GMB HR84
grifo® Mini BLOCK Housing
8 Opto Inputs, 4 Relay Outputs

TECHNICAL MANUAL
Modular plastic Container DIN 50022 Modulbox, model M4 HC53; size: front 90 x 71 mm, height 58 mm; mounting on Omega rail DIN 46277-1 and DIN 46277-3; 8 Optocoupled Inputs that can be both NPN or PNP; status of 8 inputs shown by 8 LEDs; some inputs can perform Interrupt or Counter functions; 4 Relay Outputs 5 A; status of 4 outputs shown by 4 LEDs; 1 TTL output driven by optional RTC of Mini Module and visualized by its own 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 TTL PWM to generate a D/A-like signal by software; all signals can be connected through connectors featuring Normalized pin out; up to 6 I/O TTL signals; I²C 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; 28 pin socket for connection of Mini Modules grifo® like: CAN GM Zero, GMM AM08, GMM 876, etc.
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®.

Other Product and Company names listed, are trade marks of their respective companies.
GENERAL INDEX

INTRODUCTION ................................................................................................................... 1
CARD VERSION ................................................................................................................... 3

GENERAL INFORMATION .................................................................................................. 4
  ANALOG INPUT ............................................................................................................. 6
  OPTOCOUPLED DIGITAL INPUTS ................................................................................... 6
  DIGITAL RELAYS OUTPUTS .............................................................................................. 6
  SERIAL COMMUNICATION ............................................................................................... 6
  MINI MODULE ....................................................................................................................... 7
  CAN INTERFACE .................................................................................................................. 7
  I2C BUS LINES .................................................................................................................... 7
  TELECONTROL FIRMWARE ............................................................................................. 7
  DIGITAL I/O TTL SIGNALS ................................................................................................. 8
  POWER SUPPLY SECTION ................................................................................................. 8

TECHNICAL FEATURES ........................................................................................................ 10
  GENERAL FEATURES ........................................................................................................ 10
  PHYSICAL FEATURES ....................................................................................................... 10
  ELECTRIC FEATURES ....................................................................................................... 11

INSTALLATION ................................................................................................................... 12
  CONNECTIONS .................................................................................................................... 12
    CN5 - POWER SUPPLY CONNECTOR ........................................................................ 12
    CN3 - I2C BUS LINE CONNECTOR .............................................................................. 13
    ZC1 - CONTROL DEVICE SOCKET ............................................................................ 14
    CN2 - SERIAL LINE CONNECTOR ............................................................................. 16
    CN6 - OPTOCOUPLED DIGITAL INPUTS CONNECTOR ...................................... 22
    CN1 - RELAYS OUTPUTS CONNECTOR GROUPS A AND B ................................. 24
    CN4 - TTL I/O, A/D, ETC. CONNECTOR .................................................................... 26
  INTERRUPTS ..................................................................................................................... 30
  I/O CONNECTION ............................................................................................................. 30
  POWER SUPPLY ............................................................................................................... 32
  VISUAL SIGNALATIONS ................................................................................................... 33
  JUMPERS ............................................................................................................................... 34
    2 PINS JUMPERS ............................................................................................................. 36
    3 PINS JUMPERS ............................................................................................................. 37
  ISP PROGRAMMING .......................................................................................................... 38
  ANALOG INPUT .................................................................................................................. 38
  SERIAL COMMUNICATION SELECTION ......................................................................... 40
PERIPHERAL DEVICES SOFTWARE DESCRIPTION ..................................................... 44
   RELAYS OUTPUTS .............................................................................................................. 44
   OPTOCOUPLED INPUTS ................................................................................................... 44
   SERIAL LINE ....................................................................................................................... 44
   I2C BUS .......................................................................................................................... 45
   CAN LINE ....................................................................................................................... 45
   ANALOG INPUT ................................................................................................................ 45
   DIGITAL TTL I/O ............................................................................................................. 45

BIBLIOGRAPHY ................................................................................................................... 46

APPENDIX A: ALPHABETICAL INDEX ............................................................................ A-1
FIGURE INDEX

