GMB HR168  
Housing Relay - 16 Opto In, 8 Outputs  
GMM 4620  
grifo® Mini Module PIC18LF4620

TECHNICAL MANUAL

Modular plastic Container DIN 50022 Modulbox, model M6 HC53; front 90 x 106 mm, height 58 mm; mounting on Omega rail DIN 46277-1 and DIN 46277-3; GMM4620 included in delivery; 16 Optocoupled Inputs that can be both NPN or PNP; status of 16 inputs shown by 16 LEDs; two inputs can perform Interrupt functions; two inputs can perform Counter functions; 8 Relay Outputs 5 A; status of 8 outputs shown by 8 LEDs; Serial Line in RS 232, RS 422, RS 485, current loop or TTL; 1 analog signal for A/D conversion with selectable full range; all signals can be connected through connectors featuring Normalized pin out; up to 4 I/O TTL signals; PC BUS available on connector for external devices; Real Time Clock capable to manage day, month, year, weekday, hours, minutes, seconds and to generate periodic interrupts; 240 bytes of SRAM for configuration parameters; RTC and SRAM backed by on board Lithium battery and driven by hardware PC BUS line; 1 TTL open drain interrupt output driven by RTC and visualized by a specific LED; Switching power supply on board; protection of on board logic, through TransZorb; power supply in DC or in AC: 10 ÷ 40 Vdc or 8÷24 Vac for logic supply; possibility to manage internal FLASH and EEPROM in In System Programming mode; free software for PC, downloadable from Microchip web site, to support ISP programming upload the generated code into on-board FLASH memory; wide range of development software available: C Compilers (HI Tech C PIC 18); BASIC Compilers (mikroBasic, PIC BASIC PRO); PASCAL Compilers (mikroPascal); etc.; several demo programs and use examples provided as source code completely commented available for every development structure.
IMPORTANT

Although all the information contained herein have been carefully verified, grifo® assumes no responsibility 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

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INTRODUCTION

The use of these devices has turned - IN EXCLUSIVE WAY - to specialized personnel. This device is not a safe component as defined in directive 98-37/CE.

Pins of Mini Module are not provided with any kind of ESD protection. They are connected directly to their respective pins of microcontroller. Mini Module is affected by electrostatic discharges. Personnel who handles Mini Modules is invited to take all necessary precautions to avoid possible damages caused by electrostatic discharges.

The purpose of this handbook is to give the necessary information to the cognizant and sure use of the products. They are the result of a continual and systematic elaboration of data and technical tests saved and validated from the manufacturer, related to the inside modes of certainty and quality of the information.

The reported data are destined- IN EXCLUSIVE WAY- to specialized users, that can interact with the devices in safety conditions for the persons, for the machine and for the enviroment, impersonating an elementary diagnostic of breakdowns and of malfunction conditions by performing simple functional verify operations , in the height respect of the actual safety and health norms.

The informations for the installation, the assemblage, the dismantlement, the handling, the adjustment, the reparation and the contingent accessories, devices etc. installation are destined - and then executable - always and in exclusive way from specialized warned and educated personnel, or directly from the TECHNICAL AUTHORIZED ASSISTANCE, in the height respect of the manufacturer recommendations and the actual safety and health norms.

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

To be on good terms with the products, is necessary guarantee legibility and conservation of the manual, also for future references. In case of deterioration or more easily for technical updates, consult the AUTHORIZED TECHNICAL ASSISTANCE directly.
To prevent problems during card utilization, it is a good practice to read carefully all the informations of this manual. After this reading, the user can use the general index and the alphabetical index, respectively at the beginning and at the end of the manual, to find information in a faster and more easy way.
CARD VERSION

The present handbook is reported to the **GMB HR168** card release **110104** and **GMM 4620** card release **120304**.

The validity of the bring informations is subordinate to the number of the card release.

**Figure 1**: Position of card release of GMM 4620 and GMB HR168
GENERAL INFORMATION

GMB HR168 & GMM 4620 is a module for DIN rail with a Mini Module CPU type GMM 4620 already installed.

The board features 16 galvanically isolated inputs and 8 relays outputs with LEDs visualizations; an asynchronous serial line; an FC BUS serial line; an analog input for A/D converter; a PWM output; up to 4 I/O TTL; a Real Time Clock (RTC) featuring date and time, capable to generate periodic interrupts and provided with 240 bytes of SRAM backed up through a Lithium battery.

Its rank is low cost controller, that can work as intelligent peripheral in autonomy and/or remoted inside a wider telecontrol/teleacquisition network.

The union GMB HR168 & GMM 4620 is provided with a standard plastic container with clamps for common Omega rails that can be found in any electric panel.

Low cost of this interface and CPU Mini Modules allow to build with great profit a series of low budget automation systems.

It is possible to create complete applications in short times and minumum costs by taking advantage of software development tools, like mikroBASIC and PIC BASIC PRO, unexpensive and portable, C compilers HI Tech C PIC 18, or mikroPascal, a PASCAL compiler all available from grifo®.

The union is provided with a set of comfortable connectors that can be easily linked to the signals of the field without any additional module, so there is no additional cost.

Such connectors easy also update and assistance phases, that can be needed in time.

- Modular plastic Container DIN 50022 Modulbox, model M6 HC53
- Front 90 x 106 mm, height 58 mm
- Mounting on Omega rail DIN 46277-1 and DIN 46277-3
- GMM 4620 included in delivery
- 16 Optocoupled Inputs that can be both NPN or PNP
- Status of 16 inputs shown by 16 LEDs
- Two inputs can perform Interrupt functions
- Two inputs can perform Counter functions
- 8 Relay Outputs 5 A
- Status of 8 outputs shown by 8 LEDs
- Serial Line in RS 232, RS 422, RS 485, current loop or TTL
- 1 analog signal for A/D conversion with selectable full range
- All signals can be connected through connectors featuring Normalized pin out
- Up to 4 I/O TTL signals
- FC BUS available on connector for external devices
- FC BUS Real Time Clock capable to manage date, time and to generate periodic interrupts, also featuring 240 bytes of SRAM backed by on board Lithium battery
- 1 TTL open drain interrupt output driven by RTC and visualized by a specific LED
- Switching power supply on board
- Protection of on board logic, through TransZorb
- Power supply in DC or in AC: 10 ÷ 40 Vdc or 8÷24 Vac for logic supply
- Possibility to manage internal FLASH and EEPROM in In System Programming mode
- Free software for PC, downloadable from Microchip web site, to support ISP programming upload the generated code into on-board FLASH memory
- Wide range of development software available: C Compilers (HI Tech C PIC 18); BASIC Compilers (mikroBasic, PIC BASIC PRO); PASCAL Compilers (mikroPascal); etc.
- Several demo programs and use examples provided as source code completely commented available for every development structure
**Figure 2: Blocks diagram**

