GMB HR168
Housing Relay - 16 Opto In, 8 Outputs

GMM AM32
grifo® Mini Module ATmega32L

TECHNICAL MANUAL
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Housing Relay - 16 Opto In, 8 Outputs
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TECHNICAL MANUAL

Modular plastic Container DIN 50022 Modulbox, model M6 HC53; size: front 90 x 106 mm, height 58 mm; mounting on Omega rail DIN 46277-1 and DIN 46277-3; GMM AM32 already installed on the 40 pin socket; 16 Optocoupled Inputs that can be both NPN or PNP; status of 16 inputs shown by 16 LEDs; two inputs can perform Interrupt functions; other two inputs can perform Counter functions; 8 Relay Outputs 5 A; status of 8 outputs shown by 8 LEDs; Real Time Clock capable to manage day, month, year, week day, hours, minutes, seconds and to generate periodic interrupts; 240 bytes of SRAM for configuration parameters; RTC and SRAM backed with on board Lithium battery and driven by hardware FC BUS line; 1 TTL open collector interrupt output driven by RTC and visualized by a specific LED; Serial Line in RS 232, RS 422, RS 485, current loop or TTL; 1 analog signal for A/D conversion with selectable full range; 1 PWM output 8 bit; all signals can be connected through connectors featuring Normalized pin out; 3 I/O TTL signal; FC BUS availabe on connector for external devices; 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 and 8 ÷ 30 Vdc or 8 ÷ 24 Vac for optocouplers; possibility to manage internal FLASH and EEPROM in In System Programming mode; free software for PC, downloadable from ATMEL web site, to support ISP programming upload the generated code into on-board FLASH memory; wide range of development software available: C compilers (ICC AVR); BASIC compilers (BASCOM AVR); 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

GPC®, grifo®: are trade marks of grifo®.

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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, respectly at the begining and at the end of the manual, to find information in a faster and more easy way.
CARD VERSION

The present handbook is reported to the GMB HR168 card release 110104 and GMM AM32 card release 221003. The validity of the bring informations is subordinate to the number of the card release.

**Figure 1: Position of Card Release of GMM AM32 and GMB HR168**
GENERAL INFORMATION

GMB HR168 & GMM AM32 is a module for DIN rail with a grifo® Mini Module CPU type GMM AM32 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 three I/O TTL signals; 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 AM32 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 serie of low budget
automation systems.
It is possible to create complete applications in astonishing short times and minimum costs by taking
advantage of wide variety of software development tools, like BASCOM AVR., inexpensive and
portable, or C compilers ICC AVR and DDS Micro C, 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.
Overall features of union GMB HR168 & GMM AM32 are:

- Modular plastic Container DIN 50022 Modulbox, model M6 HC53
- Size: front 90 x 106 mm, height 58 mm
- Mounting on Omega rail DIN 46277-1 and DIN 46277-3
- GMM AM32 already installed on the 40 pin socket
- 16 Optocoupled Inputs that can be both NPN or PNP
- Status of 16 inputs shown by 16 LEDs
- Two inputs can perform Interrupt functions
- Other two inputs can perform Counter functions
- 8 Relay Outputs 5 A
- Status of 8 outputs shown by 8 LEDs
- Real Time Clock capable to manage day, month, year, week day, hours, minutes, seconds
  and to generate periodic interrupts
- 240 bytes of SRAM for configuration parameters
- RTC and SRAM backed with on board Lithium battery and driven by hardware FC BUS
  line
- 1 TTL open collector interrupt output drivered by RTC and visualized by a specific LED
- Serial Line in RS 232, RS 422, RS 485, current loop or TTL
- 1 analog signal for A/D conversion with selectable full range
- 1 PWM output 8 bit; all signals can be connected through connectors featuring
  Normalized pin out
- 3 I/O TTL signal
- FC BUS available on connector for external devices
- 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 and 8 ÷ 30 Vdc or 4 ÷ 24 Vac for optocouplers supply
- Possibility to manage internal FLASH and EEPROM in In System Programming mode
- Free software for PC, downloadable from ATMEL web site, to support ISP programming upload the generated code into on-board FLASH memory
- Wide range of development software available: C compilers (ICC AVR); BASIC compilers (BASCOM AVR); etc.
- Several demo programs and use examples provided as source code completely commented available for every development structure

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 ADC7 corresponding to I/O signals PA.7).
For further information please refer to manual GMB HR 168.

