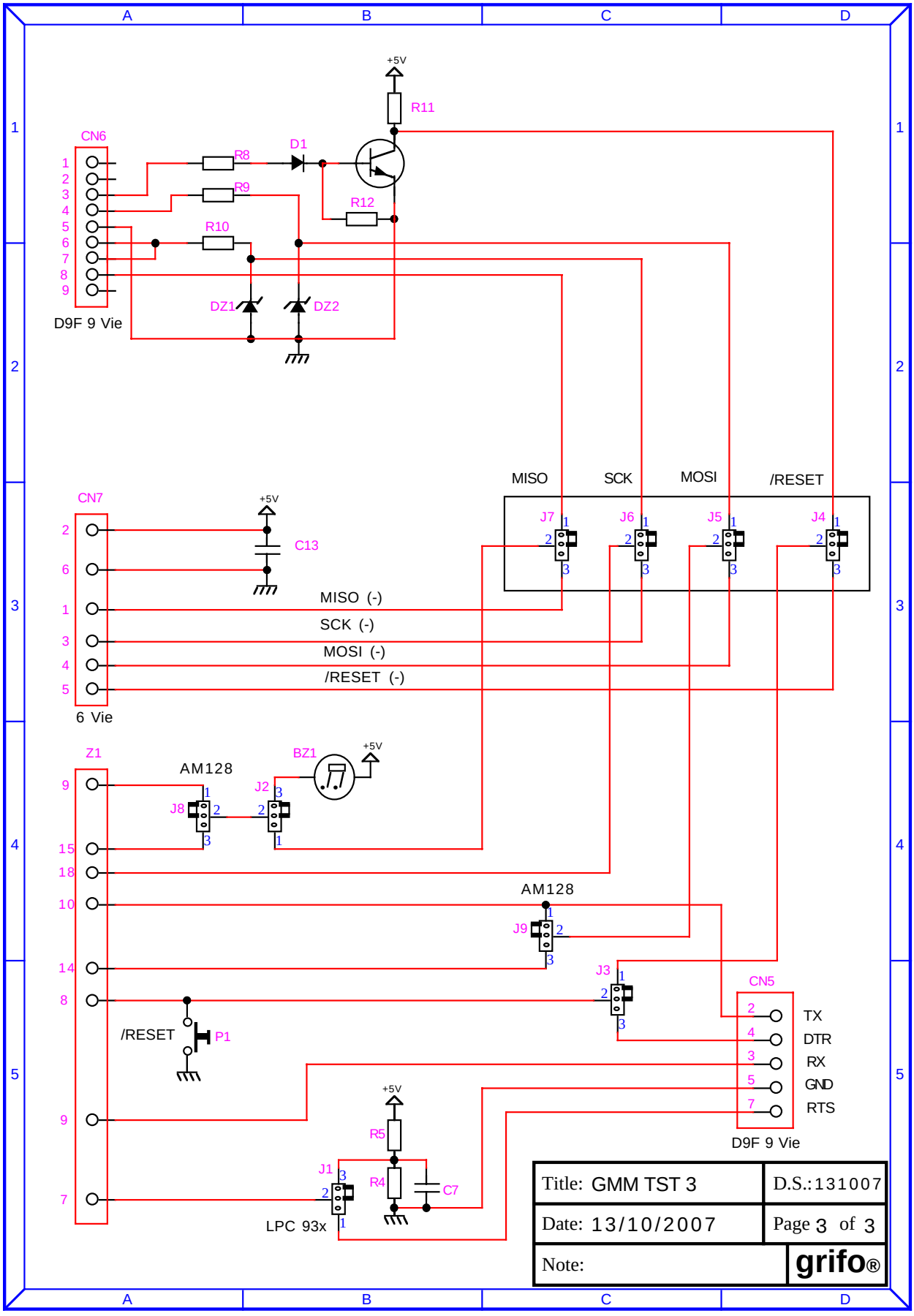
This product conforms to specifications per the terms of the Ramtron standard warranty. The product has completed Ramtron's internal qualification testing and has reached production status.

Ramtron International Corporation
1850 Ramtron Drive, Colorado Springs, CO 80921
(800) 545-FRAM, (719) 481-7000
http://www.ramtron.com

APPENDIX B: GMM TST 3 ELECTRIC DIAGRAM




A
B
C
D
Z2
Z1
CN9
RJ12 6 Vie
J12
PIC
J13
PIC
R15
L4
CN10
10 Vie
R7-DATA
R6-CLK
CN3
20 Vie
PZ4
PZ3
+5V
C5
C6
C8
C9
CN8
D9F 9 Vie
CN4
20 Vie
PZ6
PZ5
C10
Title: GMM TST 3
D.S.:131007
Date: 13/10/2007
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
D9F 9 Vie
MISO
SCK
MOSI
/RESET
CN7
+5V
C13
J7
J6
J5
J4
MISO (-)
SCK (-)
MOSI (-)
/RESET (-)
6 Vie
Z1
AM128
BZ1
+5V
J8
J2
AM128
J9
J3
CN5
TX
DTR
RX
GND
RTS
D9F 9 Vie
/RESET
P1
+5V
R5
J1
R4
C7
LPC 93x
Title: GMM TST 3
D.S.:131007
Date: 13/10/2007
Page 3 of 3
Note:
grifo®

APPENDIX C: BASE CONFIG., OPTIONS, ACCESSORIES

In corrispondence of the first purchase, or after a reparation, the **GMM AM1284** is supplied in its base configuration. The features of this configuration has been described many times in the manual (by using also the name default configuration) and in this appendix they are summarized, opportunely divided in the following table.

DEVICE	CONFIG.	FUNCTION
J1.1 J1.2 J1.3	2-3	Configure the serial line 0 on CN1,for the electrical standard RS 232
J1.4	2-3	Not connect the lithium battery to back up circuitry of Real Time Clock.
J2.1 J2.2 J2.3	2-3	Configure the serial line 1 on CN1, for the electrical standard RS 232
J2.4	2-3	Not connect the pin 37 of the Mini Module leaving the PD7 of microcontroller, and LD2, user manageable
JS1	Not connected	Reserved use
FLASH for Boot Loader	Firmware AVR Bootloader grifo(r)	At the beginning allow to communicate with a PC that run the proper AVR Bootloader grifo(r) to manage ISP programming of memories FLASH and EEPROM.
FLASH for user	Demo program	Perform the blinking of LEDs and communicate with a console on RS 232 serial set to 19200 Baud, 8 bit x chr, None parity, 1 Stop bit, None handshake
EEPROM	Calibration data	The last 8 byte of this memory are reserved for all calibration data and they can't be changed. Both the program application program and the ISP management have to save these bytes for the a good yield of the Mini Module
FRAM	None data	None FRAM location is non-volatile is used for paticular functiones and is all available for user
RTC	None data	The date, the time and the calibration of the Real Time Clock are not set

FIGURE C1: DEFAULT CONFIGURATION

Previous table can be reduced anymore by asserting that the product is supplied calibrated, with all the I/O lines free for user and ready for an RS 232 serial communication, with a physic protocol of 19200, 8, No, 1 , on serial line 0.

The **GMM AM1284** hasn't options that can be added in the order phase; as described in the SUPPORT CARDS chapter there are other boards suitable for direct Mini Module mounting, that allows an immediate use of all the available resources.

APPENDIX D: ISP AND JTAG PROGRAMMING

In this appendix are reported the specifical instructions to program **GMM AM1284** Mini Module using an external ISP or JTAG interface.
These programming method alternatie to that one reported in the section C of HOW TO START chapter of this manual.
By genarl way ISP means In System Programming, so indicates the possibility to program a device when is already installed in a muonted board.
In commerce there are a lot of different ISP and JTAG programmers for AVR and all of these have the common feature to connect the same microcontroller interfaces to a PC that perform the programming. All these programmers are very similar, but in the follow paragraphs are reìported the essential information to use them in according with **GMM AM1284**. If user needs more information for the selected programmer, he can find it in thedocumentation provided with the same pruduct.

AVR BOOTLOADER GRIFO(R)

AVR Bootloader grifo(r) meets the ISP mode developped by grifo® in order to programm the FLASH and the EEPROM of **GMM AM1284**, through a serial RS 232 connection between Mini Module and PC. In this appendix is not described the work of this modality because is already shown in the HOW TO START chapter: here are shown some important information for the using :

a) This modality is composed by a performed firmware on Mini Module and a software perfomed on PC, that communicate though a serial line with their protocol.
b) The **AVR Bootloader grifo(r)** firmare uses 2K Bytes of programm area, that reserve a block at the end of theFLASH memory of 1K Word, that is not available for user program. Then in this modality only 62K Bytes of available 64K are programmable.
c) The used resources are the serial line 0 (TX0 RS232 and RX0 RS232) that can be available for the user when **AVR Bootloader grifo(r)** is not in execution.
d) **AVR Bootloader grifo(r)** are performed only after a power on or a reset of Mini Module, if on the connected PC is executed software (in synchronization). In other words in normal use conditions this modality don't start and is executed the user program application.
e) The configuration fuses, that enable the same Bootloader, and the protection bits are non managed by **AVR Bootloader grifo(r)** and have to be programmed through the other ISP modalities.
f) **AVR Bootloader grifo(r)** can be performed by command line, in order to allow its integration in the IDE of development tools. The sintax tu use, with the options, is as follows:

AVRBootloaderGrifo.exe /comx /f<file per FLASH> /e<file per EEPROM>

where:

/comx	PC serial port used for communication (COM1÷COM16).
/f<file for FLASH>	Option that says the name complete with the path, of HEX file to write in the FLASH memory of microcontroller (code of application program).
/e<file for EEPROM>	Option that says the name complete with the path, of the HEX file to write in the EEPROM memory of microcontroller (data, parametrers of applicatio program).