- **CN1**: 8 Input Lines
- **CN2**: 8 Input Lines
- **CN5**: Power Supply
- **CN6**: Serial Line
- **CN7**: PWM, A/D, I/O, etc.
- **CN8**: I2C Bus
- **CN3**: 6 Outputs
- **CN4**: 2 Outputs
- **CN8**: I2C Bus
- **CN7**: PWM, A/D, I/O, etc.
- **RTC**: Real-Time Clock
- **SRAM**: Synchronous Random Access Memory
- **Lithium Battery**: +5 Vdc
- **Opto Couplers**: Optocouplers
- **Power Supply Sections**: Power Supply Sections
- **Serial Buffers**: Serial Buffers
- **Multiplexers**: Multiplexers
- **CPU**: PIC18LF4620
- **A/D Converter**: Analog-to-Digital Converter
- **CCP**: Capture/Compare/PWM
- **Port I/O**: Port Input/Output
- **Timer/COUNTER**: Timer/Counter
- **UART**: Universal Asynchronous Receiver Transmitter
- **64 KB Flash**: 64 Kilobytes Flash Memory
- **3986 B RAM**: 3986 Bytes RAM
- **1024 B EEPROM**: 1024 Bytes EEPROM

**GMB HR168 & GMM 4620** Rel. 5.00
Here follows a description of the board's sections and the operations they perform. To easily locate such section on verify their connections please refer to figure 2.

ANALOG INPUT

One analog input is available on pin 8 of connector CN7 (input signal AN4). When using the analog input, voltage reference source must be the internal Vdd and Vss source. For further information please refer to manual GMB HR168.

OPTOCOUPLED DIGITAL INPUT LINES

The card features 16 NPN/PNP inputs connected to two quick release screw terminal connectors and visualized by specific LEDs. Optocoupled inputs are supplied by a specific external voltage called +Vopto that the user must provide. For further information please refer to manual GMB HR168.

DIGITAL RELAYS OUTPUTS

The board is provided with 8 relays outputs 5 A, normally open, whose status is visualized by 8 LEDs. Each line is driven directly by a signal of GMM 4620, buffered through a specific driver and connected to a comfortable quick release screw terminal connector to easy interface to the field signals. For further information please refer to manuals GMB HR168 and GMM 4620.

I/O TTL SIGNALS

GMB HR168 features up to 4 digital I/O TTL signals of GMM 4620 connected to a specific connector (CN7). For further information please refer to manuals GMB HR168 and GMM 4620.
FIGURE 3: SNAPSHOT OF GMB HR168 AND MINI MODULE GMM 4620
I²C BUS LINES

GMB HR168 is provided with one connector (CN8) dedicated to I²C BUS, a hardware peripheral of the microcontroller, connected to two signals of GMM 4620 (RC4 and RC3), each provided with a 4.7 kΩ pull-up installed on GMB HR168. This kind of interface allows to connect devices featuring the same communication standard, to easily improve the system performances.

A wide set of software examples explains the management of most common I²C BUS peripherals like A/D and D/A converters, display drivers, memories, temperature sensors, etc.

For this purpose it can be interesting to consider K51-AVR, for which both technical manual and electric diagram are available, also a wide set of examples in several languages are available.

GMB HR168 & GMM 4620 feature a Real Time Clock provided with 240 bytes of SRAM already installed and backed by a Lithium battery; slave address A0H is already taken by this peripheral, eventual third part hardware cannot use it.

For further information please refer to manuals GMB HR168 and GMM 4620.

POWER SUPPLY SECTION

GMB HR168 is provided with two power supply sections, galvanically isolated. First section includes connectors CN5, pin 3 and 4, and provides supply voltages for GMB HR168. In detail this switching section generates +5 Vdc voltage needed by logic and output circuits.

A second section is present, includes CN5 (pin 1 and 2), is independent and galvanically isolated from the first one, and generates the rectified and levelled voltage \( V_{opto} \), to supply optocouplers of inputs.

The board features components and circuits designed to reduce consumptions and to reduce noise sensibility.

Remarkable is protection circuit on CN5.3 and CN5.4 based on TransZorb™ that avoids damages due to incorrect voltages.

For further information please refer to chapter “ELECTRIC FEATURES” and paragraph “SUPPLY VOLTAGES”.
SERIAL COMMUNICATION

GMB HR168 features one AMP MODU II 2x4 P/N 280365 dedicated connector (CN6) for serial communication.
By hardware it is possible to select the electric protocol, through a comfortable set of jumpers and drivers to install.
In detail line can be buffered in current loop, RS 232, RS 422 or RS 485; in these last two cases also abilitation and direction of line can be defined using signal RC2 or signal RE2, according to the configuration of jumper J10.
For further information please refer to manuals GMB HR168 and GMM 4620.
TECHNICAL FEATURES

GENERAL FEATURES

On board resources:  
- 16 optocoupled digital inputs NPN and PNP
- 2 optocoupled digital inputs NPN and PNP are interrupts
- 2 optocoupled digital inputs NPN and PNP are counters
- 8 relays digital buffered outputs 5 A
- 1 serial line (RS 232, TTL, RS422, RS485, Current Loop, etc.)
- 1 connector for I²C BUS lines
- 1 analog input
- 1 eight bit PWM output
- Up to 4 digital I/O TTL
- 1 switching power supply section
- 14 status LEDs + 2 internal LEDs
- 1 internal eight pin Dip Switch

Mini Module: GMM 4620

Opto input cut-off frequency: 13 KHz

PHYSICAL FEATURES

Size:  
- 90 x 106 x 58 mm (container DIN 50022)
- 85 x 120 x 32 mm (without container)