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 voltage called +Vopto generated on board by a specific circuitery galvanically isolated from +5 Vdc generation circuitery.
Selection between PNP and NPN inputs is made by moving a match of jumpers called J1 and J2.
For further information please refer to manual GMB HR 168.

SERIAL COMMUNICATION

GMB HR168 features one AMPMODU 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 signals PD.5 or PD.7, according to the configuration of jumper J10.
For further information please refer to manuals GMB HR 168 and GMM AM32.
Figure 2: Block diagram

GMB HR168 & GMM AM32 Rel. 5.00
I²C BUS LINES

GMB HR168 features a connector (CN8) dedicated to I²C BUS, a hardware CPU internal peripheral, connected to two signals of GMM AM32 (PC.0 and PC.1), each provided with a 4.7 kΩ pull-up. 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 AM32 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 HR 168 and GMM AM32.

I/O TTL SIGNALS

GMB HR168 features up to 3 digital I/O TTL signals of GMM AM32 connected to a specific connector (CN7). For further information please refer to manuals GMB HR 168 and GMM AM32.

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 AM32, 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 HR 168 and GMM AM32.

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 "Vopto", 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”.
Figure 3: Snapshot of GMB HR168 and Mini Module GMM AM32
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
1 serial line (RS 232, TTL, RS422, RS485, Current Loop, etc.)
1 connector for FC BUS lines
1 RTC with back up Lithium battery and 240 bytes SRAM
1 Open Collector RTC interrupt output
1 analog input
1 eight bit PWM output
Up to 3 digital I/O TTL
1 switching power supply section
1 optocouplers supply section
28 status LEDs + 2 internal LEDs
1 internal eight pin Dip Switch

Mini Module:

GMM AM32

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:

249 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 degrees

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 AM32** has 8 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:

- \( \text{Vac, +Vdc pow} \) = I - Positive terminal of direct supply voltage.
- \( \text{Vac, GND} \) = I - Negative terminal of direct supply voltage.
- \( \text{Vopto, Vopto} \) = I - Terminal of alternate optocouplers supply voltage.
- \( \text{Vac opto, GND opto} \) = I - Terminal of alternate optocouplers supply voltage.

For further information please refer to paragraphs "POWER SUPPLY" and "ELECTRIC FEATURES".
CN8 - I²C 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 I²C 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 I²C BUS standard, their disposition has been designed to reduce interferences and so easy the connection.

![Figure 5: CN8 - I²C BUS Line Connector](Image)

Signals description:

- **PC.1, SDA** = I/O - Data signal of I²C BUS software serial line connected to PC.1.
- **PC.0, SCL** = O - Clock signal of I²C BUS software serial line connected to PC.0.
- **+5 Vdc** = O - Unique +5 Vdc power supply.
- **GND** = - Ground.

![Figure 6: I²C Bus Connection Diagram](Image)
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 figure 8 or to the manual of a grifo® Mini Module combinaton.