FIGURE 1: POSITION OF CARD RELEASE OF GMB HR84 ................................................................. 3
FIGURE 2: BLOCKS DIAGRAM ........................................................................................................... 5
FIGURE 3: PHOTO OF GMB HR84 WITH ITS CONTAINER ............................................................... 9
FIGURE 4: CN5 - POWER SUPPLY CONNECTOR ............................................................................. 12
FIGURE 5: CN3 - I2C BUS LINE CONNECTOR .................................................................................. 13
FIGURE 6: I2C BUS CONNECTION DIAGRAM .................................................................................. 13
FIGURE 7: ZC1 - CONTROL DEVICE SOCKET .................................................................................. 14
FIGURE 8: PHOTO OF GMB HR84 WITHOUT MINI MODULE INSTALLED ........................................ 15
FIGURE 9: CN2 - SERIAL LINE CONNECTOR ..................................................................................... 16
FIGURE 10: SERIAL COMMUNICATION BLOCK DIAGRAM ............................................................ 17
FIGURE 11: RS 232 PC POINT TO POINT CONNECTION EXAMPLE ............................................. 17
FIGURE 12: RS 232 POINT TO POINT CONNECTION EXAMPLE ................................................. 18
FIGURE 13: RS 422 POINT TO POINT CONNECTION EXAMPLE ................................................. 18
FIGURE 14: RS 485 POINT TO POINT CONNECTION EXAMPLE ................................................... 18
FIGURE 15: RS 485 NETWORK CONNECTION EXAMPLE ............................................................... 19
FIGURE 16: CURRENT LOOP 4 WIRES POINT-TO-POINT CONNECTION EXAMPLE ....................... 20
FIGURE 17: CURRENT LOOP 2 WIRES POINT-TO-POINT CONNECTION EXAMPLE ......................... 20
FIGURE 18: CURRENT LOOP NETWORK CONNECTION EXAMPLE .............................................. 21
FIGURE 19: CN6 - OPTOCOUPLER DIGITAL INPUTS CONNECTOR ................................................ 22
FIGURE 20: OPTOCOUPLER INPUTS BLOCK DIAGRAM ................................................................. 23
FIGURE 21: OPTOCOUPLER INPUTS CONNECTION DIAGRAM ...................................................... 23
FIGURE 22: CN1 - RELAYS OUTPUTS CONNECTOR GROUPS A AND B ........................................... 24
FIGURE 23: RELAY OUTPUTS A AND B BLOCK DIAGRAM ............................................................ 25
FIGURE 24: RELAY OUTPUTS A AND B CONNECTION DIAGRAM .................................................. 25
FIGURE 25: CN4 - TTL I/O, A/D, ETC. CONNECTOR ....................................................................... 26
FIGURE 26: A/D ANALOG INPUT CONNECTION DIAGRAM .......................................................... 27
FIGURE 27: TTL SERIAL LINE CONNECTION EXAMPLE ............................................................... 27
FIGURE 28: CAN INTERFACE CONNECTION EXAMPLE ............................................................... 28
FIGURE 29: MINI MODULE, LEDs, CONNECTORS, ETC. LOCATION ........................................... 29
FIGURE 30: COMPONENTS MAP (COMPONENT SIDE) ................................................................. 31
FIGURE 31: COMPONENTS MAP (SOLDER SIDE) ........................................................................... 31
FIGURE 32: LEDS TABLE .................................................................................................................. 33
FIGURE 33: JUMPERS SUMMARIZING TABLE .................................................................................. 34
FIGURE 34: JUMPERS LOCATION .................................................................................................... 35
FIGURE 35: 2 PINS JUMPERS TABLE ............................................................................................. 36
FIGURE 36: DEFAULT JUMPERS CONNECTION ............................................................................... 36
FIGURE 37: 3 PINS JUMPERS TABLE ............................................................................................. 37
FIGURE 38: ISP ACTIVATION THROUGH CN4 ............................................................................... 38
FIGURE 39: PHOTO OF EXPS-2 POWER SUPPLY ....................................................................... 39
FIGURE 40: SERIAL COMMUNICATION DRIVERS ......................................................................... 41
FIGURE 41: CONNECTIONS EXAMPLE ............................................................................................ 43
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 HR84** card release 220503. The validity of the bring informations is subordinate to the number of the card release.

**Figure 1: Position of Card Release of GMB HR84**
GENERAL INFORMATION

GMB HR84 is a module for DIN rail with a grifo® where a 28 pins Mini Module CPU type GMM or CAN can be installed. The board features 8 galvanically isolated inputs and 4 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. Its rank is low cost controller, that can work as intelligent peripheral in autonomy and/or remoted inside a wider telecontrol/teleacquisition network.

GMB HR84 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 BASIC, C and Pascal compilers, unexpensive and portable, 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 GMB HR84 are:

- Modular plastic Container DIN 50022 Modulbox, model M4 HC53
- Size: front 90 x 71 mm, height 58 mm
- Mounting on Omega rail DIN 46277-1 and DIN 46277-3
- 8 Optocoupled Inputs that can be both NPN or PNP
- Status of 8 inputs shown by 8 LEDs
- Some inputs can perform Interrupt or Counter functions
- 4 Relay Outputs 5 A
- Status of 4 outputs shown by 4 LEDs
- 1 TTL output driven by optional RTC of Mini Module and visualized by its own 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 TTL PWM to generate a D/A-like signal by software
- All signals can be connected through connectors featuring Normalized pin out
- Up to 6 I/O TTL signals
- 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
- 28 pin socket for connection of Mini Modules grifo® like: CAN GM Zero, GMM AM08, GMM 876, etc.

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.
**Figure 2: Blocks Diagram**

- **CN6**: 8 Input Lines
- **CN5**: Power Supply
- **CN2**: Serial Line
- **Microcontroller on grifo® Mini Module**
  - **CN1**: I2C Bus
  - **CN3**: PWM, A/D, I/O, etc.
  - **CN4**: Analog Adapter
  - **CN2**: Serial Line
  - **CN5**: Power Supply Sections
  - **CN6**: Opto Couplers
  - **Output Drivers**
    - N.O. Relays
  - **4 Output Lines**
ANALOG INPUT

One analog input is available connected through a field connector to a specific circuitery that allows to acquire signals in variable ranges with the resolution typical of Mini Module installed. This feature depends on Mini Module used, so please refer to documentation of specific GMB HR84 + Mini Module union.

OPTOCOUPLED DIGITAL INPUTS

GMB HR84 features 8 NPN and/or PNP inputs connected to a quick release screw terminal connector that are directly acquired by 8 I/O lines of Mini Module through a galvanically isolated interface. These lines are visualized by specific LEDs and have been selected to be able to take advantage completely of Mini Module's CPU internal peripherals, so the inputs can generate interrupts, be counted by hardware counters, etc. Optocoupled inputs are supplied by a specific voltage called +Vopto that must be provided from an external source.

DIGITAL RELAYS OUTPUTS

The board is provided with 4 relays outputs 5 A, normally open, whose status is visualized by 4 LEDs. Each line is driven directly by a I/O line of Mini Module, buffered through a specific driver and connected to a comfortable quick release screw terminal connector to easy interface to the field signals.

SERIAL COMMUNICATION

GMB HR84 features one interface for an asynchronous serial line whose physical protocol (baud rate, stop bit, bit per character, etc.) is completely settable by software programming the Mini Module installed on the card, so for further information please refer to its technical manual. 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 not buffered (TTL) or 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. Please remark that by default the board is provided with both serial lines in RS 232, so any different configuration must be specified in the order. For further information about serial communication please refer to paragraph: “CONNECTIONS” and “SERIAL COMMUNICATION SELECTION”.

MINI MODULE

**GMB HR84** has been designed to accept all 28 pins grifo® Mini Modules; such CPU modules are the core of the system, in fact they provide and define the use for all peripherals according to the application to make. Mini Module is also software programmable, to allow the user to satisfy needs that can also change in time.