Container: DIN 50022 modulbox, model M6 HC53

Montaggio: On Ω rails type DIN 46277-1 and DIN 46277-3

Weight: 251 g

Connectors:  
- CN1: 9 ways quick release screw terminal connector
- CN2: 9 ways quick release screw terminal connector
- CN3: 9 ways quick release screw terminal connector
- CN4: 3 ways quick release screw terminal connector
- CN5: 4 ways quick release screw terminal, pitch 3.5 mm
- CN6: 2x4 ways AMPMODU II, male, vertical
- CN7: 2x4 ways AMPMODU II, male, vertical
- CN8: 4 ways strip, male, vertical

Temperature range: from 0 to 50 centigrad degreeses

Relative humidity: 20% up to 90% (without condense)
ELECTRIC FEATURES

Power supply: 10÷40 Vdc or 8÷24 Vac (control logic)

Power required for logic: 5.25 W (*)

Output power supply: +5 Vdc

Current required by GMB HR168: 572 mA max (+5 Vdc)
32÷150 mA max (+V opto)

Current on +5 Vdc output: 950 mA - 572 mA (corrente required) = 378 mA

Relays max voltage: 30 Vdc

Relays max non inductive current: 5 A (resistive load)

On board battery: 3.0 Vdc; 180 mAh

Backup current: 2.3 µA

Optocouplers input voltage: +V opto = 8 + 30 Vdc or 8 + 24 Vac (*)

Power required for optocouplers: 4.4 W

Analog input range: 0÷2.5; 0÷10 V

Analog input impedance: 4.7 kΩ

Pull-up on I²C BUS dedicated lines: 4.7 kΩ

Termination network RS 422-485: Line termination resistor =120 Ω
Positive pull up resistor =3.3 KΩ
Negative pull down resistor =3.3 KΩ

(*) The data are referred to 20 C° work temperature (for further information please refer to chapter "POWER SUPPLY VOLTAGE").
INSTALLATION

In this chapter there are the information for a right installation and correct use of the card. The user can find the location and functions of each connector, LEDs, jumper, etc. and some explanatory diagrams.

CONNECTIONS

Module **GMB HR168 & GMM 4620** has 6 connectors that can be linkeded to other devices or directly to the field, according to system requirements. In this paragraph there are connectors pin out, a short signals description (including the signals direction) and connectors location (see figure 23).

**CN5 - POWER SUPPLY CONNECTOR**

CN5 is a 4 ways, quick release screw terminal connector, vertical, 3.5 mm pitch. CN5 allows to provide power needed by the switching power supply to generate logic control and optocouplers supply voltage.

![Figure 4: CN5 - Power Supply Connector](image)

Signals description:

- **Vac , +Vdc pow** = I - Positive terminal of direct supply voltage.
- **Vac , GND** = I - Negative terminal of direct supply voltage.
- **Vac opto , Vopto** = I - Terminal of alternate optocouplers supply voltage.
- **Vac opto , GND opto** = I - Terminal of alternate optocouplers supply voltage.

For further information please refer to paragraphs "POWER SUPPLY" and "ELECTRIC FEATURES".
**CN8 - \( \text{I}^2\text{C} \) BUS LINE CONNECTOR**

CN8 is a 4 ways, male, vertical, strip connector with 2.54mm pitch. On CN8 is available a standard interface for any \( \text{I}^2\text{C} \) BUS peripheral device. The connector features +5 Vdc supply voltage generated by on board switching power supply that can be connected to external devices or systems. Signals are TTL compliant, according to \( \text{I}^2\text{C} \) BUS standard, their disposition has been designed to reduce interferences and so easy the connection.

**Figure 5: CN8 - \( \text{I}^2\text{C} \) BUS LINE CONNECTOR**

Signals description:

- **RC4, SDA** = I/O - Data signal of \( \text{I}^2\text{C} \) BUS software serial line connected to RC4.
- **RC3, SCL** = O - Clock signal of \( \text{I}^2\text{C} \) BUS software serial line connected to RC3.
- **+5 Vdc** = O - Unique +5 Vdc power supply.
- **GND** = - Ground.

**Figure 6: \( \text{I}^2\text{C} \) BUS CONNECTION DIAGRAM**
**CN6 - SERIAL LINE CONNECTOR**

CN6 is a 8 ways, male, vertical, AMPMODU II 4x2 type connector, 2.54 mm pitch. This connector features signals for serial communication in RS 232, RS 422, RS 485, current loop and TTL, performed through hardware module on ZC1 hardware serial port. Signals position, reported as follows, has been designed to reduce interferences and easy connections to the field, while signals are compliant to CCITT standard of protocol used. Female connector can be ordered from grifo® (cod. CKS.AMP8) or its parts can be purchased from AMP catalog (P/N 280365: connector and P/N 182206-2: pins to crimp). For further information please refer to manual of GMB HR168.

![Figure 7: CN6 - Serial line connector](image)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS 232 serial line (please see paragraph &quot;SERIAL COMMUNICATION SELECTION&quot;):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>RX RS232</td>
<td>= I</td>
<td>Receive Data for RS 232.</td>
</tr>
<tr>
<td>3</td>
<td>TX RS232</td>
<td>= O</td>
<td>Transmit Data for RS 232.</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>=</td>
<td>Ground signal.</td>
</tr>
<tr>
<td>RS 422 serial line (please see paragraph &quot;SERIAL COMMUNICATION SELECTION&quot;):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>RX- RS422</td>
<td>= I</td>
<td>Receive Data Negative for RS 422.</td>
</tr>
<tr>
<td>2</td>
<td>RX+ RS422</td>
<td>= I</td>
<td>Receive Data Positive for RS 422.</td>
</tr>
<tr>
<td>3</td>
<td>TX- RS422</td>
<td>= O</td>
<td>Transmit Data Negative for RS 422.</td>
</tr>
<tr>
<td>4</td>
<td>TX+ RS422</td>
<td>= O</td>
<td>Transmit Data Positive for RS 422.</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>=</td>
<td>Ground signal.</td>
</tr>
<tr>
<td>RS 485 serial line (please see paragraph &quot;SERIAL COMMUNICATION SELECTION&quot;):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>RXTX+ RS485</td>
<td>= I/O-</td>
<td>Receive/Transmit Data Positive for RS 485.</td>
</tr>
<tr>
<td>2</td>
<td>RXTX- RS485</td>
<td>= I/O-</td>
<td>Receive/Transmit Data Negative for RS 485.</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>=</td>
<td>Ground signal.</td>
</tr>
<tr>
<td>Current Loop serial line (please see paragraph &quot;SERIAL COMMUNICATION SELECTION&quot;):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>RX- C.L.</td>
<td>= I</td>
<td>Receive Data Negative for Current Loop.</td>
</tr>
<tr>
<td>8</td>
<td>RX+ C.L.</td>
<td>= I</td>
<td>Receive Data Positive for Current Loop.</td>
</tr>
<tr>
<td>7</td>
<td>TX- C.L.</td>
<td>= O</td>
<td>Transmit Data Negative for Current Loop.</td>
</tr>
<tr>
<td>6</td>
<td>TX+ C.L.</td>
<td>= O</td>
<td>Transmit Data Positive for Current Loop.</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>=</td>
<td>Ground signal.</td>
</tr>
</tbody>
</table>

