Theoretic/Practical course on BASCOM AVR Programming.
***Author: DAMINO Salvatore.***

CENTRONICS interface and Parallel Printer Port LPT

The **Parallel Port**, well known as **LPT** from **Line Printer** (that is a term derived from *Line Printer Terminal*) is an interface originally used to connect a computer to a printer or a plotter.

After time, when the bidirectional version was developed, it is widely used also to connect other peripheral devices as **Scanner**, **ZIP** unit, **Hard Disk**, **CD-ROM** reader, **Webcam**, etc.

The port came out as **Unidirectional** interface, and it sent data only from computer to connected peripheral, but then it has been improved with a **Bidirectional** standard **(IEEE 1284)**.
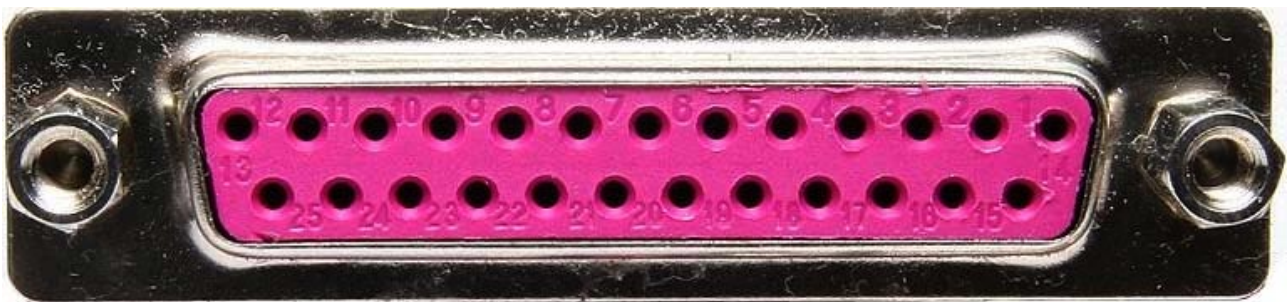
LPT Port. DB25 Female Connector.

Today the parallel port in the **PC** environment is almost no more used, but this doesn't happen in the industrial fields. For the connections, especially for the printers, now are commonly used other communication standard as the **USB**, that is a multifunction serial communication.

The **LPT** allows the connection of many different peripheral devices and it transfers 8 parallel bits with the **TTL** standard.

On computer the port is a **Female** connector commonly named **DB25** complete of **25** pins.

On printer side it is available a different connector, named **Centronics**, according with the name of the first producer. The presence of **8 GND** wires and of twisted couple cables, allows to obtain a sufficient shielding of the signals.

Pin Number (DB25)	Pin Number Centronics	Signal name	Direction	Register-Bit	Signal inverted by Hardware
1	1	/STROBE	Out	Control-0	Yes
2	2	Data1	In/Out	Data0	
3	3	Data2	In/Out	Data1	
4	4	Data3	In/Out	Data2	
5	5	Data4	In/Out	Data3	
6	6	Data5	In/Out	Data4	
7	7	Data6	In/Out	Data5	
8	8	Data7	In/Out	Data6	
9	9	Data8	In/Out	Data7	
1 0	1 0	/ACK	In	Status-6	Yes
1 1	1 1	Busy	In	Status-7	
1 2	1 2	Paper Empty	In	Status-5	
1 3	1 3	Select	In	Status-4	
1 4	1 4	/Auto Linefeed	Out	Control-1	Yes
1 5	3 2	/Error /Fault	In	Status-3	Yes
1 6	3 1	/Reset	Out	Control-2	Yes
1 7	3 6	Mode Printer Select-In	Out	Control-3	
1 8 - 2 5	1 9 - 3 0	Ground	GND	-	-