CAN INTERFACE

**GMB HR84** featurea an interface for an eventual CAN line available on Mini Module installed. Such interface is simply a connector for field connection and CAN line termination circuitry, while all other hardware and software characteristics (line driver, bit rate, etc.) are the ones of Mini Module installed, so for further information please refer to its technical documentation.

I²C BUS LINES

**GMB HR84** is provided with one connector (CN3) dedicated to I²C BUS, which can be a hardware peripheral of the microcontroller or software emulated, connected to two signals of Mini Module, each provided with a 4.7 kΩ pull-up installed on **GMB HR84**. 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 intresting to consider **K51-AVR**, for which both technical manual and electric diagram are available, also a wide set of examples in several languager are available.

TELECONTROL FIRMWARE

The Mini Module installed on **GMB HR84** can be provided with a telecontrol firmware; such firmwares allow to manage all the board resources through a set of commands to send to the serial line. Taking advantage of these firmwares make possible to use well developed commands that solve fundamental problems of automation like impulse count, wave from generation, debounced input acquisition, Real Time Clock management, etc. In addition, Master Slave communication mode is supported; this allows to remote single modules also at great distance, to build a telecontrol network driven by a unique master unit (PC, PLC, GPC®, etc.). By now, some standard protocols like **ALB x84** (**ABACO®** Link BUS) and **MODBUS** are available, anyway new protocols can be developed on specific request of the customer. Please contact grifo® for further information.
DIGITAL I/O TTL SIGNALS

According to which Mini Module is installed, GMB HR84 features from 2 to 6 digital I/O TTL signals.
Use of these lines is completely user defineable and, in some cases, are available also automatic features controlled by Mini Module peripherals multiplexed with I/O on the same pin.
Remarkable are: optional Real Time Clock, PWM line from CPU internal PCA to generate an analog signal, count signal from CPU internal 16 bit Timer Counter, etc.

POWER SUPPLY SECTION

GMB HR84 is provided with an efficient switching power supply section, that provides supply +5 Vdc voltage needed by logic and output circuits, in any condition of input load and voltage.
If this section is not present, supply voltages must be provided from an external source.
The board features components and circuits designed to reduce consumptions (including the possibility of power-down and idle working modes of Mini Modules) and to reduce noise sensibility.
Remarkable is protection circuit based on TransZorb™ that avoids damages due to incorrect voltages.
To supply optocouplers of galvanically isolated sections an external voltage is needed.
For further information please refer to chapter “ELECTRIC FEATURES” and paragraph “SUPPLY VOLTAGES”.
**Figure 3: Photo of GMB HR84 with its container**
TECHNICAL FEATURES

GENERAL FEATURES

On board resources: 8 optocoupled digital inputs NPN and PNP
4 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 PWM output (for D/A)
Up to 6 digital I/O TTL
1 switching power supply section
14 status LEDs

Mini Module: 28 pins, like CAN GM Zero, GMM AM08, GMM 876, etc.

Opto input cut-off frequency: 13 KHz

PHYSICAL FEATURES

Size: 90 x 71 x 58 mm (container DIN 50022)
85 x 66 x 32 mm (without container)

Container: DIN 50022 modulbox, model M4 HC53

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

Weight: 160 g

Connectors:
CN1: 6 pins quick release screw terminal connector
CN2: 9 pins D type female, vertical, connector
CN3: 4 pins strip, male, vertical
CN4: 2x4 vie AMP MODU II, male, vertical
CN5: 2 pins quick release screw terminal connector
CN6: 9 pins quick release screw terminal connector

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: 2.3 W (*)

Output power supply: +5 Vdc

Current required by GMB HR84: 310 mA max (+5 Vdc)
16+75 mA max (+V opto)

Current on +5 Vdc output: 400 mA - current required - Mini Module current

Relays max voltage: 35 Vdc

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

Optocouplers input voltage: +V opto = 8÷30 Vdc (*)

Power required for optocouplers: 4.4 W

Analog input range: direct connection or attenuation factor 4
analog range depends on Mini Module

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

CAN termination network: 120 Ω resistor, disconnectable

(*) 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

GMB HR84 has 6 connectors that can be linked 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 29).

CN5 - POWER SUPPLY CONNECTOR

CN5 is a 2 ways, quick release screw terminal connector, vertical, 5.00 mm pitch. CN5 allows to provide power needed by the switching power supply to generate logic control and optocouplers supply voltage.

Signals description:

Vac, GND = I - Negative terminal of direct supply voltage.
Vac, +Vdc pow = I - Positive terminal of direct supply voltage.

For further information please refer to paragraphs "POWER SUPPLY" and "ELECTRIC FEATURES".
CN3 - I²C BUS LINE CONNECTOR

CN3 is a 4 ways, male, vertical, strip connector with 2.54mm pitch. On CN3 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: CN3 - I²C BUS Line Connector](image)

**Signals description:**

- **MM PIN7, SDA** = I/O - Data signal of I²C BUS serial line connected to Mini Module pin 7.
- **MM PIN6, SCL** = O - Clock signal of I²C BUS serial line connected to Mini Module pin 6.
- **+5 Vdc** = O - Unique +5 Vdc power supply.
- **GND** = - Ground.

![Figure 6: I²C BUS Connection Diagram](image)
ZC1 - CONTROL DEVICE SOCKET

ZC1 is a 40 pin, 600 mils DIL socket. Its purpose is to install the intelligent hardware module that manages all GMB HR 84 on board signals (reads optocoupled inputs, set relays outputs, etc.). Hardware structure of GMB HR 84 is designed for use with grifo® Mini Modules. If you are using a combination GMB HR 84 + grifo® Mini Module please refer to its specific manual. If you want to develop a new hardware or you have to check hardware compatibility of an existing board, please refer to the following figure, that shows which on board hardware resource is connected to each signal of 28 pins socket ZC1. For further details about hardware, please refer to following paragraphs. For further details about hardware, please refer to chapter "PERIPHERAL DEVICES SOFTWARE DESCRIPTION". For purpose of jumpers, please refer to chapter "JUMPERS".