**Figure 7: CN6 - Serial Line Connector**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</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>7</td>
<td>GND</td>
<td></td>
<td>Ground signal.</td>
</tr>
</tbody>
</table>

**RS 422 serial line (please see paragraph "SERIAL COMMUNICATION SELECTION"):**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>RX- RS422</td>
<td>I</td>
<td>Receive Data Negative for RS 422.</td>
</tr>
<tr>
<td>5</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>7</td>
<td>GND</td>
<td></td>
<td>Ground signal.</td>
</tr>
</tbody>
</table>

**RS 485 serial line (please see paragraph "SERIAL COMMUNICATION SELECTION"):**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>RXTX+ RS485</td>
<td>I/O-</td>
<td>Receive/Transmit Data Positive for RS 485.</td>
</tr>
<tr>
<td>5</td>
<td>RXTX- RS485</td>
<td>I/O-</td>
<td>Receive/Transmit Data Negative for RS 485.</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td></td>
<td>Ground signal.</td>
</tr>
</tbody>
</table>

**Current Loop serial line (please see paragraph "SERIAL COMMUNICATION SELECTION"):**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>RX- C.L.</td>
<td>I</td>
<td>Receive Data Negative for Current Loop.</td>
</tr>
<tr>
<td>5</td>
<td>RX+ C.L.</td>
<td>I</td>
<td>Receive Data Positive for Current Loop.</td>
</tr>
<tr>
<td>3</td>
<td>TX- C.L.</td>
<td>O</td>
<td>Transmit Data Negative for Current Loop.</td>
</tr>
<tr>
<td>4</td>
<td>TX+ C.L.</td>
<td>O</td>
<td>Transmit Data Positive for Current Loop.</td>
</tr>
</tbody>
</table>

**Power supply voltages:**

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

**Figure 9: RS 232 and TTL Point to Point Connection Example**
CN1 is a 9 ways, quick release, screw terminal connector, pitch 5.0 mm.
CN1 is used to connect the 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 transactions on these inputs can be counted by hardware by CPU.
Please refer to figure 25 for further information.
Connector also features the common signal where to connect one input to close it.
These signals are software managed through GMM AM32 I/O ports have been carefully selected to take advantage of grifo® Mini Modules internal peripherals.
For further information please refer to manual GMB HR168.

Figures description:

Px.y, IN n-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 the 8 out of 16 optocoupled NPN or PNP input signals that the card manages and are visualized by yellow LEDs. Connector also features the common pin where to connect the inputs. These input signals are software managed through GMM AM32 I/O ports that have been carefully selected to take advantage of grifo® Mini Modules internal peripherals, so they can generate interrupts, count by hardware counters, etc.

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

Signals description:

- **Py.x, IN n-2** = I - n-th optocoupled input type NPN or PNP, connected to indicated port.
- **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 normally open contacts and common pins out of 8 relays outputs available on GMB HR168. Please remark that maximum (resistive) load for each line is 5 A and maximum voltage is 30 Vdc. These signals are software managed through GMM AM32 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.

![Figure 16: CN3 - Relays Outputs Connector Groups A, B and C](image)

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 is a 3 ways, quick release screw terminal connector, pitch 5.0 mm. This connector allows to connect 2 normally open contacts and common pins out of 8 relays outputs available on GMB HR168. Please remark that maximum (resistive) load for each line is 5 A and maximum voltage is 30 Vdc. These signals are software managed through GMM AM32 I/O ports, opportunely buffered, and selected carefully to easy management (please refer to chapter “PERIPHERAL DEVICES SOFTWARE DESCRIPTION”).

**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 figure 8 or to the manual of a grifo® Mini Module combinaton.

**Figure 22: CN7 - TTL I/O, A/D, etc. connector**

Signals description:

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD.4</td>
<td>I/O - TTL digital I/O signal, connected to pin x of socket ZC1.</td>
</tr>
<tr>
<td>PA.7 , A/D</td>
<td>Analog input (please refer to manual GMB HR168).</td>
</tr>
<tr>
<td>OC1A , PWM</td>
<td>PWM 8 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>
</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, I²C BUS, UART, A/D converter, analog comparator, EEPROM, SPI, SPM Ready, Brown Out, Watch Dog.

Please refer to GMM AM32 manual for further information.