*Signals on Female DB25 and Centronics Connectors.*

Below are described the main signal's waveforms, during the transmission of a **Byte** from a **PC Controller** to a **Printer**.
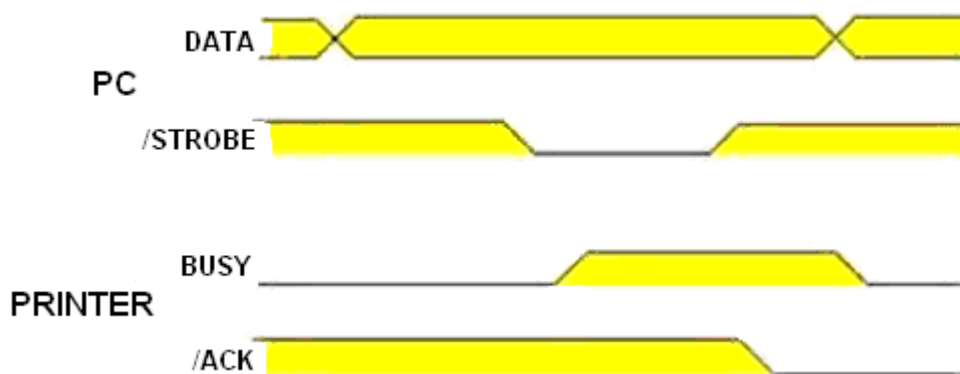
Waveform Diagram of a Print operation: Byte Transmission.

Some of the signals described in the previous table are not necessary for a printer management and the really required ones are those listed on the waveform diagram. In other words, over the **8 Data** bits, the process starts with a pulse on **/STROBE** signal, generated from **PC**, and continues with a printer response with an **/ACK** transition.

A **BUSY** signal, generated from printer, can stop the communication on **PC** side. Through this technique the printer can stop the communication with **PC** until it is again ready to print new data.
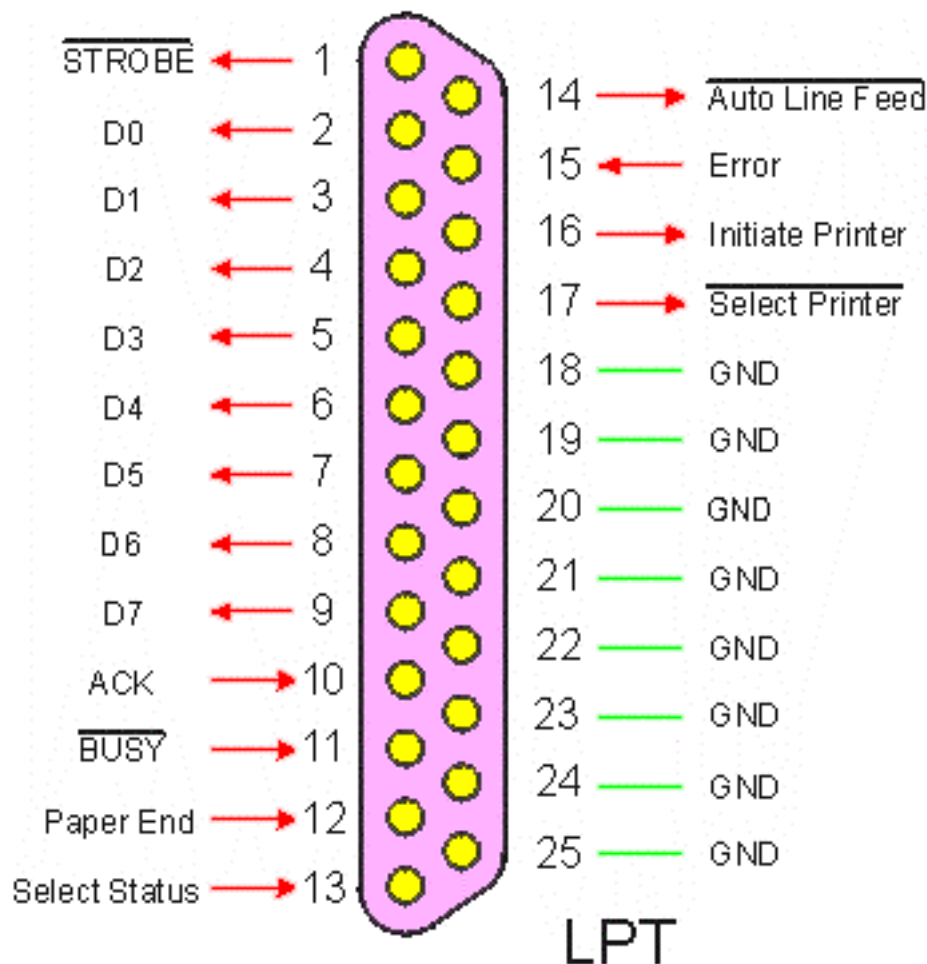

LPT Port. Pin-Out and Signals of the DB25 Female Connector.