For example the line:

AVRBootloaderGrifo.exe /com2 /fC:\Project\EngineControl\Main.hex

opern a connction on the serial port *COM2* and program the *Main.hex* file found in the *C:\Project\EngineControl* folder.

Thanks to the launch from command line,AVRBootloadergrifo(r) can be easily integratedand launched through an IDE, where the user can develop his application program. In this modeall the developping phases are managed by a PC program that meet the same IDE, making easy and taking low time.

For example the integration in the IDE of **BASCOM AVR**, there are with you open the window associated to *Options* | *Programmer* and to set it as shown in the following figure:

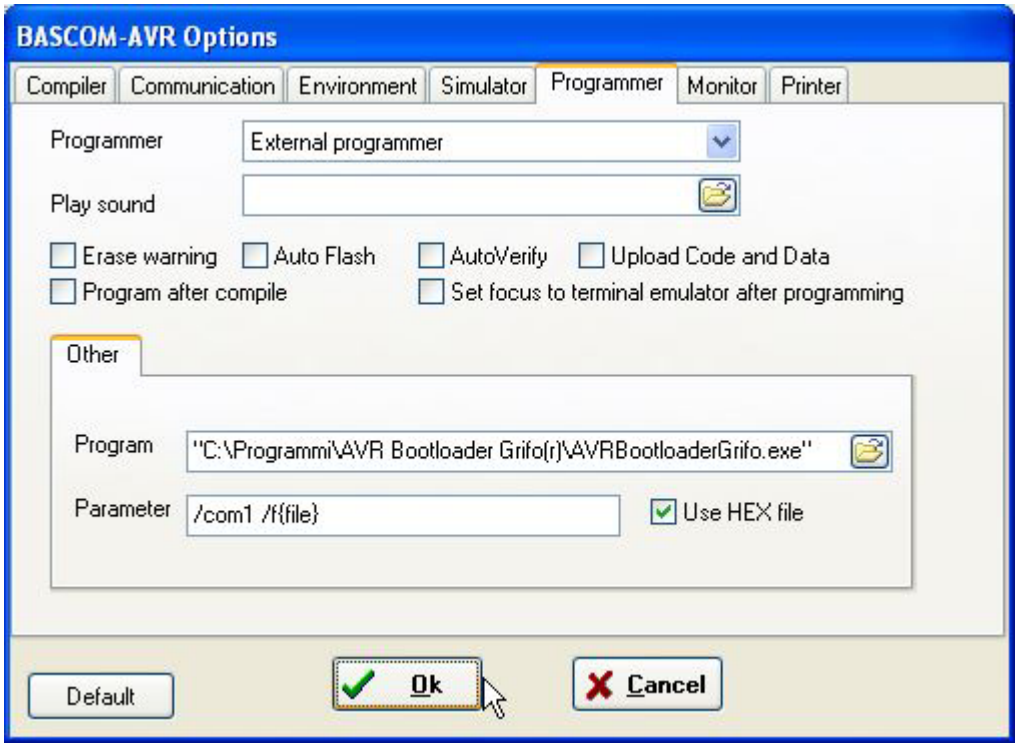


FIGURE D1: INTEGRATION AVR BOOTLOADER GRIFO(R) IN BASCOM AVR

L'indicazione *{file}* ed *Use HEX file* della finestra istruiscono il **BASCOM AVR** ad usare automaticamente il file HEX con nome corrispondente al sorgente che l'utente stà sviluppando. Una volta confermate le impostazioni con il tasto *Ok* e compilato il programma utente in modo da generare il file HEX con il codice eseguibile (si veda capitolo COME INIZIARE), per programmare tale codice nel Mini Modulo è sufficiente selezionare l'opzione *Program* | *Send to chip* o premere il tasto rapido *F4*. Subito dopo l'**AVR Bootloader grifo(r)** parte ed esegue il suo lavoro, rappresentando una finestra ridotta che riassume le operazioni eseguite, come illustrato nella seguente figura.

FIGURE D2: EXECUTION AVR BOOTLOADER GRIFO(R) TO COMMAND LINE

AVRISP MK II

The **AVRISP mk II** coincides with a converter between the ISP interface avalaible on the AVR microcontrollers and the USB interface on the PC, developed by **ATMEL**, which is able to program the FLASH, the EEPROM, the configuration fuses and the protection bits of **GMM AM1284**. In this paragraph is described the use of this interface and its features:

a) Install the **AVR Studio** management software on the PC. This software can be found on the cd supplied with the **AVRISP mk II** or it can be downloaded from the **ATMEL** site. In order to procede with the installation please follow the instructions shown on the monitor.

b) Connect the **AVRISP mk II** to a pc USB line, through the proper supplied cable.

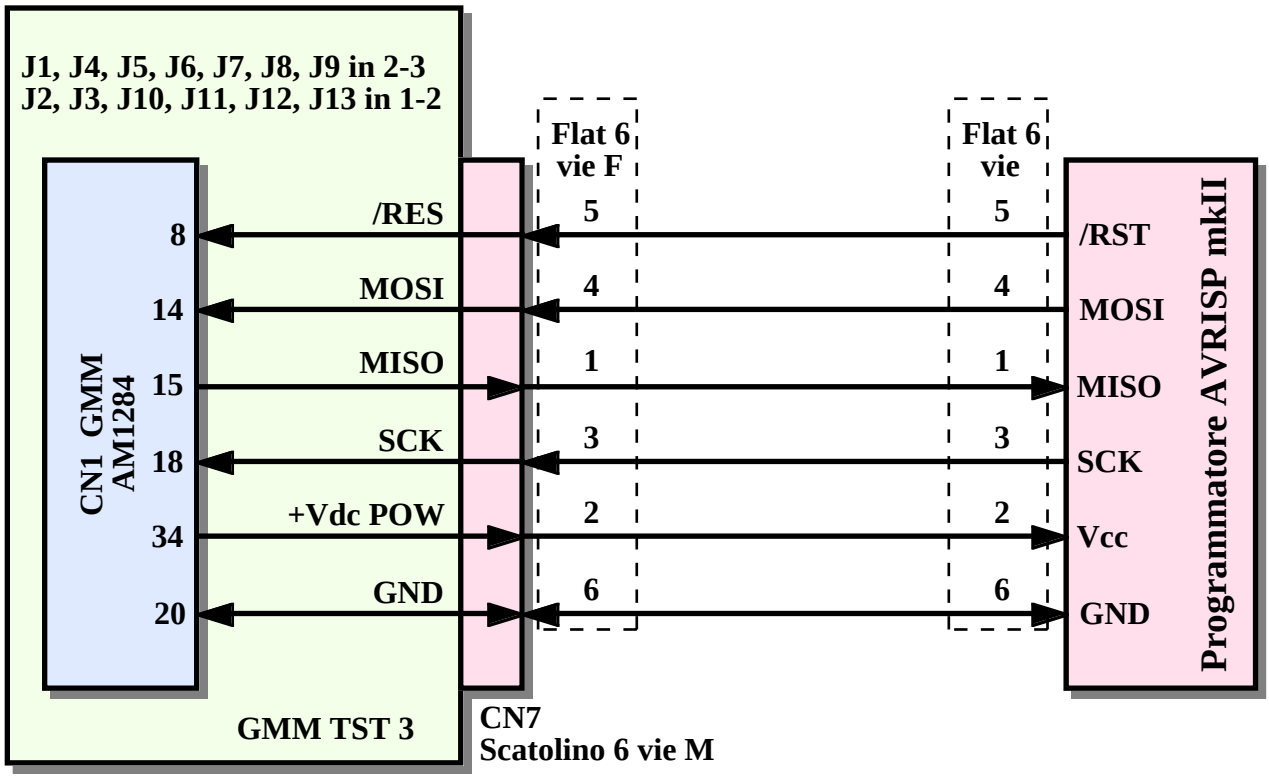


FIGURE D3: AVR ISP MK II CONNECTION

c) Connect the **AVRISP MK II** to the **ISP** interface of the **GMM AM1284**, making sure to connect the 6 signals of the same one, as you can see in the previous figure. If the user has got the **GMM TST 3** the connection is reduced to a six ways flat cable of the **AVRISP mk II**, directly insertedto the CN7 connector of the card, as you can see in the figure D3.