| MM PIN1 , pin 2 of J11 | MM PIN2 , pin 2 of J10 | MM PIN3 , RxD | MM PIN4 , TxD | MM PIN5 , /INTRTC , pin 4 of CN4 | MM PIN6 , SCL , pin 2 of CN3 | MM PIN7 , SDA , pin 3 of CN3 | MM PIN8 , CAN-L , pin 3 of CN4 | MM PIN9 , CAN-H , pin 5 of CN4 | MM PIN10 , N. C. | MM PIN11 , pin 1 of J7 | MM PIN12 , I/O , pin 2 of CN4 | MM PIN13 , IN8 | MM PIN14 , GND | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 |
|------------------------|------------------------|--------------|--------------|------------------------------|----------------------------|-----------------------------|-----------------------------|-----------------------------|----------------|----------------|----------------|--------|--------|----|----|----|----|----|----|----|----|----|----|----|----|
| 1                      | 2                      | 3            | 4            | 5                            | 6                          | 7                          | 8                          | 9                            | 10              | 11              | 12              | 13        | 14    | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 |

**Figure 7: ZC1 - Control Device Socket**
Figure 8: Photo of GMB HR84 without Mini Module installed
CN2 - SERIAL LINE CONNECTOR

CN2 is a 9 ways, female, vertical, D-type type connector. 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.

![Figure 9: CN2 - Serial line connector](image)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RS 232 serial line (please see paragraph &quot;SERIAL COMMUNICATION SELECTION&quot;):</strong></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><strong>RS 422 serial line (please see paragraph &quot;SERIAL COMMUNICATION SELECTION&quot;):</strong></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><strong>RS 485 serial line (please see paragraph &quot;SERIAL COMMUNICATION SELECTION&quot;):</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>RXTX+ RS485</td>
<td>= I/O-</td>
<td>Receive/Trasmit Data Positive for RS 485.</td>
</tr>
<tr>
<td>2</td>
<td>RXTX- RS485</td>
<td>= I/O-</td>
<td>Receive/Trasmit Data Negative for RS 485.</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>= -</td>
<td>Ground signal.</td>
</tr>
<tr>
<td><strong>Current Loop serial line (please see paragraph &quot;SERIAL COMMUNICATION SELECTION&quot;):</strong></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>
**Figure 10:** Serial communication block diagram

**Figure 11:** RS 232 PC point to point connection example
**Figure 12: RS 232 point to point connection example**

**Figure 13: RS 422 point to point connection example**

**Figure 14: RS 485 point to point connection example**
Please remark that in a RS 485 network two forcing resistors must be connected across the net and two termination resistors (120 Ω) must be placed at its extremes, respectively near the Master unit and the Slave unit at the greatest distance from the Master.

Forcing and terminating circuitry is installed on GMB HR84 board. It can be enabled or disabled through specific jumpers, as explained later.

For further information please refer to TEXAS INSTRUMENTS Data-Book, "RS 422 and RS 485 Interface Circuits", the introduction about RS 422-485.
**Figure 16:** Current loop 4 wires point-to-point connection example

**Figure 17:** Current loop 2 wires point-to-point connection example
Possible Current Loop connections are two: 2 wires and 4 wires. These connections are shown in figures 16 to 18 where it is possible to see the voltage for VCL and the resistances for current limitation (R). The supply voltage varies in compliance with the number of connected devices and voltage drop on the connection cable.

The choice of the values for these components must be done considering that:
- circulation of a 20 mA current must be guaranteed;
- potential drop on each transmitter is about 2.35 V with a 20 mA current;
- potential drop on each receiver is about 2.52 V with a 20 mA current;
- in case of shortcircuit each transmitter must dissipate at most 125 mW;
- in case of shortcircuit each receiver must dissipate at most 90 mW.

For further info please refer to HEWLETT-PACKARD Data Book, (HCPL 4100 and 4200 devices).

**Figure 18: Current Loop Network Connection Example**
CN6 - OPTOCOUPLED DIGITAL INPUTS CONNECTOR

CN6 is a 9 ways, quick release, screw terminal connector, pitch 5.0 mm. CN6 is used to connect the 8 optocoupled NPN or PNP input signals that the card manages and are visualized by green LEDs. Connector also features the common pin where to connect one input to close it. These signals are software managed and have been carefully selected to take advantage of grifo® Mini Modules internal peripherals.

**Figure 19: CN6 - Optocoupled Digital Inputs Connector**

Signals description:

**MM PIN x, INn =**  
- n-th optocoupled input type NPN or PNP, connected to indicated signal of Mini Module.

**COMMON =**  
- Common pin where an input must be connected to close it.
Input lines are optocoupled and provided with low-pass filter; this warrants a grade of protection for internal electronics against external noise.

Each line features a LED for visual signalation that turns ON whenever voltage $+V_{opto}$ is connected between input pin and common pin, regardless polarity of connection.

This makes input lines suitable both for PNP and NPN drivers.

**Figure 20: Optocoupled inputs block diagram**

**Figure 21: Optocoupled inputs connection diagram**
CN1 - RELAYS OUTPUTS CONNECTOR GROUPS A AND B

CN1 is a 6 ways, quick release screw terminal connector, pitch 5.0 mm. This connector allows to connect 4 normally open contacts and common pins relays outputs available on GMB HR84.

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

**FIGURE 22: CN1 - RELAYS OUTPUTS CONNECTOR GROUPS A AND B**

Signals description:

**MM PIN x, OUT An** = O - Normally open contact for n-th relay of group A, connected to indicated Mini Module pin.

**COMMON A** = - Common contact for relays of group A.

**MM PIN x, OUT Bn** = O - Normally open contact for n-th relay of group B, connected to indicated Mini Module pin.

**COMMON B** = - Common contact for relays of group B.
Le linee di output a relé, comprendono un diodo LED con funzione di segnalazione visiva (il LED si accenderà tutte le volte in cui il contatto del relé risulterà chiuso). I relè sono pilotati da 4 transistors PNP che a loro volta sono gestiti attraverso altrettanti pins di I/O del Mini Modulo.