I/O CONNECTION

To prevent possible connecting problems between GMB HR168 & GMM AM32 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 corrisponds 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 30 Vdc. To drive load with different supplies, different COMMONS for the groups of relays are available.
POWER SUPPLY

GMB HR168 & GMM AM32 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 though 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 AM32, 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 AM32 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 AM32 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 AM32 are managed by GMM AM32 through signals and peripherals of local microcontroller, Atmel ATmega32L. 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>
<thead>
<tr>
<th>Connettore GMB HR168</th>
<th>PIN</th>
<th>Segnale GMB HR168</th>
<th>FUNZIONE</th>
<th>PIN CN1 GMM AM32</th>
<th>Segnale GMM AM32</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPTO INPUTS COM 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Input 1</td>
<td>Ingresso optoisolato n° 1.</td>
<td>pin 32</td>
<td>PA.0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Input 2</td>
<td>Ingresso optoisolato n° 2.</td>
<td>pin 31</td>
<td>PA.1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Input 3</td>
<td>Ingresso optoisolato n° 3 oppure interrupt INT0.</td>
<td>pin 25</td>
<td>PD.2, INT0</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Input 4</td>
<td>Ingresso optoisolato n° 4 oppure interrupt INT1.</td>
<td>pin 24</td>
<td>PD.3, INT1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Input 5</td>
<td>Ingresso optoisolato n° 5 oppure contatore Timer 0.</td>
<td>pin 23</td>
<td>PB.0, T0</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Input 6</td>
<td>Ingresso optoisolato n° 6 oppure contatore Timer 1.</td>
<td>pin 22</td>
<td>PB.1, T1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Input 7</td>
<td>Ingresso optoisolato n° 7.</td>
<td>pin 21</td>
<td>PA.2</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Input 8</td>
<td>Ingresso optoisolato n° 8.</td>
<td>pin 19</td>
<td>PA.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pin comune degli ingressi optoisolati del connettore CN1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>OPTO INPUTS COM 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Input 1</td>
<td>Ingresso optoisolato n° 9.</td>
<td>pin 1</td>
<td>PA.4</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Input 2</td>
<td>Ingresso optoisolato n° 10.</td>
<td>pin 2</td>
<td>PA.5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Input 3</td>
<td>Ingresso optoisolato n° 11.</td>
<td>pin 3</td>
<td>PC.2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Input 4</td>
<td>Ingresso optoisolato n° 12.</td>
<td>pin 4</td>
<td>PC.3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Input 5</td>
<td>Ingresso optoisolato n° 13.</td>
<td>pin 35</td>
<td>PC.4</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Input 6</td>
<td>Ingresso optoisolato n° 14.</td>
<td>pin 36</td>
<td>PC.5</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Input 7</td>
<td>Ingresso optoisolato n° 15.</td>
<td>pin 37</td>
<td>PC.6</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Input 8</td>
<td>Ingresso optoisolato n° 16.</td>
<td>pin 38</td>
<td>PC.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pin comune degli ingressi optoisolati del connettore CN2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RELAY OUTPUTs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Output 1</td>
<td>Uscita a rele’ 5 A n° 1.</td>
<td>pin 29</td>
<td>PD.6</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td>Pin comune delle uscite a rele’ del gruppo A su CN3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>Output 2</td>
<td>Uscita a rele’ 5 A n° 2.</td>
<td>pin 28</td>
<td>PB.4</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>Output 3</td>
<td>Uscita a rele’ 5 A n° 3.</td>
<td>pin 27</td>
<td>PB.2</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>Pin comune delle uscite a rele’ del gruppo B su CN3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>Output 4</td>
<td>Uscita a rele’ 5 A n° 4.</td>
<td>pin 26</td>
<td>PB.3</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Output 5</td>
<td>Uscita a rele’ 5 A n° 5.</td>
<td>pin 14</td>
<td>PB.5</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>Pin comune delle uscite a rele’ del gruppo C su CN3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>Output 6</td>
<td>Uscita a rele’ 5 A n° 6.</td>
<td>pin 15</td>
<td>PB.6</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Output 7</td>
<td>Uscita a rele’ 5 A n° 7.</td>
<td>pin 18</td>
<td>PB.7</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>Pin comune delle uscite a rele’ del gruppo D su CN4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2</td>
<td>Output 8</td>
<td>Uscita a rele’ 5 A n° 8.</td>
<td>pin 16</td>
<td>PA.6 (se J10 è in 3-4)</td>
<td>PD.5 (se J10 è in 4-5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pin comune delle uscite a rele’ del gruppo D su CN4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AMP 8 I/O</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pin 1</td>
<td>+5 Vdc</td>
<td>Alimentazione +5 Vdc</td>
<td>pin 40</td>
<td>+5 Vdc</td>
<td></td>
</tr>
<tr>
<td>pin 2</td>
<td>I/O TTL</td>
<td>I/O TTL.</td>
<td>pin 5</td>
<td>PD.4</td>
<td></td>
</tr>
<tr>
<td>pin 4</td>
<td>/INTRTC</td>
<td>Interrupt RTC Open Drain.</td>
<td>pin 11</td>
<td>/INTRTC</td>
<td></td>
</tr>
<tr>
<td>pin 6</td>
<td>D/A</td>
<td>PWM di OC1A o I/O TTL.</td>
<td>pin 30</td>
<td>PD.5</td>
<td></td>
</tr>
<tr>
<td>pin 7</td>
<td>GND</td>
<td>Massa del Mini Block.</td>
<td>pin 20</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>pin 8</td>
<td>A/D</td>
<td>Ingresso ADC7 o I/O TTL.</td>
<td>pin 33</td>
<td>ADC7</td>
<td></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 Atmel ATmega32L internal FLASH through a GMM TST 2, a specific tool produced by ATMEL and a RS232 serial connection.