FIGURE D4: AVRISP MK II CONNECTED TO GMM TST3

d) As you can see in the figure D3, the ISP interface uses 4 signals of the Mini Mode and its electricity supply. For this reason, while the **AVRISP mk II** is used, the signals connected to the 8, 14, 15, 18 pins of the socket, can't be used by the user.

e) Turn on the Mini Mode and verify that both LEDS of the **AVRISP mk II** are on and green.

f) Launch the **AVR Studio** installed at point A and wait until it shows the maining screen. It is important to remember that the **AVR Studio** is a complete development environment and also a debug for all the AVR microcontrollers and it supports many interfaces and features so it is important for the user to examine its documentation in order to acquire enough knowledge, while in the following points are summarized only the operations to complete the ISP programmation with **AVRISP mk II**.

g) Allowing the connection with the AVRISP mk II by cicking the icon with the AVR chip and the writing Con; in the Select AVR Programmer choose the programmer, the USB connection and push the button Connect.

h) At this point a management **AVRISP mk II** windows shows up, this window is composed by many under windows. Naturally these windows can be configured by the user according to his needs. In the following points we can find the settings to program the **GMM AM1284** demo with, used in the chapter HOW TO START.

i) In the *main* window below, select the *AT mega1284P* microcontroller an *ISP frequency:125.0 KHz* and push the bottom *read signature* in order to verify that the programmer is working properly, as it is shown in the figure D5.

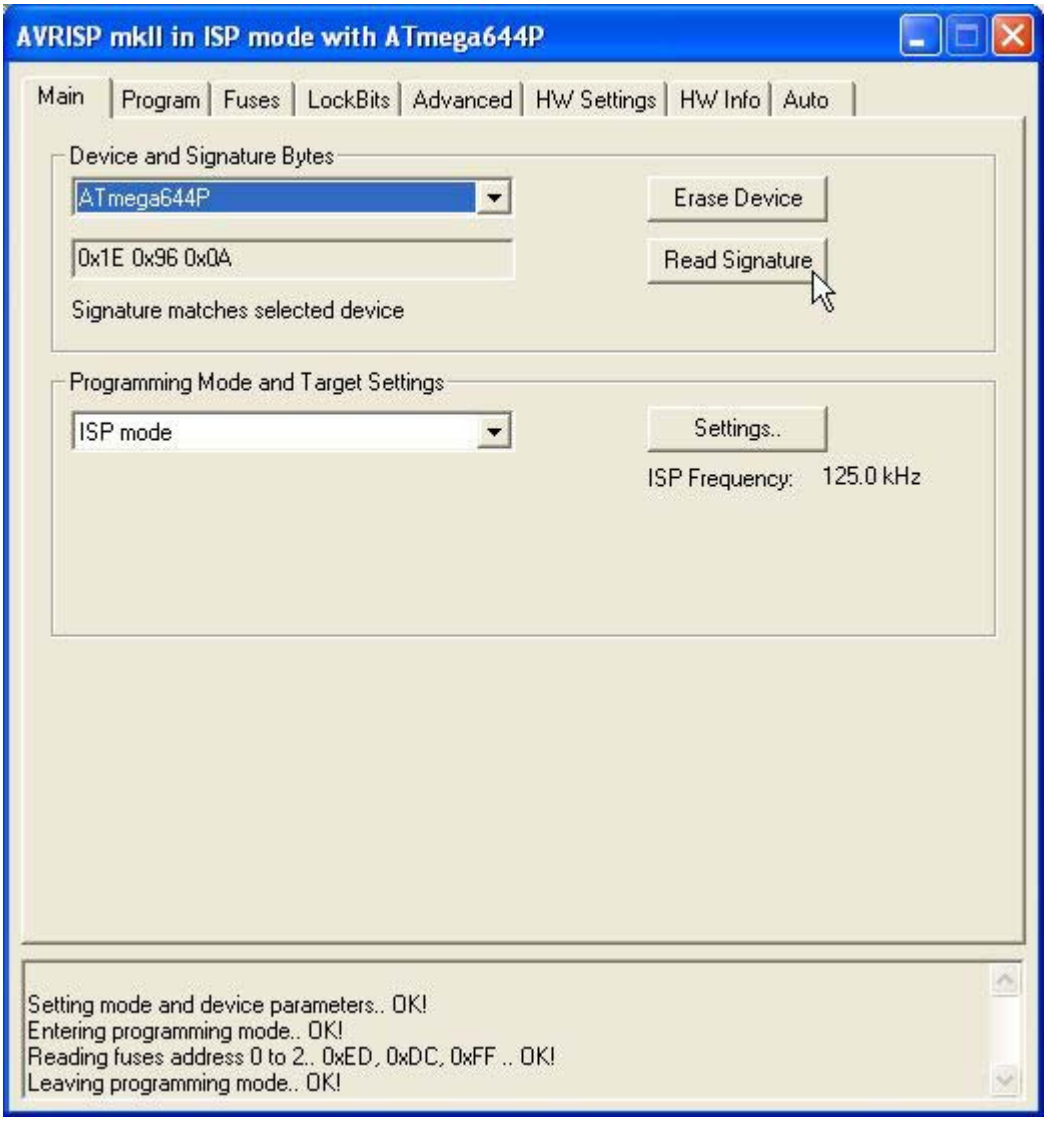


FIGURE D5: AVR STUDIO SETTINGS FOR AVRISP MK II (1 OF 4)

j) In the *Program* window please execute the settings reported in the figure D6 and select the HEX file to program in the FLASH.

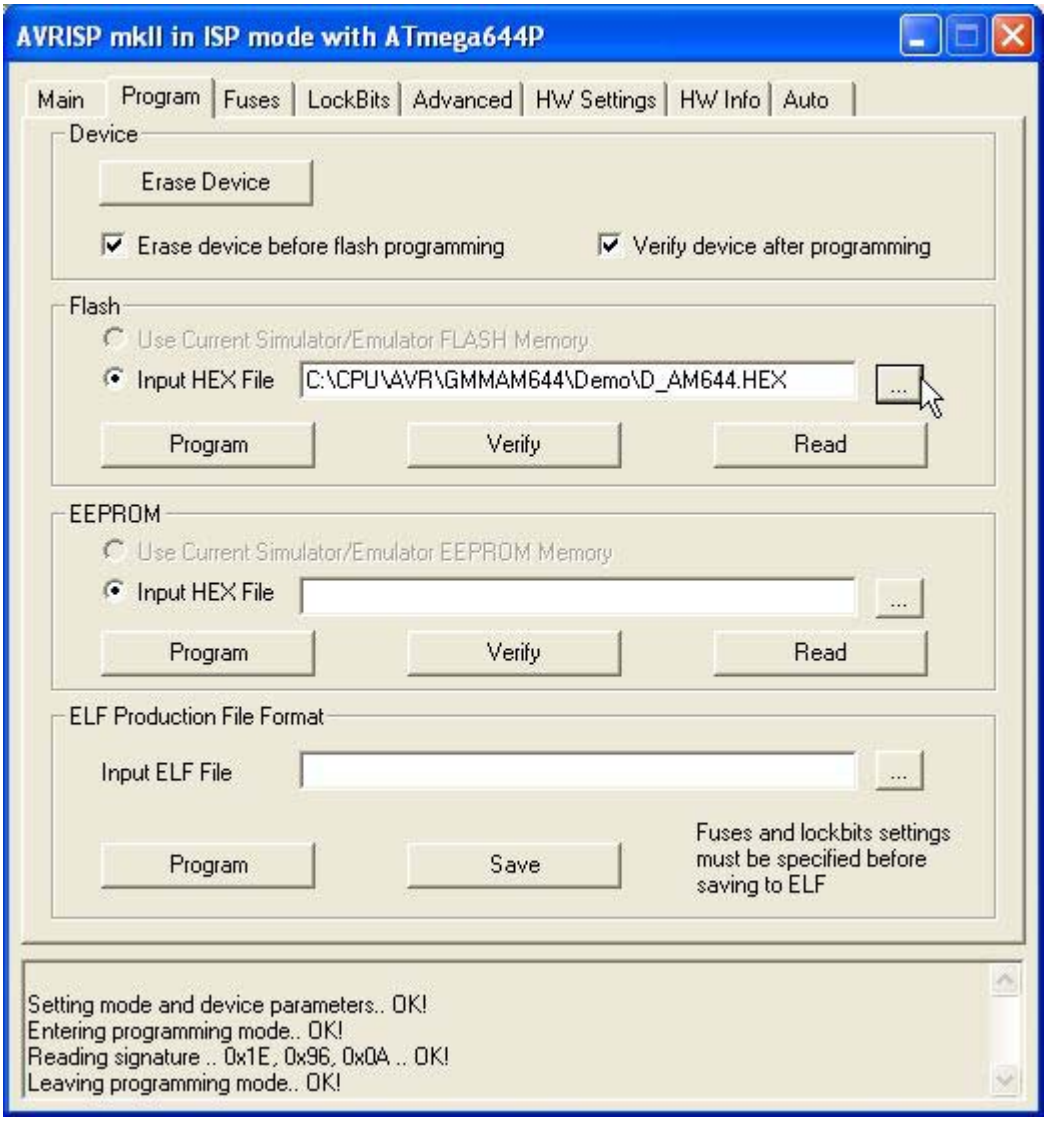


FIGURE D6: AVR STUDIO SETTINGS FOR AVRISP MK II (2 OF 4)

k) In the window *Fuses* set the configuration fuses according to the needs of the user application. It is important to remember that those fuses influence the functioning of the Mini Module and they must be set very carefully or the whole system could work not properly. The figure D7 shows the configuration that **grifo®** suggests for the demo of the **GMM AM1284**, while the other supplied one, enables the Bootloader with the fuse BOOTRST.