**FIGURE 23: RELAY OUTPUTS A AND B BLOCK DIAGRAM**

**FIGURE 24: RELAY OUTPUTS A AND B CONNECTION DIAGRAM**
CN4 is a 8 ways, male, vertical, AMP MODU II 2x4 connector with pitch 2.54 mm. This connector features +5 Vdc supply voltage (generated by on board switching power supply), up to 4 TTL digital I/O signals and an analog input connected to A/D section. Pin 4 is connected to Real Time Clock 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. AMP8.cable).

![Figure 25: CN4 - TTL I/O, A/D, ETC. CONNECTOR](image)

**Signals description:**

- **MM PIN x**: I/O - TTL digital I/O signal, connected to pin x of Mini Module.
- **A/D**: I - Analog input for A/D converter section of Mini Module.
- **CAN H**: I/O - Differential line high of Mini Module's optional CAN interface.
- **CAN L**: I/O - Differential line low of Mini Module's optional CAN interface.
- **/INTRTC**: I/O - Interrupt signal of Mini Module's optional Real Time Clock.
- **PWM**: O - Pulse Width Modulation TTL output of Mini Module.
- **+5 Vdc**: O - Positive terminal of +5 Vdc power supply.
- **GND**: - Ground signal.

Next figures show connection modalities of GMB HR84 that will be explained more in detail further; it is suggested to refer to table of figure 36 to see which signals are available on connector CN4 according to which Mini Module is installed.
**Figure 26: A/D Analog Input Connection Diagram**

**Figure 27: TTL Serial Line Connection Example**
Please remind that a CAN network line must have impedance of 60 Ω; in order to obtain this, two termination resistors (120 Ω) placed at its extrem, respectevely near the master unit and the slave unit at the greatest distance from the master.

On GMB HR84 board the terminating circuitry is already installed: it can be connected or not through specific jumper, as explained later, in paragraph "JUMPERS".

If the system to connect are at very different potentials, it is possible to connect also the grounds of the systems, that is pin 7 of CN4, to solve eventual problems of communication and/or working.
FIGURE 29: MINI MODULE, LEDs, CONNECTORS, ETC. LOCATION
INTERRUPTS

A remarkable feature of GMB HR84 card is the powerful interrupt management, directly bound to the Mini Module, installed.
In fact, this latter has lines and controller for interrupt.
Please refer to Mini Module manual for further information about interrupts management, while to identify quickly the interrupt sources, please refer to figure 7.
On every Mini Module an interrupt manager (ICU) allows to enable, disable, mask and prioritize the interrupt sources, so the user has the possibility to respond promptly and efficiently to any external event.

I/O CONNECTION

To prevent possible connecting problems between GMB HR84 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;

- 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) must be connected to signals in the ranges available according to Mini Module installed. Inputs feature high impedance, anyway an eventual interfacing circuitry should provide low impedance to assure greater stability and precision. Please remark that the analog input on CN4 is provided with filtering capacitors that warrant more stability on the signal to acquire and lower the cut-off frequency. It also features a voltage divider to attenuate signal amplitude by 4.

- For optocoupled input signals, both the contact to acquire and external +Vopto must be connected in serie. In detail, contacts must perform the following connection:

<table>
<thead>
<tr>
<th>NPN</th>
<th>PNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN x</td>
<td>GND opto</td>
</tr>
<tr>
<td>COMMON</td>
<td>+Vopto</td>
</tr>
<tr>
<td></td>
<td>GND opto</td>
</tr>
</tbody>
</table>

to avoid problems with electric noise, it is suggestable to keep galvanically separated +Vopto and board power supply, this means to keep separate board GND and GND opto.

- 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 two groups of relays are available.
Figure 30: Components map (component side)

Figure 31: Components map (solder side)
POWER SUPPLY

GMB HR84 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 and must be provided on connector CN6.

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 1 and 2 of CN5 (in case of Vdc, pin 1 must be connected to positive terminal). This allows to supply the cards using standard devices of industrial sector like transformers, batteries, solar cells, etc. Also, if there is the need to supply at +5 Vdc I2C BUS external peripherals from GMB HR84, pins 1 and 4 of CN4 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 HR84 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 must be less than:

400 mA - current absorbed by GMB HR84 - current absorbed by Mini Module

for example, in case of Mini Module GMM 5115:

400 mA - 310 mA - 20 mA = 70 mA.

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

GMB HR84 features the LEDs described in the following table:

<table>
<thead>
<tr>
<th>LED</th>
<th>COLOUR</th>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD1</td>
<td>Red</td>
<td>Visualizes status of relay output OUT A1. LED ON indicates that the input is connected to COMMON A.</td>
</tr>
<tr>
<td>LD2</td>
<td>Red</td>
<td>Visualizes status of relay output OUT A2. LED ON indicates that the input is connected to COMMON A.</td>
</tr>
<tr>
<td>LD3</td>
<td>Red</td>
<td>Visualizes status of relay output OUT B1. LED ON indicates that the input is connected to COMMON B.</td>
</tr>
<tr>
<td>LD4</td>
<td>Red</td>
<td>Visualizes status of relay output OUT B2. LED ON indicates that the input is connected to COMMON B.</td>
</tr>
<tr>
<td>LD5</td>
<td>Yellow</td>
<td>Visualizes presence of +5 Vdc power supply for logic.</td>
</tr>
<tr>
<td>LD6</td>
<td>Red</td>
<td>Visualizes status of signal MM PIN 5 connected to pin 4 of CN4, which normally corresponded to interrupt of Mini Module RTC.</td>
</tr>
<tr>
<td>LD7÷LD14</td>
<td>Green</td>
<td>Visualize status of optocoupled input 1÷8. One LED ON indicates current circulation between input INP n-th and COMMON.</td>
</tr>
</tbody>
</table>

**FIGURE 32: LEDS table**

The main function of LEDs is to inform the user about card status, with a simple visual indication and in addition to this, LEDs make easier the debug and test operations of the complete system. To recognize the LED location on the card, please refer to figure 29.