Power supply voltages:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Voltage</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+5 Vdc</td>
<td>=</td>
<td>+5 Vdc generated by on board switching power supply.</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>=</td>
<td>Ground signal.</td>
</tr>
<tr>
<td>2</td>
<td>Vopto A</td>
<td>= O</td>
<td>Optocoupled digital inputs power supply voltage.</td>
</tr>
<tr>
<td>8</td>
<td>Vopto B</td>
<td>= O</td>
<td>Optocoupled digital inputs power supply voltage.</td>
</tr>
</tbody>
</table>
Figure 8: Serial Communication Block Diagram

Figure 9: RS 232 PC Point to Point Connection Example
CN1 - OPTOCOUPLED DIGITAL INPUTS CONNECTOR GROUP 1

CN1 is a 9 ways, quick release, screw terminal connector, pitch 5.0 mm.
CN1 is used to connect 8 out of 16 optocoupled NPN or PNP input signals that the card manages and are visualized by green LEDs.

Two of these inputs (IN3 and IN4) are connected directly to interrupt signals, so they can generate an immediate interrupt request to the CPU.

Two more of these inputs (IN5 and IN6) are connected to the external trigger of timer/counters, so transitions on these inputs can be counted by hardware by CPU.

Please refer to figure 25 for further information.

Connector also features the common pin where to connect one input to close it.

These signals are software managed through GMM 4620I/O ports have been carefully selected to take advantage of grifo® Mini Modules internal peripherals.

For further information please refer to manual GMB HR168.

Signals description:

**Rx.y, INu-1** = I - n-th optocoupled input type NPN or PNP, connected to indicated port.
**COM 1** = - Common pin where an input must be connected to close it.
**Figure 11: Optocoupled Inputs Block Diagram**

**Figure 12: Optocoupled Inputs Connection Diagram**
CN2 - OPTOCOUPLED DIGITAL INPUTS CONNECTOR GROUP 2

CN2 is a 9 ways, quick release, screw terminal connector, pitch 5.0 mm.
CN2 is used to connect 8 out of 16 optocoupled NPN or PNP input signals that the card manages and are visualized by yellow LEDs.
Please refer to figure 25 for further information.
Connector also features the common pin where to connect one input to close it.
These signals are software managed through GMM 4620I/O ports have been carefully selected to take advantage of grifo® Mini Modules internal peripherals.
For further information please refer to manual GMB HR168.

**Figure 13: CN2 - Optocoupled digital inputs connector group 2**

Signals description:

- \( \text{Rx.y, INn-2} \) = I - n-th optocoupled input type NPN or PNP, connected to indicated port.
- \( \text{COM 2} \) = - Common pin where an input must be connected to close it.
**Figure 14: Optocoupled Inputs Block Diagram**

**Figure 15: Optocoupled Inputs Connection Diagram**
CN3 - RELAYS OUTPUTS CONNECTOR GROUPS A, B AND C

CN3 is a 9 ways, quick release screw terminal connector, pitch 5.0 mm. This connector allows to connect 6 out of 8 normally open contacts and common pins relays outputs available on GMB HR168.

Please remark that maximum (resistive) load for each line is 5 A and maximum voltage is 35 Vdc. These signals are software managed through GMM 4620 I/O ports, opportunely buffered, and selected carefully to easy management (please refer to chapter “PERIPHERAL DEVICES SOFTWARE DESCRIPTION”).

For further information please refer to manual GMB HR168.

![Diagram of CN3 connector]

**Figure 16: CN3 - Relays Outputs Connector Groups A, B and C**

Signals description:

- Py.x, OUT An = O - Normally open contact for n-th relay of group A.
- COMMON A = - Common contact for relays of group A.
- Py.x, OUT Bn = O - Normally open contact for n-th relay of group B.
- COMMON B = - Common contact for relays of group B.
- Py.x, OUT Cn = O - Normally open contact for n-th relay of group C.
- COMMON C = - Common contact for relays of group C.
**Figure 17:** Relay outputs A, B and C block diagram

**Figure 18:** Relay outputs A, B and C connection diagram
CN4 - RELAYS OUTPUTS CONNECTOR GROUP D

CN4 is a 3 ways, quick release screw terminal connector, pitch 5.0 mm. This connector allows to connect 2 out of 8 normally open contacts and common pins relays outputs available on GMB HR168.

Please remark that maximum (resistive) load for each line is 5 A and maximum voltage is 35 Vdc. These signals are software managed through GMM 4620 I/O ports, opportunely buffered, and selected carefully to easy management (please refer to chapter “PERIPHERAL DEVICES SOFTWARE DESCRIPTION”).

For further information please refer to manual GMB HR168.

![Diagram of CN4 Connector](image)

**FIGURE 19: CN4 - RELAYS OUTPUTS CONNECTOR GROUP D**

Signals description:

- **Px.y, Dn** = O - Normally open contact for n-th relay of group D.
- **COMMON D** = - Common contact for relays of group D.
**Figure 20: Relay Outputs D Block Diagram**

**Figure 21: Relay Outputs D Connection Diagram**
CN7 - TTL I/O, A/D, ETC. CONNECTOR

CN7 is a 8 ways, male, vertical, AMPMODU II 2x4 connector with pitch 2.54 mm. This connector features +5 Vdc supply voltage (generated by on board switching power supply), up to 5 TTL digital I/O signals and an analog input connected to A/D section. In case an optional Real Time Clock is installed, pin 4 is connected to its interrupt signal, so it cannot be used as generic I/O signal.