A) FIRST CHECK:

A1) First of all, check whether the Mini Module is already programmed or not. If it is programmed you may go to point C, otherwise you may continue with point B.

B) FLASH REPROGRAMMING:

B1) It is very comfortable to use a GMM TST 2 to program a GMM AM32. Please refer to respective manuals for further information. The best device to program GMM AM32 is programmer Atmel AVR ISP, anyway it is also possible to use a free software called Pony Prog, which uses only the PC port.

B2) Find on CD grifo® and save to a comfortable position on your hard drive the demo program "prgmb168.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 26).

B3) Perform FLASH programming using AVR ISP or Pony Prog and a GMM TST 2. As this operation is remarkably different according to the tools used, here follows a detailed explanation.

I) Flash Programming by Atmel AVR ISP:

Ia) Control program of AVR ISP is AVR STUDIO, version 4 or greater. Latest version can be downloaded from Atmel website www.atmel.com. You may download it and install it following the instructions on screen.

Ib) Configure AVR ISP to use the 10 ways flat cable and connect it to connector CN7 of GMM TST 2, connect AVR ISP to PC serial port (please refer to AVR ISP instructions), configure GMM TST 2 to program through AVR ISP and supply it (please refer to GMM TST 2 manual).
Ia) Run **AVRSTUDIO**. AVR ISP control program can be activated by pressing the button with AVR chip as icon, it is shown in figure 27.
Id) Select CPU ATmega32:

![AVR Studio](image)

**Figure 27: Activation of AVR Studio**

Ie) Configure the CPU not to use JTAG interface and use an high frequency external quartz, as indicated in the images of figure 29.

![AVRISP](image)

**Figure 28: Select CPU with AVR Studio**

If) Configure the programmer to perform ID check, erase the device and reprogram with verify FLASH, EEPROM and configuration bits, as indicated in figure 30.
Ig) Read current EEPROM content. This operation is required to keep internal information used by grifo® demo programs to work. If this step is omitted, grifo® demo could not work. Save EEPROM content in a file as indicated in figure 31.
Ih) Load file prgmb168.hex previously saved and perform programming by pressing button "Start" in the window indicated in figure 30.