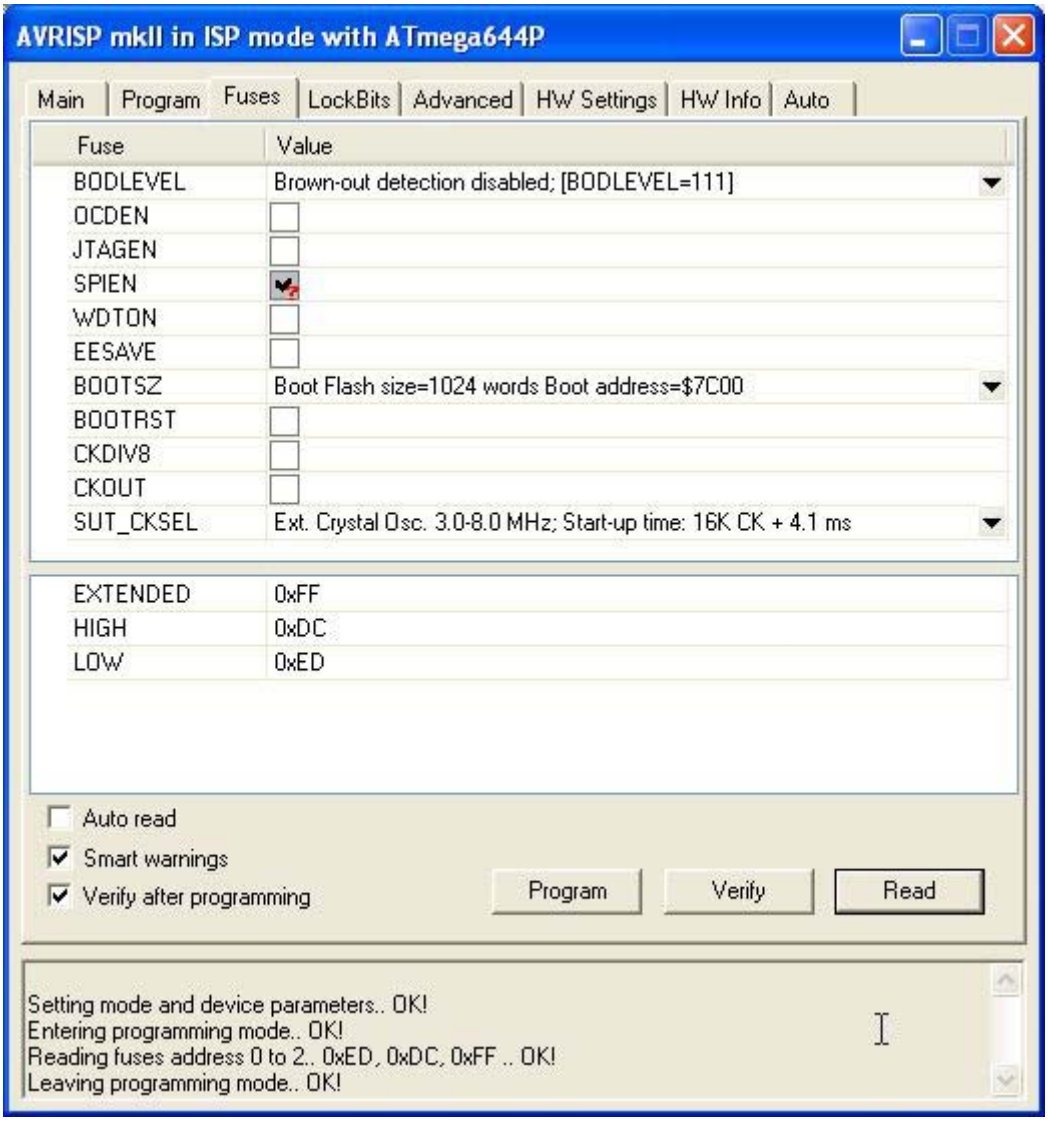


FIGURE D7: AVR STUDIO SETTINGS FOR AVRISP MK II (3 OF 4)

l) In the window Lockbits please set the protection bits according to the needs of the user application. The figure D8 reports a configuration without any protection, while that one supplied by **grifo®** protects the area of the FLASH which is reserved for the Bootloader.

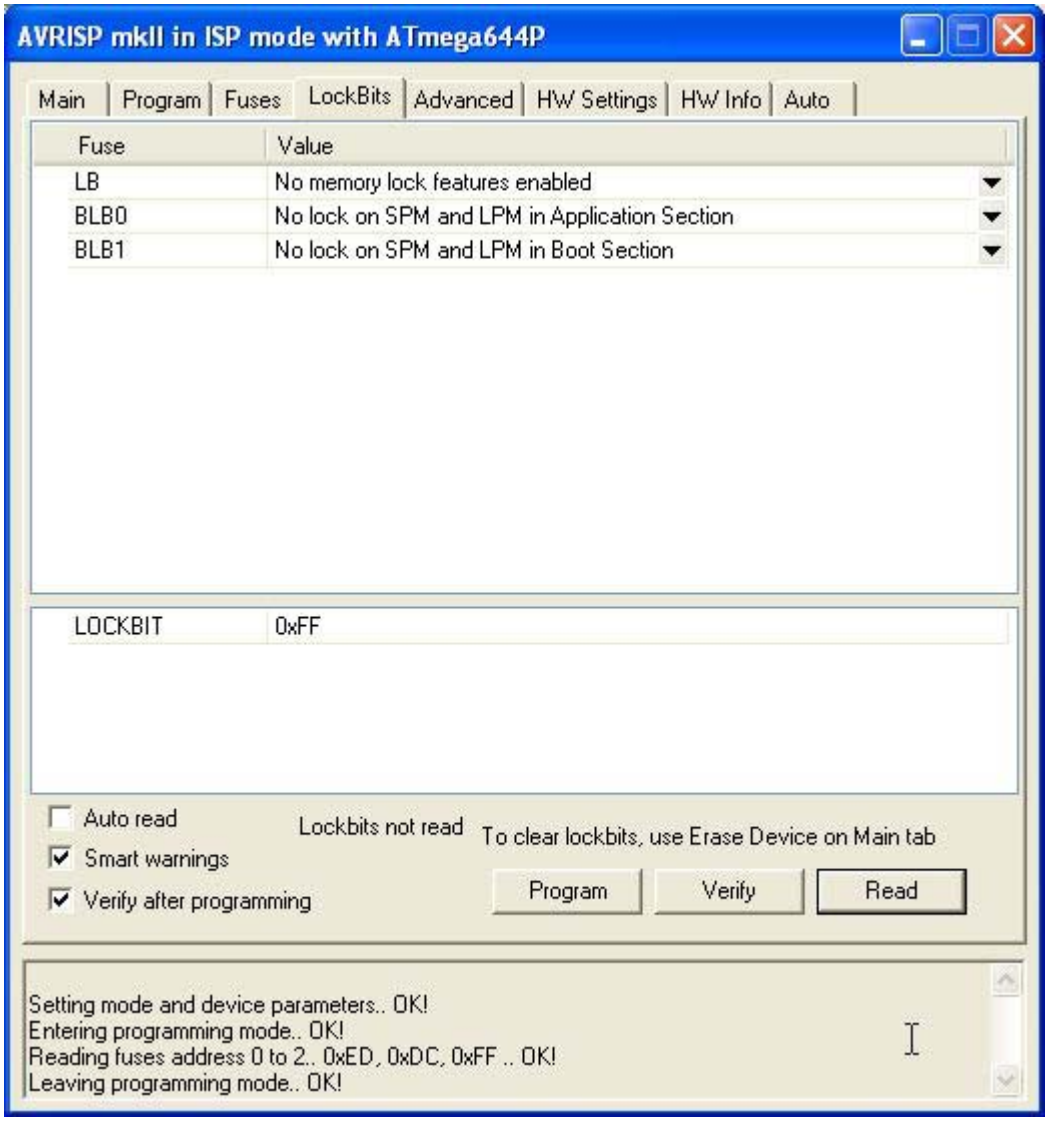


FIGURE D8: AVR STUDIO SETTINGS FOR AVRISP MK II (4 OF 4)

m) In the window Auto please select the operation to do for the ISP programmation with **AVRISP mk II**, in other words delete the device, program and verify the protection bits.
At this point it is very important to remember that by proceding with the ISP programmation, all the previous content of the FLASH will be lost for good and even the **AVR Bootloader grifo(r)**, supplied wit the Mini Module.
Start the programmation by keeping the Start button and check that in the lower part of the window all the operations keep going regularly, in other words that they are supported by the OK prompt, as it is shown in the figure D9. During the programmation the status LED of the **AVRISP mk II** turns into red and at the end, if any error occurred, it turns into green again.