All the LEDs described in figure 32 are visible from the breaks on the plastic container dedicated to the connectors, to allow inspection also when the board is closed and installed in the electric panel. In addition, LEDs that display buffered I/O are physically located near the corresponding pins to easy cabling verification and all other evental working tests.
**JUMPERS**

On **GMB HR84** there are 11 jumpers for card configuration. Here below is the jumpers list, location and function:

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>N° PINS</th>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1</td>
<td>2</td>
<td>Connects termination and forcing circuitry to RS 422 or RS 485 serial line.</td>
</tr>
<tr>
<td>J2</td>
<td>3</td>
<td>Selects connection of pin 2 on serial connector CN2.</td>
</tr>
<tr>
<td>J3</td>
<td>3</td>
<td>Selects connection of pin 3 on serial connector CN2.</td>
</tr>
<tr>
<td>J4</td>
<td>3</td>
<td>Selects connection of signals MM PIN 3, that is Mini Module's serial reception line.</td>
</tr>
<tr>
<td>J5</td>
<td>3</td>
<td>Selects direction and operational modality for serial line in RS 422, RS 485.</td>
</tr>
<tr>
<td>J6</td>
<td>3</td>
<td>Selects connection of signals MM PIN 27, that is range of analog input signal.</td>
</tr>
<tr>
<td>J7</td>
<td>3</td>
<td>Selects DIR signal connections for serial communication in RS 422, RS 485.</td>
</tr>
<tr>
<td>J8</td>
<td>2</td>
<td>Connects termination circuitry to CAN line.</td>
</tr>
<tr>
<td>J9</td>
<td>2</td>
<td>Connects termination and forcing circuitry to RS 422 or RS 485 serial line.</td>
</tr>
<tr>
<td>J10</td>
<td>3</td>
<td>Connects the reset signal to signal DTR from serial interface, to be able to program Mini Module GMM 935.</td>
</tr>
<tr>
<td>J11</td>
<td>3</td>
<td>Connects the input Vref to signal RTS from serial interface, to be able to program Mini Module GMM 935.</td>
</tr>
</tbody>
</table>

**FIGURE 33: JUMPERS SUMMARIZING TABLE**

The following tables describe all the right connections of **GMB HR84** jumpers with their relative functions. To recognize these valid connections, please refer to the board printed diagram (serigraph) or to figures 30 and 31 of this manual, where the pins numeration is listed; for recognizing jumpers location, please refer to figure 29. The "*" denotes the default connection, or on the other hand the connection set up at the end of testing phase, that is the configuration the user receives.
FIGURE 34: JUMPERS LOCATION
## 2 PINS JUMPERS

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>CONNECTION</th>
<th>PURPOSE</th>
<th>DEF.</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1</td>
<td>not connected</td>
<td>Does not connect termination and forcing circuitry to serial line RS 485 receiver/transmitter or RS 422 receiver.</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>connected</td>
<td>Connects termination and forcing circuitry to serial line RS 485 receiver/transmitter or RS 422 receiver.</td>
<td></td>
</tr>
<tr>
<td>J8</td>
<td>not connected</td>
<td>Does not connect 120 Ω termination resistor to CAN line.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>connected</td>
<td>Connect 120 Ω termination resistor to CAN line.</td>
<td>*</td>
</tr>
<tr>
<td>J9</td>
<td>not connected</td>
<td>Does not connect termination and forcing circuitry to serial line RS 485 receiver/transmitter or RS 422 receiver.</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>connected</td>
<td>Connects termination and forcing circuitry to serial line RS 485 receiver/transmitter or RS 422 receiver.</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 35: 2 PINS JUMPERS table**

**Figure 36: Default jumpers connection**
### 3 PINS JUMPERS

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>CONNECTION</th>
<th>PURPOSE</th>
<th>DEF.</th>
</tr>
</thead>
<tbody>
<tr>
<td>J2</td>
<td>position 1-2</td>
<td>Connects pin 2 of connector CN2 to serial line in RS 422 or RS 485.</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>position 2-3</td>
<td>Connects pin 2 of connector CN2 to serial line in RS 232 or TTL.</td>
<td></td>
</tr>
<tr>
<td>J3</td>
<td>position 1-2</td>
<td>Connects pin 3 of connector CN2 to serial line in RS 422 or RS 485.</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>position 2-3</td>
<td>Connects pin 3 of connector CN2 to serial line in RS 232 or TTL.</td>
<td></td>
</tr>
<tr>
<td>J4</td>
<td>position 1-2</td>
<td>Connects Mini Module serial line reception signal to serial line in RS 422, RS 485 or current loop.</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>position 2-3</td>
<td>Connects Mini Module serial line reception signal to serial line in RS 232 or TTL.</td>
<td></td>
</tr>
<tr>
<td>J5</td>
<td>position 1-2</td>
<td>Configures serial line for electric standard RS 485 (2 wires half duplex).</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>position 2-3</td>
<td>Configures serial line for electric standard RS 422 (4 wires full duplex or half duplex).</td>
<td></td>
</tr>
<tr>
<td>J6</td>
<td>position 1-2</td>
<td>Connects signal MM PIN 27 directly to pin 4 of CN4, that is selects range 0÷2.5 Vdc for analog input of A/D.</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>position 2-3</td>
<td>Connects signal MM PIN 27 directly to pin 4 of CN4, that is selects range 0÷10 Vdc for analog input of A/D.</td>
<td></td>
</tr>
<tr>
<td>J7</td>
<td>position 1-2</td>
<td>Connects signal DIR (used for RS 422 and RS 485 communication) to pin 11 of Mini Module.</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>position 2-3</td>
<td>Connects signal DIR (used for RS 422 and RS 485 communication) to pin 24 of Mini Module.</td>
<td></td>
</tr>
<tr>
<td>J10</td>
<td>position 1-2</td>
<td>Connects Mini Module reset signal to serial interface DTR signal to program in ISP mode Mini Module GMM 935 and similar.</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>position 2-3</td>
<td>Does not connect Mini Module reset signal.</td>
<td></td>
</tr>
<tr>
<td>J11</td>
<td>position 1-2</td>
<td>Connects Mini Module Vref input to serial interface RTS signal to program in ISP mode Mini Module GMM 935 and similar.</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>position 2-3</td>
<td>Connects Mini Module Vref input to GMB HR84 on board reference voltage generator.</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 37: 3 PINS JUMPERS Table**
ISP PROGRAMMING