IIa) Pony Prog is a software that allows to program GMM AM32 on a GMM TST 2 simply connecting PC serial port to connector CN6. Version 2.06c supports Atmel ATmega32, you may download it from www.lancos.com and install it following the instructions on screen.

IIb) Connect CN6 of GMM TST 2 to PC serial port, configure GMM TST 2 to program through Pony Prog and supply it (please refer to GMM TST 2 manual).

IIc) Run Pony Prog and perform calibration through menu Setp | Calibration.
IId) Select communication library SI Prog API through menu Setup | Communication setup.

![Figure 34: Communication library selection using Pony Prog]

Ile) Select "AVR micro" and "ATmega32" from the specific list boxes.

![Figure 35: Communication library selection using Pony Prog]

If) Open the file "prgmb168.hex" previously saved:

![Figure 36: File loading using Pony Prog]
IIg) Configure the CPU not to use JTAG interface and use an high frequency external quartz, as indicated in the following figures.

![Configuration and Security bits](image)

**Figure 37: CPU configuration with Pony Prog**

IIh) Read current EEPROM content. This operation is required to keep internal information used by grifo® demo programs to work. If this step is omitted, grifo® demo could not work. Save EEPROM content in a file as indicated in video instructions.

![EEPROM read using Pony Prog](image)

**Figure 38: EEPROM read using Pony Prog**
IIi) Configure the programmer to perform ID check, erase the device and reprogram with verify FLASH, EEPROM and configuration bits.

**Figure 39: Configuration of Pony Prog**

IIj) Perform the programming pressing the indicated button.

**Figure 40: Programming using Pony Prog**

B4) After performing the programming, remove power supply of GMM TST 2.
C) SERIAL CONNECTION TO THE PC:

C1) First of all, open the container of **GMB HR168** to install Mini Module **GMM AM32** on socket ZC1.

C2) 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 AM32**. Also any other power supply capable to generated the two required voltages can be used.

![Picture of Power Supply EXPS-2](image)

**Figure 41: Picture of Power Supply EXPS-2**

C3) Make the connection described in figure 9.

C4) After performing the connection described at point C3, run a terminal emulator 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.

C5) 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 C3 or repeat the programming procedure described at points B.
D) Generating Demo Executable Code:

D1) 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 as the BASCOM AVR, ICC AVR, etc.

D2) On grifo® CD in addition to file with the executable code of the demo program, described at point B2, there are also the source file of the same. These have an extension that identifies the used software development tools (for example prgmb168.bas for BASCOM AVR, prgmb168.c for ICC AVR) and they are properly organized inside demo programs tables available on CD, together with possible definition file (like for example prgmb168.prj for ICC AVR). Once these files have been located they must be copied in a comfortable folder on the hard disk of development P.C.

D3) Compile the source file by using the selected software tools: the file prgmb168.hex must be obtained equal to those available on grifo® CD and already used at steps B2. This operation is very different according to the programming environment selected, so here follows the details:

1) Recompilation using BASCOM AVR.

Ia) When in BASCOM IDE, load the program source with menu File | Open:

![Figure 42: Loading a source file with BASCOM AVR](image)
Ib) From menu Options | Compiler | Chip set the value 64 for HW Stack, 32 for Soft Stack, 64 for Framesize, as suggested also in the source code, and press OK. Such values must be considered minimal and must be increased if required:

![Configuration of Compiler BASCOM AVR](image)

**Figure 43: Configuration of Compiler BASCOM AVR**

Ic) Compile the source file by pressing the button with the icon of an integrated circuit.

![Compilation with BASCOM AVR](image)

**Figure 44: Compilation with BASCOM AVR**
II) Recompilation with ICC AVR.

IIa) Once in the standard editor, load the project file using the menu Project | Open...:

![Figure 45: Loading project file with ICC AVR](image)

IIb) Compile the project using the menu Project | Make project:

![Figure 46: Compilation with ICC AVR](image)
D4) Program the compiled file into FLASH memory of GMM AM32 repeating the steps after B2.