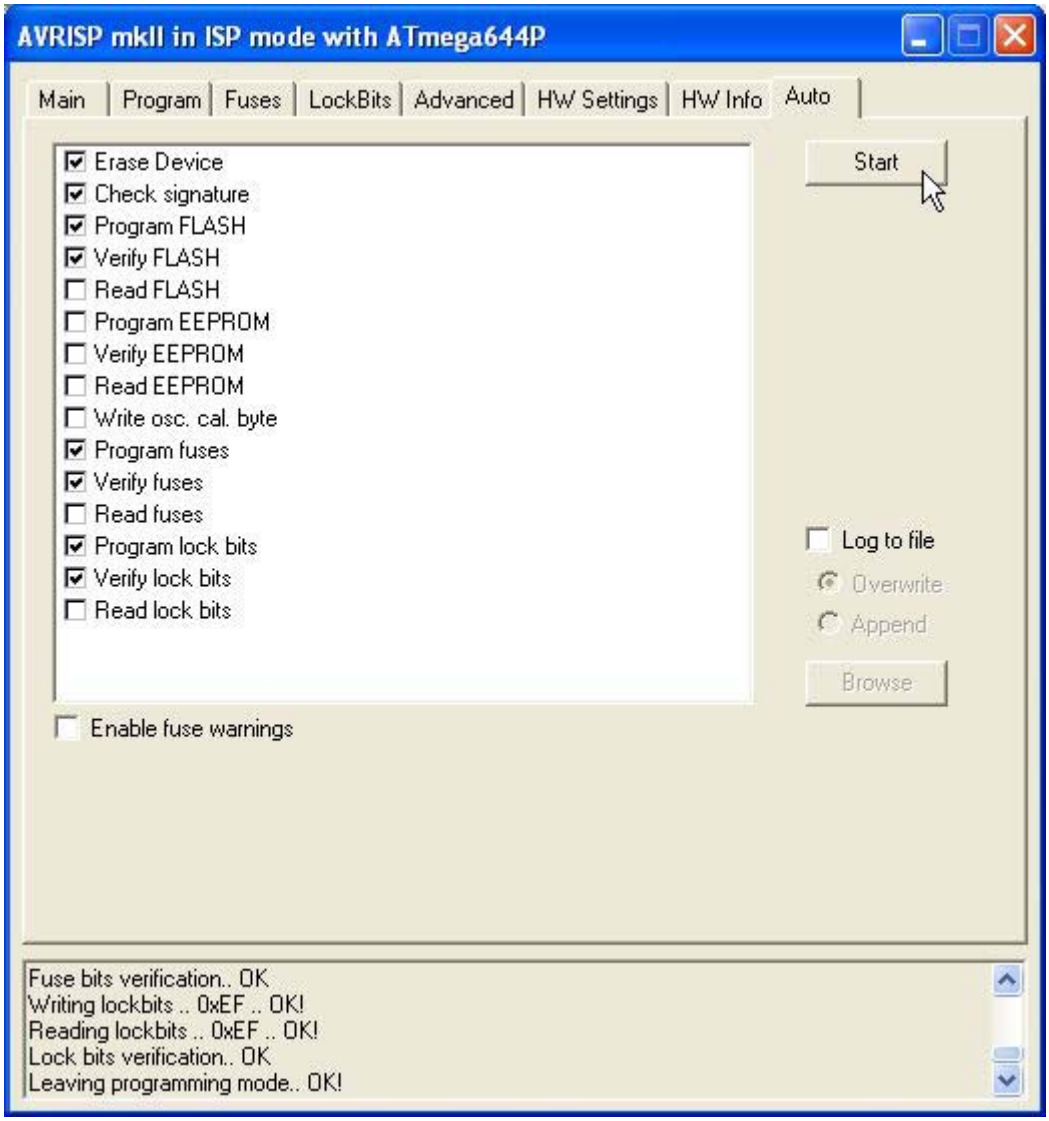


FIGURE D9: ISP PROGRAMMINGWITH AVRISP MK II

MP-AVR51/USB

The **MP-AVR51/USB** coincides with a programmer which is dedicated to the microcontrollers of the I51 and AVR families and to some memory devices.It is produced by **grifo®**. The programmer can be connected to the pc through an USB line, it is supplied with an ISP interface and it is able to program the FLASH and the EEPROM, the configuration fuses and the protection bits of the **GMM AM1284**. In this paragraph is described how to use this programmer and its features:

a) Install the **PG4UW** management software on the pc. This software can be supplied together with the **MP-AVR51/USB** or it can be downloaded for free from the **grifo®** sites. For the installation please follow the instructions introduced on the screen and in the enclosed documentation.

b) Turn the **MP-AVR51/USB** through the proper power pack.

c) Connect the **MP-AVR51/USB** to an USB line of the pc, through the proper cable.

FIGURE D10: MP-AVR51/USB PROGRAMMER

d) Connect the **MP-AVR51/USB** to the ISP interface of the **GMM AM 1284**,paying attention to connect the 6 signals of the same one, as you can see in the figure D11. If the user has a **GMM TST 3** the connection will happen on the CN7 connector, by interposing a proper wire adaptor which is able to adapt the two connectors provided with a different pin out. It also will have to configure the jumpers of the **GMM TST 3** properly, as you can see in the following
f figure.

e) As it is shown in the figure D11 the ISP interface uses 4 signals of the Mini Mode and its electricity supply. For this reason, during the use of the **MP-AVR51/USB** the signals connected to the pin 8, 14, 15, 18 of the socket can't be used by the user.

f) Launch the **PG4UW** which is already installed and wait until this shows its main screen. It is important to remember that the **PG4UW** is a complete management program for all the programmers by Grifo® which supports many devices, different options and windows. It is important then that the user examines its documentation in order to acquire enough knowledge about it. Naturally the program can be used according to the user's needs.In the followings points there are summarized only the operations and the settings used to complete the ISP programmation of the demo of the **GMM AM1284**, used in the chapter HOW TO START.

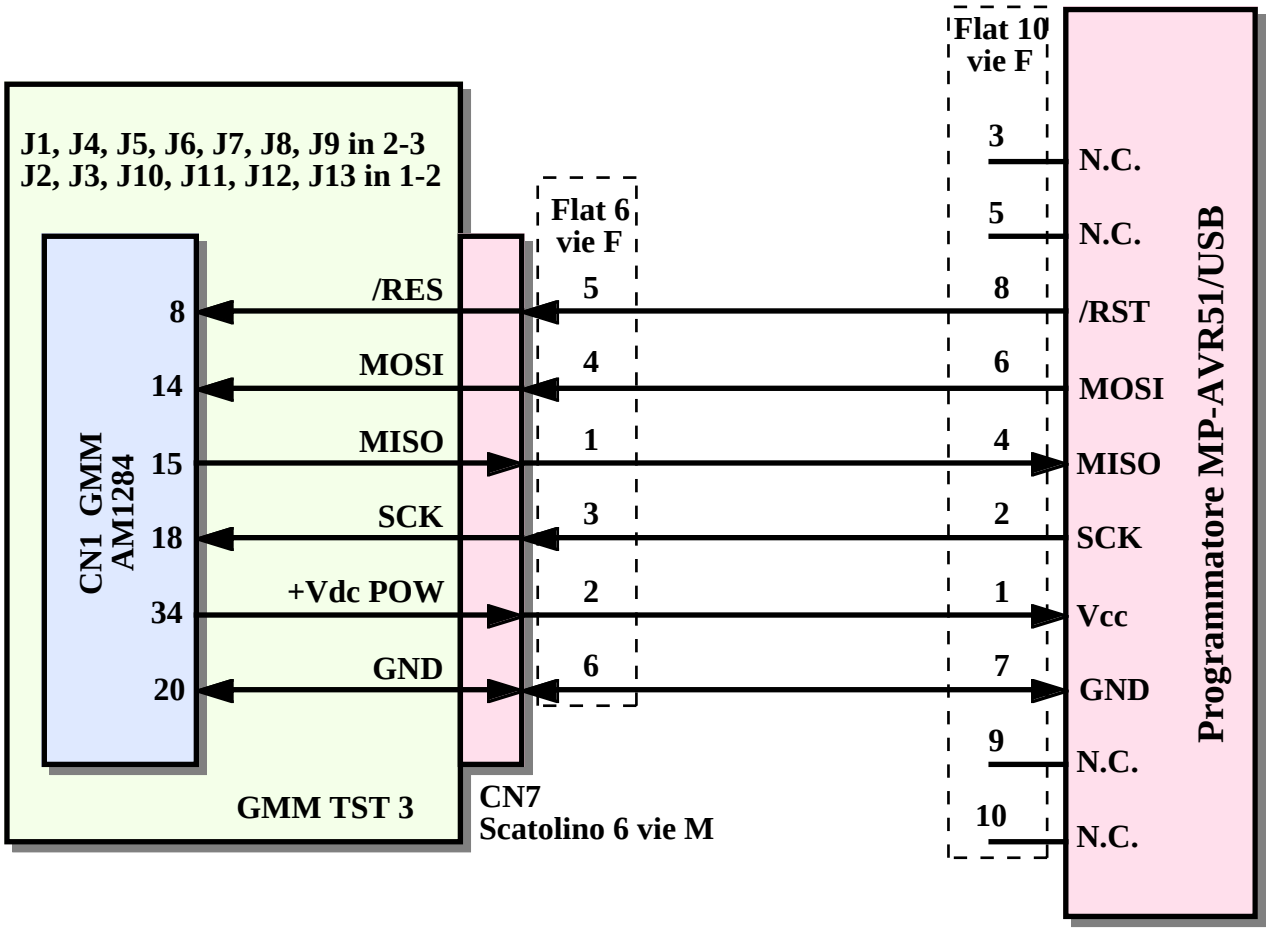


FIGURE D11: MP-AVR51/USB CONNECTION

g) Choose the *Component/Select component* menu and select the device that needs to be programmed, alias the *Atmega644P* in ISP mode, as it is shown in the figure D12.