Female connector can be ordered from grifo® (cod. CKS.AMP8) or its parts can be purchased from AMP catalog (P/N 280365: connector and P/N 182206-2: pins to crimp). It is also possible to order the female connector with pins to crimp already mounted and one meter long cables (grifo® cod. CKS.AMP8).

For further information please refer to manual of GMB HR168.

**FIGURE 22: CN7 - TTL I/O, A/D, ETC. CONNECTOR**

Signals description:

<table>
<thead>
<tr>
<th>Rx.y</th>
<th>= I/O - TTL digital I/O signal, connected to socket ZC1.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN4</td>
<td>= I - Analog input (please refer to manual GMB HR168).</td>
</tr>
<tr>
<td>PWM</td>
<td>= I - PWM 10 bit output (please refer to manual GMB HR168).</td>
</tr>
<tr>
<td>/INTRTC</td>
<td>= I/O - Interrupt signal of Real Time Clock.</td>
</tr>
<tr>
<td>+5 Vdc</td>
<td>= O - Positive terminal of +5 Vdc power supply.</td>
</tr>
<tr>
<td>GND</td>
<td>= - Ground signal.</td>
</tr>
<tr>
<td>N. C.</td>
<td>= - No connection.</td>
</tr>
</tbody>
</table>
INTERRUPTS

Possible interrupt sources are:

- Input IN3 of CN1   ->  Generates an external interrupt called INT0.
- Input IN4 of CN1   ->  Generates an external interrupt called INT1.
- CPU internal peripherals  ->  Generate internal interrupts. In detail interrupt sources can be: Timer 0, Timer 1, Timer 2, Timer 2, I²C BUS, UART, A/D converter, analog comparator, EEPROM, SPI, CCP, Brown Out, Watch Dog.

Please refer to GMM 4620 manual for further information.

I/O CONNECTION

To prevent possible connecting problems between GMB HR168 & GMM 4620 and the external systems, the user has to read carefully the previous paragraph information and he must follow these instructions:

- For RS 232, RS 422, RS 485, Current Loop and I²C BUS signals the user must follow the standard rules of each one of these protocols, I²C BUS signals are also provided with 4.7 kΩ pull up.

- For all TTL signals the user must follow the rules of this electric standard. The connected digital signal must be always referred to card digital ground and if an electric insulation is necessary, then an opto coupled interface must be connected. For TTL signals, the 0V level corresponds to logic state 0, while 5V level corresponds to logic state 1.

- The analog inputs (A/D Converter section) on CN7 is provided with filtering capacitors that warrant more stability on the signal to acquire and lower the cut-off frequency. It is also possible to connect a voltage divider that divides by 4 the signal amplitude.

- Optocoupled input signals can be configured as NPN or PNP through jumpers J1 and J2, these jumpers must be moved together. In detail, if inputs are configured as NPN, positive voltage is present on input pins (INx-1, INy-2) and ground is present on the common pins (COM1 and COM2), while if the inputs are configured as PNP the situation is reversed, this means ground on input pins and positive signal on common pins.

- Relays outputs must be connected directly to the load to drive (remote control switches, power relays, etc.). Board contact is normally open and can bear 5 A up to 35 Vdc. To drive load with different supplies, different COMMONS for the groups of relays are available.
POWER SUPPLY

GMB HR168 & GMM 4620 is provided with an efficient circuitry that solves in a comfortable and efficient way the problem to supply the card in any condition of use. Here follow the voltages required by the card:

+V opto: Provides power supply to optocouplers of board input section; input voltage must be in the range 8 ÷ 30 Vdc or 8 ÷ 24 Vac and must be provided on connector CN5 through pins 1 and 2, connecting pin 2 to the positive terminal of external power supply and pin 1 to its ground terminal, if it is direct voltage.

It is also possible to fetch the optocouplers section supply voltage through pins 2 and 8 of CN7. Please refer to paragraph about CN7 for further information. Current fetch must be compatible with electric features of rectifier section that generates the voltage, such features are written in paragraph "ELECTRIC FEATURES".

Vac, +Vdc pow, GND: Provide power supply to control logic and to output section of the board through the on board switching power supply; input voltage must be in the range 10 ÷ 40 Vdc or 8 ÷ 24 Vac and must be provided through pins 3 and 4 of CN5 (in case of Vdc, pin 4 must be connected to positive terminal). This allows to supply the cards using standard devices of industrial sector like transformers, batteries, solar cells, etc. If external loads must be supplied, a +5 Vdc voltage can be fetched from pins 1 and 7 of CN6, CN7. Also, if there is the need to supply FC BUS external peripherals from GMB HR168 & GMM 4620, pins 1 and 4 of CN8 can be used. Please remark that on board switching power supply is provided with single diode rectifier, so in case of Vdc supply, all ground signals (GND) of the card are at the same potential.

To warrant highest immunity against noise and so a correct working of the cards, it is essential that these two voltages are galvanically isolated

In order to obtain this power supply EXPS-2 can be ordered. This device performs galvanic isolation starting from mains power supply.

GMB HR168 features a TransZorb™-based protection circuit to avoid damages from incorrect tensions and break-down of power supply section.

On board power supply is visualized through a LED on the bottom left corner. Current available to supply external loads using +5 Vdc is less than 370 mA.

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

...
Figure 23: LEDs, connectors, etc. location
INPUTS CONFIGURATION AS NPN OR PNP

The 16 optocoupled inputs of **GMB HR168 & GMM 4620** can be configured as NPN or PNP according to the connection of jumpers J1 and J2.
For further information please refer to manual of **GMB HR168**.

BACK UP

**GMB HR168 & GMM 4620** features a Real Time Clock and a back up Lithium battery already installed. Lithium battery keeps the time and the content of SRAM even when power supply is off, if DSW1.6 is ON. **By default, DSW1.6 is OFF**.
For further information, please refer to paragraph "ELECTRIC FEATURES".

ANALOG INPUT

**GMB HR168** features an interface for one analog input that can accept an input voltage in a variable range according to connection of jumper J11.
For further information please refer to manual of **GMB HR168**.