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

Instead when execution of all the steps above described is right, the user has realized his first application program that coincides with demo of GMM AM32 & 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 (successive to B2, C and D) 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:

**E) FINAL APPLICATION:**

E1) Install GMM AM32 into GMB HR168 and close it.
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 AM32. In the following paragraphs the $D_7+D_0$ 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 AM32 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:

- J10 connected in 3-4 -> OUT D2 driven by PA.6
- J10 connected in 4-5 -> OUT D2 driven by PD.5

When the signal of socket ZC1 is set to logic state low (logic 0), the corresponding output is actived (relay contact is connected to its common pin). Viceversa 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 actived). Summarizing, the correspondance is:

- PD.6 , OUT A1 -> LED LD1
- PB.4 , OUT A2 -> LED LD2
- PB.2 , OUT B1 -> LED LD3
- PB.3 , OUT B2 -> LED LD4
- PB.5 , OUT C1 -> LED LD5
- PB.6 , OUT C2 -> LED LD6
- PB.7 , OUT D1 -> LED LD7
- (see above) , OUT D2 -> LED LD8

SERIAL LINE

The GMM AM32 signals used are the ones called TxD and RxD.
I2C BUS

Signals used are pin 2 of CN8 (SDA) and pin 3 of CN8 (SCL).
Please remark that GMM AM32 is provided with an hardware I2C 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 I2C BUS Real Time Clock.

OPTOCOUPLED INPUTS

Status of 16 digital optocoupled inputs can be acquired by software reading the status of corresponding GMM AM32.
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:

<table>
<thead>
<tr>
<th>Digital Input</th>
<th>LED</th>
<th>Digital Input</th>
<th>LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA.0, IN1-1</td>
<td>LED LD16</td>
<td>PA.4, IN1-2</td>
<td>LED LD24</td>
</tr>
<tr>
<td>PA.1, IN2-1</td>
<td>LED LD15</td>
<td>PA.5, IN2-2</td>
<td>LED LD23</td>
</tr>
<tr>
<td>PD.2, IN3-1</td>
<td>LED LD14</td>
<td>PC.2, IN3-2</td>
<td>LED LD22</td>
</tr>
<tr>
<td>PD.3, IN4-1</td>
<td>LED LD13</td>
<td>PC.3, IN4-2</td>
<td>LED LD21</td>
</tr>
<tr>
<td>PB.0, IN5-1</td>
<td>LED LD12</td>
<td>PC.4, IN5-2</td>
<td>LED LD20</td>
</tr>
<tr>
<td>PB.1, IN6-1</td>
<td>LED LD11</td>
<td>PC.5, IN6-2</td>
<td>LED LD19</td>
</tr>
<tr>
<td>PA.2, IN7-1</td>
<td>LED LD10</td>
<td>PC.6, IN7-2</td>
<td>LED LD18</td>
</tr>
<tr>
<td>PA.3, IN8-1</td>
<td>LED LD9</td>
<td>PC.7, IN8-2</td>
<td>LED LD17</td>
</tr>
</tbody>
</table>

DIGITAL TTL I/O

They are pins 2, 6, and 8 of connector CN8, connected respectively to signals PD.4, PD.5 and PA.7. 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.
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.
FIGURE 47: CONNECTION EXAMPLES
RTC + SRAM

**GMM AM32 & 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:

\[
\begin{align*}
\text{DATA line (SDA)} & \quad \rightarrow \quad \text{PC.1 (input/output)} \\
\text{CLOCK line (SCL)} & \quad \rightarrow \quad \text{PC.0 (output)}
\end{align*}
\]

Please remark that A0 of this component's slave address is bound to logic 0, so its slave address is hexadecimal **A0H**. 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 correspons to high level logic state (= 5 V).
We also would want to remark that SDA and SCL lines are connected to a 4.7 KΩ pull-up resistor.
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