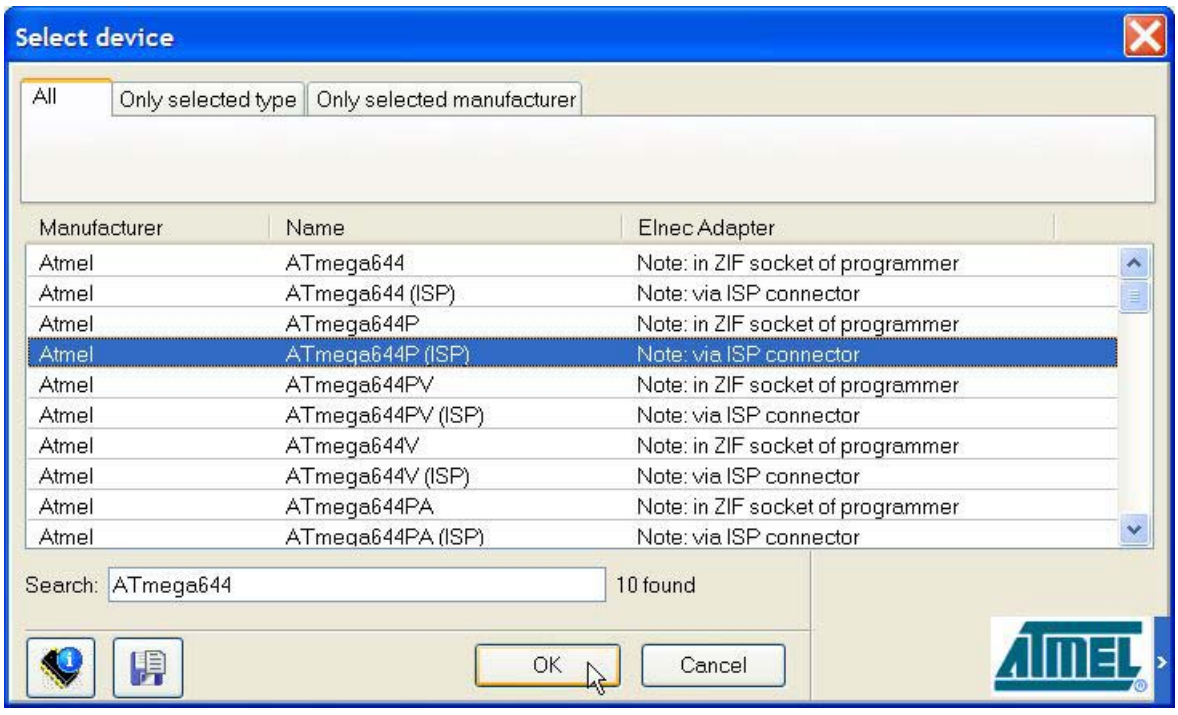


FIGURE D12: PG4UW DEVICE SELECTION

h) Load the HEX file to program in the FLASH through the proper dialogue window, opened with the menu *File/Load…*

i) Open the fuses and protection bits configuration window by pushing the couple of buttons *Alt+s* or by using the link or the icon that can be found in the main window of the **PG4UW**. Execute the settings requested by the user's application, remembering that they might influence the right functioning of the Mini Mode so they must be set by paying attention otherwise the whole system won't work properly. The figure D13 reports a setting which is valid for the card demo, without any protection. It is important to remember that the configuration supplied by **grifo®** is different because the Bootloader in FLASH and its protection are active.

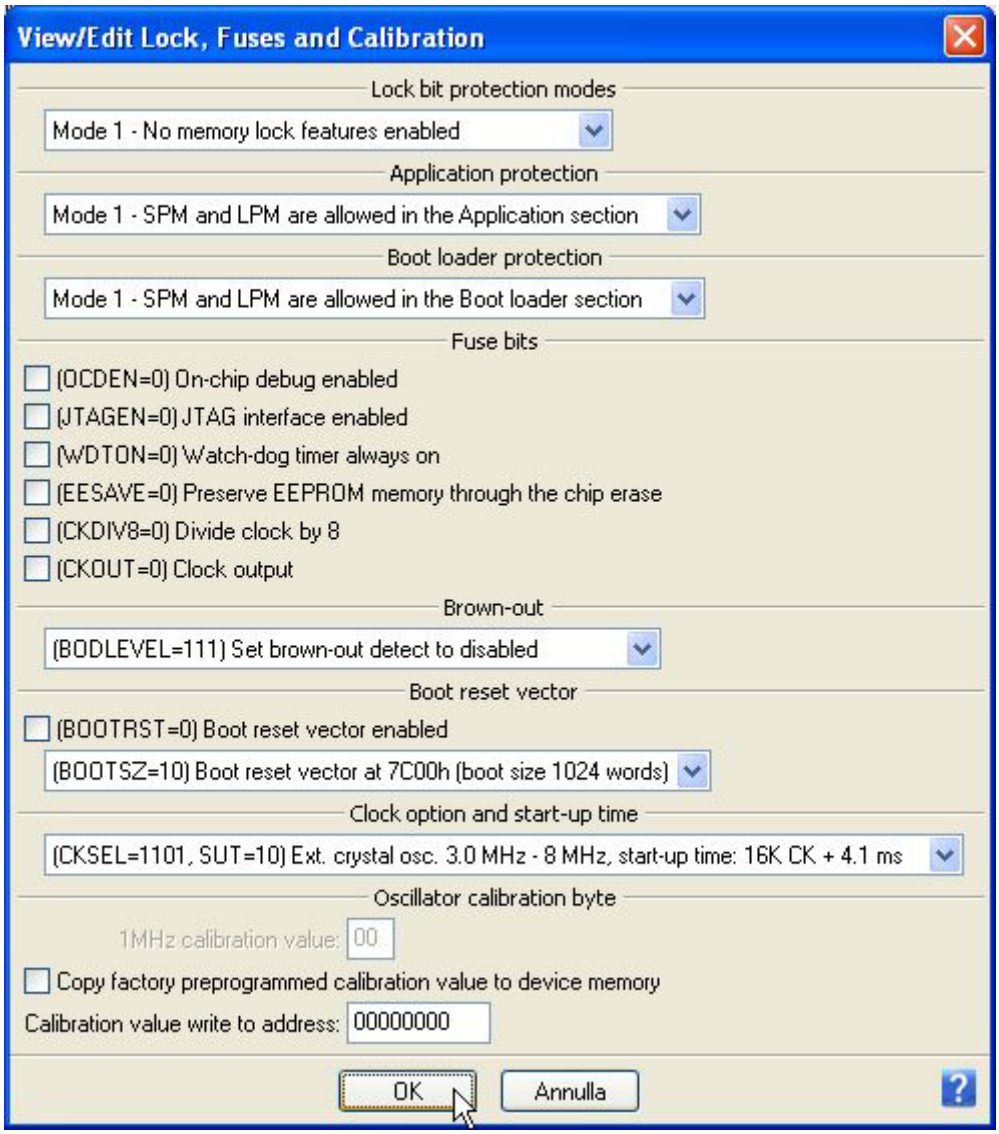


FIGURE D13: FUSES AND LOCK BITS SETTINGS WITH PG4UW

j) Open the operative options window with *Alt+O* or using the the icon in main window of **PG4UW**. In that window perform the the settings for user application, and remember that those ones are important for ISP connection and Mini Module working. Figure D14 shows a setting for demo execution where it erase the device, program and verify the FLASH, programm and verify the fuses, programm and verify the Lock bits..