CORRESPONDANCE OF SIGNALS

All hardware resources of **GMB HR168 & GMM 4620** are managed by **GMM 4620** through signals and peripherals of local microcontroller, PIC18LF4620.
To have the complete control of such resources, it is enough to refer to the table in the near page, which indicates the signal and/or peripheral that drives a specific resource.

**Figure 24: Jumpers default connection**
## Table of Correspondance Between Signals and Resources

<table>
<thead>
<tr>
<th>Connector</th>
<th>PIN</th>
<th>Signal GMB HR168</th>
<th>PURPOSE</th>
<th>PIN CN1 GMM 4620</th>
<th>Signal GMM 4620</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMB HR168</td>
<td>1</td>
<td>Input 1</td>
<td>Optocoupled input n° 1.</td>
<td>pin 32</td>
<td>RA0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Input 2</td>
<td>Optocoupled input n° 2.</td>
<td>pin 31</td>
<td>RA1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Input 3</td>
<td>Optocoupled input n° 3 or interrupt INT0.</td>
<td>pin 25</td>
<td>RB0, INT0</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Input 4</td>
<td>Optocoupled input n° 4 or interrupt INT1.</td>
<td>pin 24</td>
<td>RB1, INT1</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Input 5</td>
<td>Optocoupled input n° 5 or counter Timer 0.</td>
<td>pin 23</td>
<td>RA4, T0</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Input 6</td>
<td>Optocoupled input n° 6 or counter Timer 1.</td>
<td>pin 22</td>
<td>RC0, T1-3</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Input 7</td>
<td>Optocoupled input n° 7.</td>
<td>pin 21</td>
<td>RC1</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Input 8</td>
<td>Optocoupled input n° 8.</td>
<td>pin 19</td>
<td>RC5</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Common pin of optocoupled inputs of connector CN1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Input 1</td>
<td>Optocoupled input n° 9.</td>
<td>pin 1</td>
<td>RD0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Input 2</td>
<td>Optocoupled input n° 10.</td>
<td>pin 2</td>
<td>RD1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Input 3</td>
<td>Optocoupled input n° 11.</td>
<td>pin 3</td>
<td>RD2</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Input 4</td>
<td>Optocoupled input n° 12.</td>
<td>pin 4</td>
<td>RD3</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Input 5</td>
<td>Optocoupled input n° 13.</td>
<td>pin 35</td>
<td>RD4</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Input 6</td>
<td>Optocoupled input n° 14.</td>
<td>pin 36</td>
<td>RD5</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Input 7</td>
<td>Optocoupled input n° 15.</td>
<td>pin 37</td>
<td>RD6</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Input 8</td>
<td>Optocoupled input n° 16.</td>
<td>pin 38</td>
<td>RD7</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Common pin of optocoupled inputs of connector CN2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1</td>
<td>Output 1</td>
<td>Relay output 5 A n° 1.</td>
<td>pin 29</td>
<td>RB4</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>Common pin of buffered relay outputs of group A on CN3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A2</td>
<td>Output 2</td>
<td>Relay output 5 A n° 2.</td>
<td>pin 28</td>
<td>RB5</td>
</tr>
<tr>
<td></td>
<td>B1</td>
<td>Output 3</td>
<td>Relay output 5 A n° 3.</td>
<td>pin 27</td>
<td>RB6</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>Common pin of buffered relay outputs of group B on CN3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B2</td>
<td>Output 4</td>
<td>Relay output 5 A n° 4.</td>
<td>pin 26</td>
<td>RB7</td>
</tr>
<tr>
<td></td>
<td>C1</td>
<td>Output 5</td>
<td>Relay output 5 A n° 5.</td>
<td>pin 14</td>
<td>RB3</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>Common pin of buffered relay outputs of group C on CN3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>Output 6</td>
<td>Relay output 5 A n° 6.</td>
<td>pin 15</td>
<td>RB2</td>
</tr>
<tr>
<td></td>
<td>D1</td>
<td>Output 7</td>
<td>Relay output 5 A n° 7.</td>
<td>pin 18</td>
<td>RA3</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>Common pin of buffered relay outputs of group D on CN4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D2</td>
<td>Output 8</td>
<td>Relay output 5 A n° 8.</td>
<td>pin 16 (if J10 is in 3-4)</td>
<td>RA2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>pin 16 (if J10 is in 4-5)</td>
<td>RA2 (if J10 is in 4-5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>pin 30</td>
<td>RC2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>pin 40</td>
<td>+5 Vdc</td>
</tr>
<tr>
<td>AMP 8 I/O</td>
<td>pin 1</td>
<td>+5 Vdc</td>
<td>Power supply +5 Vdc</td>
<td>pin 5</td>
<td>RE0</td>
</tr>
<tr>
<td></td>
<td>pin 2</td>
<td>I/O TTL</td>
<td>I/O TTL.</td>
<td>pin 6</td>
<td>RE1</td>
</tr>
<tr>
<td></td>
<td>pin 3</td>
<td>I/O TTL</td>
<td>I/O TTL.</td>
<td>pin 11</td>
<td>/INTRTC</td>
</tr>
<tr>
<td></td>
<td>pin 4</td>
<td>/INTRTC</td>
<td>Interrupt RTC Open Drain.</td>
<td>pin 30</td>
<td>RC2</td>
</tr>
<tr>
<td></td>
<td>pin 5</td>
<td>D/A</td>
<td>PWM of CCP1 or I/O TTL.</td>
<td>pin 20</td>
<td>GND</td>
</tr>
<tr>
<td></td>
<td>pin 6</td>
<td>Ground</td>
<td>Ground of Mini Block.</td>
<td>pin 33</td>
<td>AN4</td>
</tr>
</tbody>
</table>

**Figure 25: Table of Correspondance Between Signals and Resources**
HOW TO START

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

A) FLASH REPROGRAMMING:

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

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

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

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

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

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

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

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

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

Id) Select PIC18LF4620 from MP LAB® IDE using menu Configuration | Select device.
### FIGURE 26: EXAMPLES TABLES