Every Mini Module that can be installed on **GMB HR84** can be programmed in-circuit (In System Programming) that allows to read and write internal memories of Mini Module with simple and comfortable operations.  
Through ISP the user can, for example, change the application program, fetch and set configurations data and or data gathered by the program, etc.  
ISP activation mode changes according to which Mini Module is used but, in general, require a manual intervention on a jumper or dip switch.  
When **GMB HR84** is closed in its container, it is not possible to access the Mini Module so ISP can be activated externally acting on connector CN4. 
It is enough to short-circuit pins 7 and 8 of this latter (see figure below) with a jumper or a little switch, it pins are already used:

![Figure 38: ISP activation through CN4](image)

NOTE
Activating ISP through CN4 can be done only on Mini Modules that have ISP ability on pin 27 of their socket (e.g. CAN GM2, GMM 5115) and setting jumper J6 in position 1-2.
On other Mini Modules, you must open the container and act on specific selector.

ANALOG INPUT

**GMB HR84** features an interface for one analog input that can accept an input voltage in a variable range according to the Mini Module installed and the connection of jumper J6.
Please refer to figure 7 and to manual of **GMB HR84 + Mini Module** for further information.
As shown in figure 26, such analog interface is based on high precision passive components that are selected during mounting phase to optimize signal acquisition.
Anyway, to compensate eventual tolerances and thermal drifts, the best thing is to make a software calibration of the signal acquired, that is to calculate a correction coefficient using a reference signal, then to use such coefficient for successive analog signal acquisitions.
Examples provided with delivery show some calibration techniques that the user can modify according to his/her needs.
Figure 39: Photo of EXPS-2 power supply
SERIAL COMMUNICATION SELECTION

Serial line of **GMB HR84** can be buffered in RS 232, RS 422, RS 485, Current Loop or TTL. By hardware can be selected which one of these electric standards is used, through jumpers connection (as described in the previous tables) and drivers installation. By software the serial line can be programmed to operate with all the standard physical protocols, in fact the bits per character, parity, stop bits and baud rates can be decided by setting opportunes CPU internal registers. In the following paragraphs there are all the informations on serial communication configurations.

Some devices needed for RS 422, RS 485 and Current Loop configurations are not mounted on the board in standard configuration; this is why each fist non-standard (non-RS 232) serial configuration for line A must be always performed by **grifo®** technicians.

This far the user can change in autonomy the configuration following the informations below:

- **HW SERIAL LINE IN RS 232 (default configuration)**
  
  | J1, J9  | J2, J3  | J4   | J5   | J7   | Mini Module | IC1 | IC2 | IC3 | IC4
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>not connected</td>
<td>position 2-3</td>
<td>position 2-3</td>
<td>indifferent</td>
<td>indifferent</td>
<td>serial in RS 232 (#)</td>
<td>no device</td>
<td>no device</td>
<td>no device</td>
<td>no device</td>
</tr>
</tbody>
</table>
  
- **HW SERIAL LINE A IN CURRENT LOOP (option .CLOOP)**

  | J1, J9  | J2, J3  | J4   | J5   | J7   | Mini Module | IC1 | IC2 | IC3 | IC4
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>not connected</td>
<td>indifferent</td>
<td>position 1-2</td>
<td>indifferent</td>
<td>indifferent</td>
<td>serial in TTL (#)</td>
<td>no device</td>
<td>no device</td>
<td>driver HP 4200</td>
<td>driver HP 4100</td>
</tr>
</tbody>
</table>

Please remark that Current Loop serial interface is passive, so it must be connected an active Current Loop serial line, that is a line provided with its own power supply, like described in figures 16÷18. Current Loop interface can be employed to make both point-to-point and multi-point connections through a 2-wires or a 4-wires connection.

- **HW SERIAL LINE A IN RS 422 (option .RS 422)**

  | J1, J9  | J2, J3  | J4   | J5   | J7   | Mini Module | IC1 | IC2 | IC3 | IC4
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(*)</td>
<td>position 1-2</td>
<td>position 1-2</td>
<td>position 2-3</td>
<td>(**)</td>
<td>serial in TTL (#)</td>
<td>driver SN 75176 or MAX 483</td>
<td>driver SN 75176 or MAX 483</td>
<td>no device</td>
<td>no device</td>
</tr>
</tbody>
</table>

Status of signal **DIR** (software managed with Mini Module signal selected with J7), allows to enable or disable the transmitter:

- DIR = low level = logic state 0 -> transmitter enabled
- DIR = high level = logic state 1 -> transmitter disabled

In point-to-point connections, signal **DIR** can be always kept low (transmitter always enabled), while in multi-point connections transmitter must be enabled only when a transmission is requested.
FIGURE 40: SERIAL COMMUNICATION DRIVERS

Serial in RS 232, TTL
Serial in Current Loop
Serial in RS 422
Serial in RS 485
- HW SERIAL LINE A IN RS 485 (option .RS 485)

| J1, J9       | = (*) Mini Module = serial in TTL (#) |
| J2, J3       | = position 1-2 IC1 = driver SN 75176 or MAX 483 |
| J4           | = position 1-2 IC2 = no device |
| J5           | = position 1-2 IC3 = no device |
| J7           | = (**) IC4 = no device |

In this modality the signals to use are pins 1 and 2 of connector CN2, that become transmission or reception lines according to the status of signal DIR, managed by software, as follows:

| DIR   | =low level = logic state 0 -> transmitter enabled |
|       | =high level = logic state 1 -> transmitter disabled |

This kind of serial communication can be used for multi-point connections, in addition it is possible to listen to own transmission, so the user is allowed to verify the success of transmission. In fact, any conflict on the line can be recognized by testing the received character after each transmission.