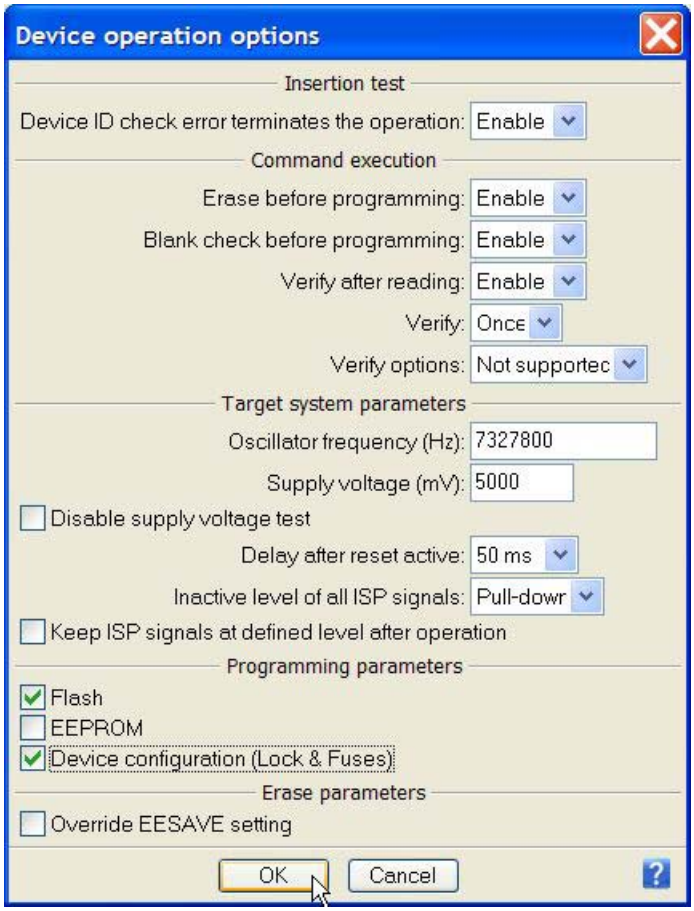


FIGURE D14: OPERATION OPTIONS SETTINGS WITH PG4UW

k) Provide the programming command through menu *Device* | *Program* or *F9* hot key or the proper icon. After that it compare another window that reports the performed settings at points i and j wher the user can check the the same ones. At this poin is important to remenber that do on with the ISP programming, the whole previous content of FLASH will be lost and the **AVR Bootloader grifo(r)** too.

l) Stop the programming through the *No button* or confirm it with *Yes*. In this last case there ais a window that ask to perform the ISP connection and to turn on the the system.

m) The ISP connection is already performed at point d, it is sufficient to provide power supply to Mini Module and press *OK*. At this point the performed operation start their progress. The user has to wait that the all operation are completed and has to checks if there was errors. During the programming the red LED *BUSY* (both on **MP-AVR51/USB** and in the progrmming window) are active and at the end, the disabled themselves and activate those green *GOOD*.

n) When the programming is complete a window with instruction window says to turn off the system, remove the ISP connection and ask for repeat the operation or not. The user can perform that operations and press *No* button.

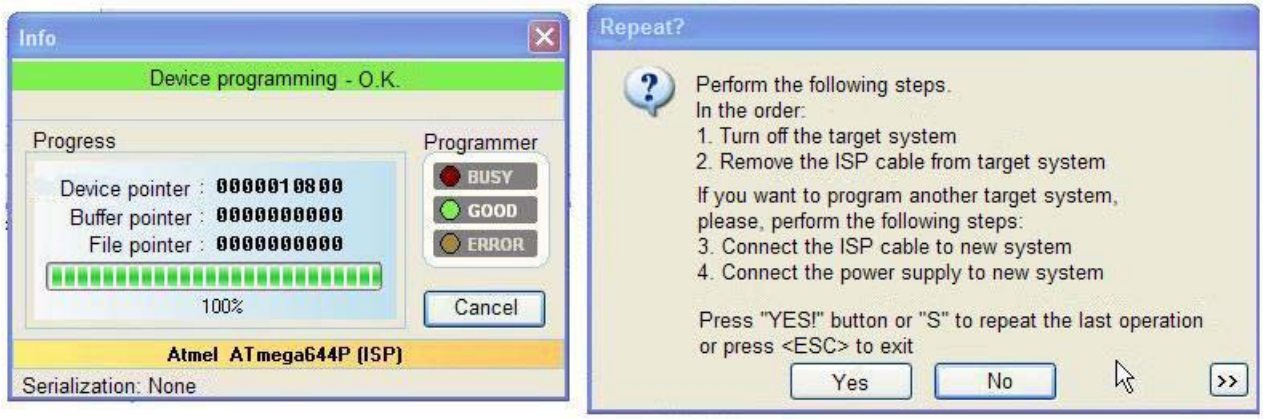


FIGURE D15: ISP PROGRAMMING WITH MP-AVR51/USB

JTAGICE MK II

The **GMMAM1284** Mini Module offers the JTAG interface that can be found on the already assembled microcontroller. The capabilities of this interface are many, especially in the development phase and adjustment of the applicative program, in fact:
-it allows to check directly the functioning on the application while this last one is working;
-it allows to examine the microcontroller status and its peripheral devices;
-it allows to insert breakpoint in the program and/or stop anytime the execution from the pc;
-when the execution is still it can examine the status of the internal registers, the memories, etc…
-it offers a full control on the execution of the code that it can be an instruction at time, with or without any entries in the procedures, to the cursor, etc.;
-it can program the code in the FLASH of the microcontroller;
-it is easy to use thanks to its interface in color,avalaible on the PC, that makes it easy, fast and intuitive;
-when the code is generate by a high level compiler, able to generate the symbolic files, the program can be debugged to the source level: every previous possibility is directily applied on the program which is written in C or BASIC.

FIGURE D16: JTAGICE MK II

In other words the JTAG interface offers the same performances of a hardware InCircuit Emulator (ICE) with unquestionable use simplifications and with the same reduction of time of development of the final applicative.
The **JTAGICE mk II**, developed by **ATMEL**, coincides with a converter between the JTAG interface avalaible on the AVR microcontrollers and the USB interface, present on the PC and it can execute all the operations above mentioned on the **GMM AM1284**. In this paragraph is described the use of this interface and its features:

a) Install the **AVR Studio** management software on the pc. This software is found on the CD supplied together to the **JTAGICE** mk II or it can be downloaded from the **ATMEL** site. To install please follow the instructions on the screen.

b) Connect the **JTAGICE mk II** to an USB line of the PC through the proper cable.

c) The JTAG interface on the AVR microcontrollers can be activated through a couple configuration fuses . In the GMM AM1284 basic configuration, that interface is disabled in order to leave the corresponding Mini Module line for user applications. Before to go on, that fuses have to be set through the ISP programming. Fortunately **JTAGICE mk II** supports this one too, through a proper adapter cable provided in its box. The user can follow the indication reported in the previous paragraph ATMEL AVRISP mk II simply selecting **JTAGICE mk II** at point g of that paragraph.

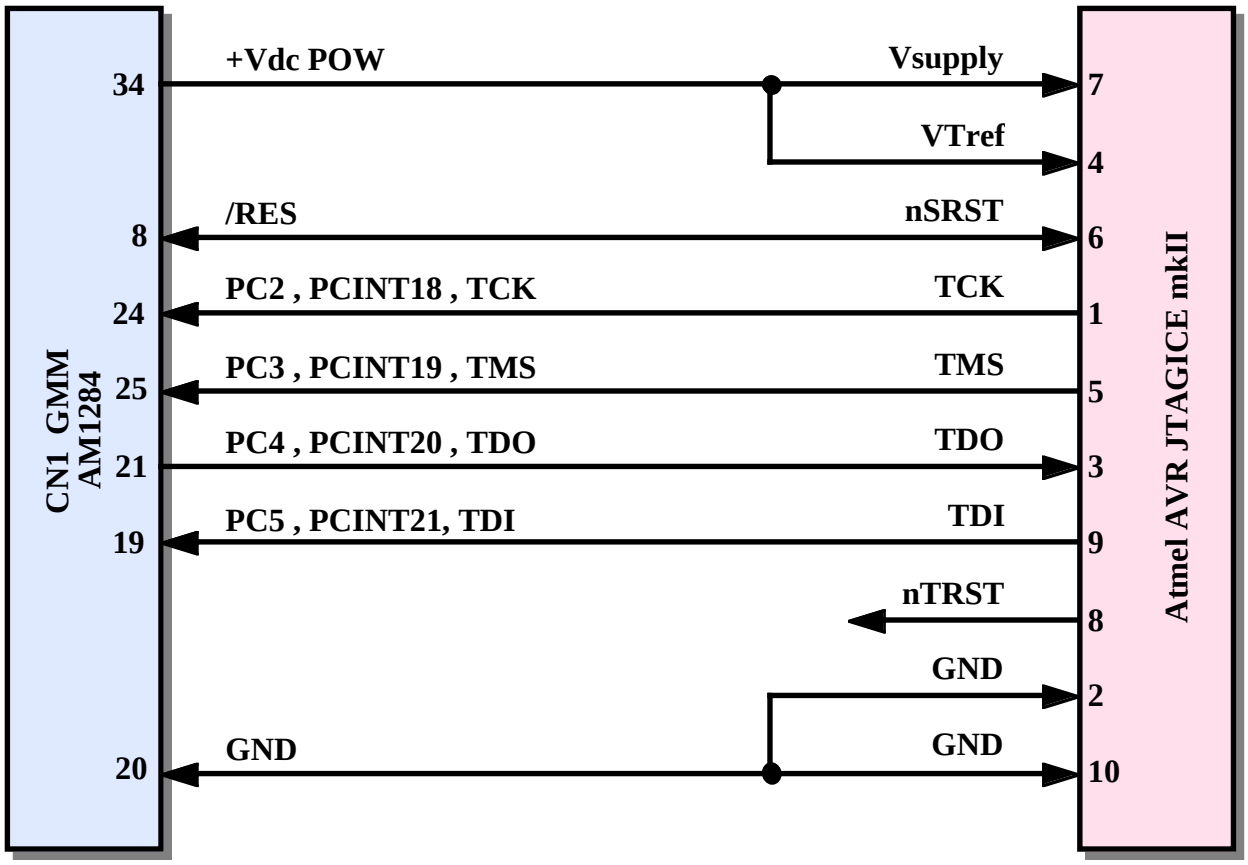


FIGURE D17: JTAGICE MK II CONNECTION

d) Remove the ISP connection and connect the **JTAGICE mk II** to JTAG of **GMM AM1284**, connecting the 7 segnals, as shew in previous figure.
The connection is on CN1 connector, by put a proper signal adapter, that make a communication between the two connectors.