<table>
<thead>
<tr>
<th>TIPO DI SCHEDA</th>
<th>GE7</th>
<th>ASM</th>
<th>Ladder</th>
<th>Abab® Link BUS</th>
<th>BASIC CE206</th>
<th>BASIC BASCOM 8051</th>
<th>BASIC BASCOM AVR</th>
<th>PIC BASIC</th>
<th>BASIC VARI</th>
<th>M C S 50</th>
<th>Basic 52</th>
<th>C</th>
<th>PASCAL</th>
<th>TIPO DI CPU / BLOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAN GM0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
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<td>Atmel78HC20 - 8051 Code</td>
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<td>CAN GM1</td>
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<td>CAN GM2</td>
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<td>PHBILLS PIC16C932 - 8051 Code</td>
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<td>-</td>
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<td>Atmel78HC12 - 8051 Code</td>
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<td>GMM AM08</td>
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<td>Atmel ATMega32 - AVR Code</td>
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<td></td>
<td>-</td>
<td>-</td>
<td>Mini Block 8 input opto 4 output relé</td>
</tr>
<tr>
<td>GMR HR168</td>
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### FIGURE 27: DEVICE SELECTION WITH MP LAB® ICD 2

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

**Figure 28: Connection to MP LAB® ICD 2**
If) Load file uk_gmb_iob.hex using menu File | Import.

![Figure 29: Loading file to program with MP Lab® ICD 2](image)

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

![Figure 30: Configuration of MP Lab® ICD 2](image)
Ih) Give the command to program (menu Programmer | Program).

![Program target device](image)

**Figure 31: FLASH MEMORY PROGRAMMING WITH MP LAB® ICD 2**

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

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

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

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

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

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

![Select device](image)

**Figure 32: Device selection with MP PIK+**
IIe) Open the programming options window (pressing ALT and letter "o") and uncheck the box "Low voltage programming" as shown in figure.

**Figure 33: Configuration of programmer MP PIK+**

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

**Figure 34: Loading file to program with MP PIK+**
IIg) Open the "Edit config." window (pressing key ALT and letter "s") then set "Oscillator" as "HS" and "WatchDog" as "Off", "Brown Out" as "Enabled in hardware" and "Extended CPU Enable" as "Disabled", like shown in figure.

![Configuration of device with MP PIK+](image)

**Figure 35: Configuration of device with MP PIK+**

IIh) Give the programming command.

![Programming of PIC18LF4620 with MP PIK+](image)

**Figure 36: Programming of PIC18LF4620 with MP PIK+**
B) SERIAL CONNECTION TO THE PC:

B1) First of all, open the container of **GMB HR168** to install Mini Module **GMM 4620** on socket ZC1.

B2) To supply **GMB HR168**, power supply **EXPS-2** can be used. It can provide two galvanically isolated tensions, required for the correct working of **GMB HR168 & GMM 4620**. Also any other power supply capable to generated the two required voltages can be used.

![Power Supply EXPS-2](image)

**FIGURE 37: PICTURE OF POWER SUPPLY EXPS-2**

B3) Make the connection described in figure 9.

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

B5) Supply the boards. If programming worked fine, the starting screen of demo program appears in the terminal emulator window. If this does not happen, please control the correct making of cable described at point B3 or repeat the programming procedure described at points A.
C1) Install on the hard disk of the development P.C. the software environment selected to develop the application program. There are many different software tools that satisfy any customers requirements but here we remind only the most diffused like Microcode Studio + PIC BASIC, mikroBasic, mikroPascal, HI TECH C PIC 18 + MP LAB IDE, etc. Please refer to software manuals for further information like installation guide.

C2) On grifo® CD in addition to file with the executable code of the demo program, described at point A1, there are also the source file of the same. These have an extension that identifies the used software development tools (for example uk_gmb_iob.bas for Microcode Studio + PIC BASIC, uk_gmb_iob.c for HI Tech C PIC 18, uk_gmb_iob.pbas for mikroBasic, uk_gmb_iob.ppas for mikroPascal) and they are properly organized inside demo programs tables available on CD, together with possible definition file (uk_gmb_iob.mcw for HI Tech C PIC 18 + MP LAB® ICD 2, uk_gmb_iob.pbp for mikroBasic, uk_gmb_iob.ppp for mikroPascal). Once these files have been located they must be copied in a comfortable folder on the hard disk of development P.C.

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

1) Recompilation using Microcode Studio + PIC BASIC.

Ia) When in Microcode Studio IDE, select the target CPU from the specific list box. Target CPU for the source recompilation must be PIC18LF4620, as shown in figure:

**Figure 38: Selecting target processor with Microcode Studio + PIC BASIC PRO**
Ib) Load file `uk_gmb_iob.bas`, containing the source code to be recompiled, using the menu File | Open, as shown:

![Figure 39: Loading source file with MicroCode Studio + PIC BASIC PRO](image)

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

![Figure 40: Compiling the program with MicroCode Studio + PIC BASIC PRO](image)

II) Recompilation with mikroBasic.

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

![Figure 41: Loading project file with MikroBasic](image)
IIb) Compile the project pressing the button near the list box that indicates the target processor. All the information required for compiling (for example: target processor, frequency of the oscillator, value of configuration words, etc.) are contained in the project file, so there is no need to specify them.

**FIGURE 42: COMPILING WITH MIKROBASIC**

III) Ricompilation with mikroPascal.

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

**FIGURE 43: LOADING PROJECT FILE WITH MIKROPASCAL**

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

**FIGURE 44: COMPILING WITH MIKROPASCAL**
IV) Ricompilation with HI Tech C PIC 18 + MP LAB® IDE.

IVa) First of all, HI Tech C PIC 18 and MP LAB® IDE must be integrated. Instruction for integration are beyond the purpose of this manual, please refer to the information published on HI Tech Soft web site (www.htsoft.com). It is suggested also to connect to Microchip web site (www.microchip.com) and to download the latest version of free development environment MP LAB® IDE.

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

![FIGURE 45: LOADING PROJECT FILE WITH HI TECH C PIC 18 + MP LAB® IDE](image)
IIb) Compile the project using the menu Project | Make or pressing the button shown in figure. All the information required for compiling (for example: target processor, etc.) are contained in the project file, so there is no need to specify them.

![Figure 46: Compiling with Hi Tech C PIC 18 + MP LAB® IDE](image)

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

Should during the execution of the steps above described a problem or a malfunction be found, we suggest to read and repeat again all the steps carefully and if malfunction persists please contact directly grifo® technician.

Instead when execution of all the steps above described is right, the user has realized his first application program that coincides with demo of GMM 4620 & GMB HR168.