- HW SERIAL LINE A IN TTL (option .RS 485)

| J1, J9       | = not connected Mini Module = serial in TTL (#) |
| J2, J3       | = position 2-3 IC1 = no device |
| J4           | = position 2-3 IC2 = no device |
| J5           | = indifferent IC3 = no device |
| J7           | = indifferent IC4 = no device |

(*) If using the RS 422 or RS 485 serial line, it is possible to connect the terminating and forcing circuit on the line by using J1 and J9. In case of point-to-point connections this circuit must be always connected, while in case of multi-point connections it must be connected only in the farthest boards, that is on the edges of the communication line.

During a reset or a power on, signal DIR is at logic level high, so during these phases driver RS 485 is in reception or transmission driver RS 422 is disabled, to avoid conflicts on line.

(**) In case of RS 422 or RS 485 communication, signal DIR can be selected according to the Mini Module installed:

| J7 in position 1-2 | -> DIR = pin 11 of Mini Module (e.g. CAN GM1) |
| J7 in position 2-3 | -> DIR = pin 24 of Mini Module (e.g. CAN GM2, GMM 5115) |

This allows to use the Mini Module resources the best way possible, without having to use I/O signal of CN4 for serial communication.

(#) Serial line of Mini Module installed on GMB HR84 must be configured through the specific selectors on board of this latter, as described in its technical manual.

For example:

| CAN GM1, CAN GM2, GMM 5115 | -> DSW1.2,3 ON ; DSW1.4,5 OFF -> RS 232 |
|                            | -> DSW1.2,3 OFF ; DSW1.4,5 ON -> TTL |

For further information, refer to figures 11-18 and 27.
FIGURE 41: CONNECTIONS EXAMPLE
PERIPHERAL DEVICES SOFTWARE DESCRIPTION

Below there is a specific description of the software managements of the on board peripheral devices through the Mini Module connections. Whenever the reported documentation is not sufficient, please search a more detailed description of the devices in manufacturing company data sheets. In the following paragraphs the $D_{7} \div D_{0}$ and $.0 \div 7$ indications denote the eight bits of the combination involved in I/O operations.

RELAYS OUTPUTS

Status of 4 digital relays outputs is set through 4 I/O pins of Mini Module, as described in table of figure 7.
When a line is set to logic state low (logic 0), corresponding output is enabled (relay contact connected to its common contact), vice versa when the line is set to logic state high (logic 1), the output is disabled (relay contact open).
As previously said, LEDs LD1+4 give a visual indication of digital outputs status (LED ON means output activated).
Remarkable is the fact that the lines driving the relays can perform also high level actions; for example wave forms generation, timed activations, etc.
During reset or power on, the 4 signals must be kept at logic 1 by Mini Module, if outputs must be disabled during these phases.

OPTOCOUPLED INPUTS

Status of 8 digital optocoupled inputs can be acquired by software by reading the status of corresponding pins of Mini Module, described in table of figure 7.
When NPN or PNP inputs are enabled, corresponding lines 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 LD7+14 give a visual indication of digital inputs status (LED ON means input activated).
Mini Modules pins have been selected to simplify software management; in fact they can generate interrupts, be counted by hardware counters or simply be acquired.

SERIAL LINE

Please refer to Mini Module manual, signals used are the ones called TxD and RxD in figure 7.
I2C BUS

Please refer to Mini Module manual, signals used are the ones called SDA and SCL in figure 7.

CAN LINE

Please refer to Mini Module manual, signals are the ones called CAN L and CAN H in figure 37.

ANALOG INPUT

Please refer to Mini Module manual, signal used is the one called A/D in figure 7.

DIGITAL TTL I/O

Please refer to Mini Module manual, signals used are the ones called PIN n on CN4 in figure 7.
BIBLIOGRAPHY

In this chapter there is a complete list of technical books, where the user can find all the necessary documentations on the components mounted on GMB HR84.

Manual TEXAS INSTRUMENTS:  
*The TTL Data Book - SN54/74 Families*

Manual PHILIPS:  
*IC bus compatible ICs*

Manual SGS-THOMSON:  
*Small signal transistor - Data Book*

Manual TAKAMISAWA:  
*Relays index Book*

Technical papers S.E.:  
*SI series - Switching power supply*

Manual TOSHIBA:  
*Mos Memory Products*

Manual TOSHIBA:  
*Photo couplers - Data Book*

Please connect to the manufactures Web sites to get the latest version of all manuals and data sheets.
APPENDIX A: ALPHABETICAL INDEX

A
ANALOG INPUT 38
ANALOG INPUT 10, 26
ANALOG INPUT RANGE 11

C
CALIBRATION 38
COMMON 1 22
CONNECTORS 10
   CN3 24
   CN5 12
   CN6 16
   CN7 26
   CN8 13
   ZC1 14
CONTAINER 10
CURRENT LOOP 10, 16, 21, 40
CURRENT ON +5 VDC 11
CURRENT REQUIRED 11
CUT-OFF FREQUENCY 10

D
DIGITAL INPUTS 10, 22
DIN 10
DIR 10

E
EXPS-2 32

I
I/O TTL 10, 26
FC BUS 7, 10, 11, 13
INTERRUPTS 30

J
JUMPERS 34
   2 PINS JUMPERS 36
   3 PINS JUMPERS 37

L
LEDS 10, 33
M
MINI MODULE  10

N
NPN  10, 22

O
OPTOCOUPLED INPUTS  44
OPTOCOUPLERS INPUT VOLTAGE  11

P
PNP  10, 22
POWER REQUIRED FOR OPTOCOUPLERS  11
POWER SUPPLY  10, 11, 12, 32
POWER SUPPLY TO OPTOCOUPLERS  32

R
RELATIVE HUMIDITY  10
RELAY OUTPUTS  10, 24
RELAYS MAX CURRENT  11
RELAYS OUTPUTS  44
RS 232  16, 40
RS 422  10, 16, 18, 40
RS 485  10, 16, 42
RS 485 NETWORK  19

S
SIZE  10
SWITCHING  10

T
TEMPERATURE RANGE  10
TERMINATION NETWORK RS 422-485  11
TRANSZORB™  32
TTL  16, 42

V
VREF  14, 15

W
WEIGHT  10