e) As reported in figure D17, the JTAG interface uses 5 signals and the power supply. So during the uso of **JTAGICE mk II** the signals connected to pin8 (/RES), 19 (TDI), 21 (TDO), 24 (TCK), 25 (TMS) of the socket, can't be used by user. We remind that for using this signals in applications, the user has to remove the **JTAGICE mk II**, and has to disable the microcontroller interface of microcontroller enabled at point c.

f) Turn on the **JTAGICE mk II** and wait for some seconds, so switch on the Mini Mode and verify that both LEDS of the **JTAGICE mk II** are on red those right and green at left.

g) Launch the **AVR Studio** installed at point a and wait until it shows the maining screen. It is important to remember that the **AVR Studio** is a complete development environment and also a debug for all the AVR microcontrollers and it supports many interfaces and features so it is important for the user to examine its documentation in order to acquire enough knowledge, while in the following points are summarized only the operations to complete the ISP programmation with **JTAGICE mk II**. These operation are very similar at those saw for the **AVRISP mk II**, and the figure of the program too.

h) Allowing the connection with the **JTAGICE mk II** by clicking the icon with the AVR chip and the writing *Con*; in the *Select AVR Programmer* choose the programmer, the USB connection and push the button *Connect*. In this phase the red right LED is disabled, and the internal green LED is enabled, near the connectors.

i) At this point a management **JTAGICE mk II** windows shows up, this window is composed by many under windows. Naturally these windows can be configured by the user according to his needs. In the following points we can find the settings to program the **GMM AM1284** demo with, used in the chapter HOW TO START.

j) In the *Main* window below, select the *AT mega1284P* microcontroller and *JTAG mode* connection and push the bottom *read signature* in order to verify that the programmer is working properly, as it is shown in the figure D18.

k) In the *Program* window please execute the settings reported in the figure D6 and select the HEX file to program in the FLASH.

l) In the window *Fuses* set the configuration fuses according to the needs of the user application. It is important to remember that those fuses influence the functioning of the Mini Module and they must be set very carefully or the whole system could work not properly. The figure D7 shows the configuration that **grifo®** suggests for the **JTAGICE mk II**, while the other supplied one, enables the *OCDEN* and *JTAGEN* items. That provided from **grifo®** don't enable this intefacebut the Bootloader with BOOTRST fuse.

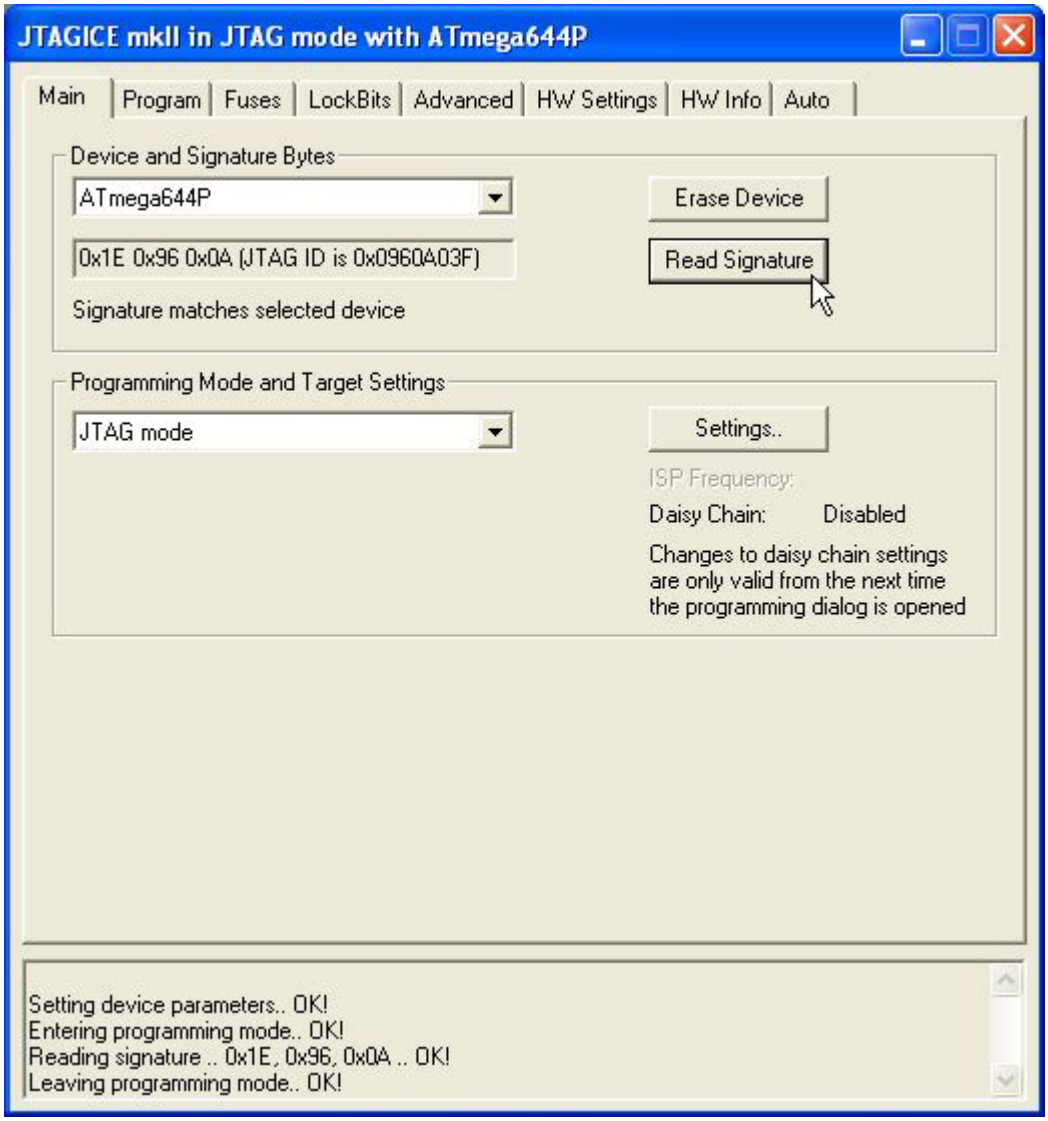


FIGURE D18: AVR STUDIO SETTINGS FOR JTAGICE MK II

m) In the window Lockbits please set the protection bits according to the needs of the user application. The figure D8 reports a configuration without any protection, while that one supplied by **grifo®** protects the area of the FLASH which is reserved for the

n) In the window Auto please select the operation to do for the ISP programmation with **JTAGICE mk II**, in other words delete the device, program and verify the protection bits. At this point it is very important to remember that by proceding with the ISP programmation, all the previous content of the FLASH will be lost for good and even the **AVR Bootloader grifo(r)**, supplied wit the Mini Module.
Start the programmation by keeping the Start button and check that in the lower part of the window all the operations keep going regularly, in other words that they are supported by the *OK* prompt, as it is shown in the figure D9. During the programmation the status LED of the **JTAGICE mk II** turns into green and at the end, if any error occurred, it turn off.

The FLASH programming with JTAGICE mk II can be realized opening a debug project through AVR Studio and uploading the code to try. If the uploaded file is .HEX, the debug is realized through assembly instructions, when if this file is .COF the debug is symbolic and through a source. This modality is described in the documentation of both the products and is reported in this APPENDIX; if the user needs further information can contact directly the grifo® .

FIGURE D19: DEBUG WINDOW WITH AVR STUDIO AND JTAGICE MK II

PONYPROG

The **PonyProg** coincides with a programmer which is dedicated to the microcontrollers of the PIC and AVR families and to some memory devices.It is produced by **LANCOS**. The programmer can be connected to the pc through a RS 232 line, it is supplied with an ISP interface and it is able to program the FLASH and the EEPROM, the configuration fuses and the protection bits of the **GMM AM1284**. In the **GMM TST 3** support board there are a proper connector and a proper interfacing circuitry that allows to program devices through a comfortable PC program.

FIGURE D20: PONYPROG LOGO

In this appendix has been not described the using of this programmer and we suggest to users to proper using documentation or to grifo® technical support.

APPENDIX E: ALPHABETICAL INDEX

Symbols

A

B

C

D

E

F

I

J

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M

O

P

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R

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T

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W