At this point it is possible to modify the source of the demo/s program according to application requirements and test the obtained program with the steps above listed (from A2 to C4) in cyclic mode, until the developed application program is completely well running.

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

D) PREPARAZIONE DEFINITIVA DELL’APPLICAZIONE

D1) Install GMM 4620 in GMB HR168 and close it.
Figure 47: Image of GMM 4620 installed in a GMB HR168
PERIPHERAL DEVICES SOFTWARE DESCRIPTION

In the previous paragraphs are described the peripheral connections to the field, while in this one there is a specific description of registers meaning and function (please refer to I/O addresses table, for the registers names and addresses values).
For a more detailed description of the devices, please refer to documentation of GMB HR168 and GMM 4620.
In the following paragraphs the D7÷D0 and .0÷7 indications denote the eight bits of the combination used in I/O operations.

RELAYS OUTPUTS

Status of 8 digital relays outputs is set through 8 signals of 40 pin socket ZC1, which means GMM 4620 TTL I/O signals are used.
Please remark that signal driving relay OUT D2 can be connected either to signal PA.6 or to signal PD.5 according to the connection of jumper J10:

\[
\begin{align*}
J10 \text{ connected in } 3-4 & \rightarrow \text{ OUT D2 driven by RC2} \\
J10 \text{ connected in } 4-5 & \rightarrow \text{ OUT D2 driven by RA2}
\end{align*}
\]

When the signal of socket ZC1 is set to logic state low (logic 0), the corresponding output is activated (relay contact is connected to its common pin).
Vice versa when the signal is set to logic state high (logic 1) the corresponding output is deactived (relay open).
As previously said, LEDs LD1÷8 provide a visual indication of digital outputs status (LED ON = output activated).
Summarizing, the correspondance is:

\[
\begin{align*}
\text{RB4} , \text{ OUT A1} & \rightarrow \text{ LED LD1} & \text{RB3} , \text{ OUT C1} & \rightarrow \text{ LED LD5} \\
\text{RB5} , \text{ OUT A2} & \rightarrow \text{ LED LD2} & \text{RB2} , \text{ OUT C2} & \rightarrow \text{ LED LD6} \\
\text{RB6} , \text{ OUT B1} & \rightarrow \text{ LED LD3} & \text{RA3} , \text{ OUT D1} & \rightarrow \text{ LED LD7} \\
\text{RB7} , \text{ OUT B2} & \rightarrow \text{ LED LD4} & \text{(see above) , OUT D2} & \rightarrow \text{ LED LD8}
\end{align*}
\]

SERIAL LINE

The GMM 4620 signals used are the ones called TxD and RxD.
Figure 48: Connections example
**I^2C BUS**

Signals used are pin 2 of CN8 (SDA) and pin 3 of CN8 (SCL).
Please remark that GMM 4620 is provided with an hardware I^2C BUS interface, so in the demo programs an example of how to perform read and write operations using microcontroller registers is shown.
Signals SDA and SCL are also provided with 4.7 kΩ pull up resistors.
Only slave addresses from 00H to 9FH and from A1H to FFH can be used by user because of the presence of an I^2C BUS Real Time Clock.

**OPTOCOUPLED INPUTS**

Status of 16 digital optocoupled inputs can be acquired by software reading the status of corresponding GMM 4620.
When NPN or PNP inputs are enabled, corresponding signals are at logic state low (logic 0), vice versa when inputs are disabled a logic level high is acquired (logic 1).
As previously said, LEDs LD9÷24 give a visual indication of digital inputs status (LED ON means input activated).
In detail, green LEDs (from LD9 to LD16), visualize optocoupled inputs from IN1-1 to IN8-1 of group 1 and referring to common pin COM1, while yellow LEDs (from LD17 to LD24), visualize optocoupled inputs from IN1-2 to IN8-2 of group 2 and referring to common pin COM2.
Summarizing, the correspondence is:

RA0 , IN1-1 -> LED LD16  
RA1 , IN2-1 -> LED LD15  
RB0 , IN3-1 -> LED LD14  
RB1 , IN4-1 -> LED LD13  
RA4 , IN5-1 -> LED LD12  
RC0 , IN6-1 -> LED LD11  
RC1 , IN7-1 -> LED LD10  
RC5 , IN8-1 -> LED LD9  
RD0 , IN1-2 -> LED LD24  
RD1 , IN2-2 -> LED LD23  
RD2 , IN3-2 -> LED LD22  
RD3 , IN4-2 -> LED LD21  
RD4 , IN5-2 -> LED LD20  
RD5 , IN6-2 -> LED LD19  
RD6 , IN7-2 -> LED LD18  
RD7 , IN8-2 -> LED LD17

**DIGITAL TTL I/O**

They are pins 2, 3, 6, and 8 of connector CN8, connected respectively to signals RE0, RE1, RC2 and RA5.
Pin 8 of CN8 can also be used as digital I/O, but remembering that it is always connected to a 4.7 kΩ pull-down (if J11 is connected in position 1-2).
In addition, pin 4 is connected to a yellow LED (LD28) that visualizes its status; this signal is connected to Real Time Clock open drain output /INTRTC and cannot be used as user digital I/O.
RTC + SRAM

**GMM4620 & GMB HR168** is provided with a Real Time Clock + SRAM module already installed. The SRAM module, features 240 bytes and the Real Time Clock which manages time (hours, minutes, seconds) and date (day, month, year, day of the week). Option is delivered with on board Lithium battery installed. RTC section can also generate periodic interrupts whose period can be programmed by the user, so it can be used to awaken CPU from low consumption working modes. For software management of serial SRAM+RTC module, please refer to specific documentation or to demo programs supplied with the card. The user must realize a serial communication with I2C bus standard protocol, through two ZC1 socket signals. The only necessary information is the electric connection:

- **DATA** line (SDA)  \(\rightarrow\)  RC4 (input/output)
- **CLOCK** line (SCL)  \(\rightarrow\)  RC3 (output)

Please remark that signal A0 of this component's slave address is bound to logic 0, so its slave address is hexadecimal A0\(^H\). This address is not available to connect external devices. Logic state 0 of line corresponds to low level logic state \(= 0\) V, while logic state 1 corresponds to high level logic state \(= 5\) V. We also would want to remark that SDA and SCL lines are connected to a 4.7 K\(\Omega\) pull-up resistor.
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