The typical signals, available on LPT interface, are described in previous figures. These describe also the directions of the involved signals.

Obviously, according with used printer, not all the typical signals are available; the minimum signals number, that normally are placed on connector, are those described on the Waveform diagram of a Print operation figure.

INDUSTRIAL SMALL PRINTER

The industrial printers are widely diffused and frequently we don't recognize them when they are used in many different applications.
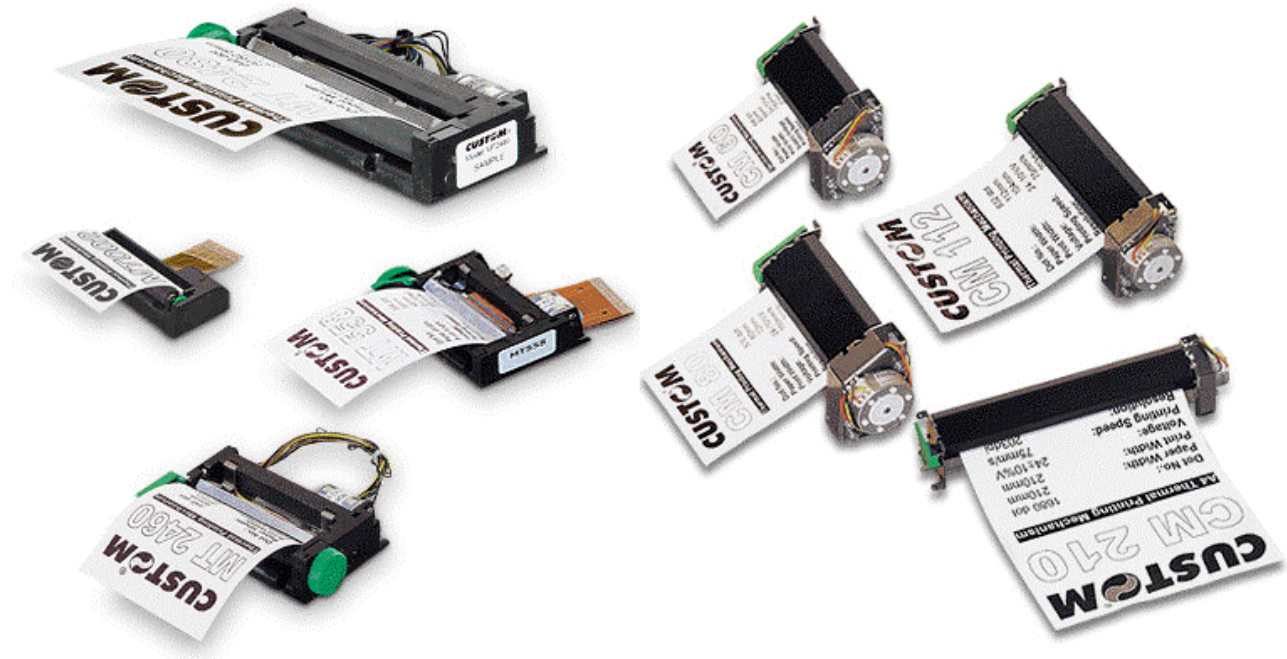
*Some Models of Printing Mechanisms.*

For example, when you are at the bar shop and you order a coffee, once you pay the bill, the dealer gives you a ticket with the consumption description and price. This ticket is produced by a small printer, usually thermal printer, that writes the information on a proper paper tape.

Tipycal Panel Thermal Printer.

The **thermal printing mechanism**, with panel mounting feature, is a very small and really light **Electronic-Mechanical** component provided of its own **CPU** that executes a specific management program and it is capable to receive the characters to print on the paper tape.

For example, by choosing the model **Custom** type **PLUS II**, the width of the paper is **58 mm**. The diameter of the paper roll is **30 mm**.
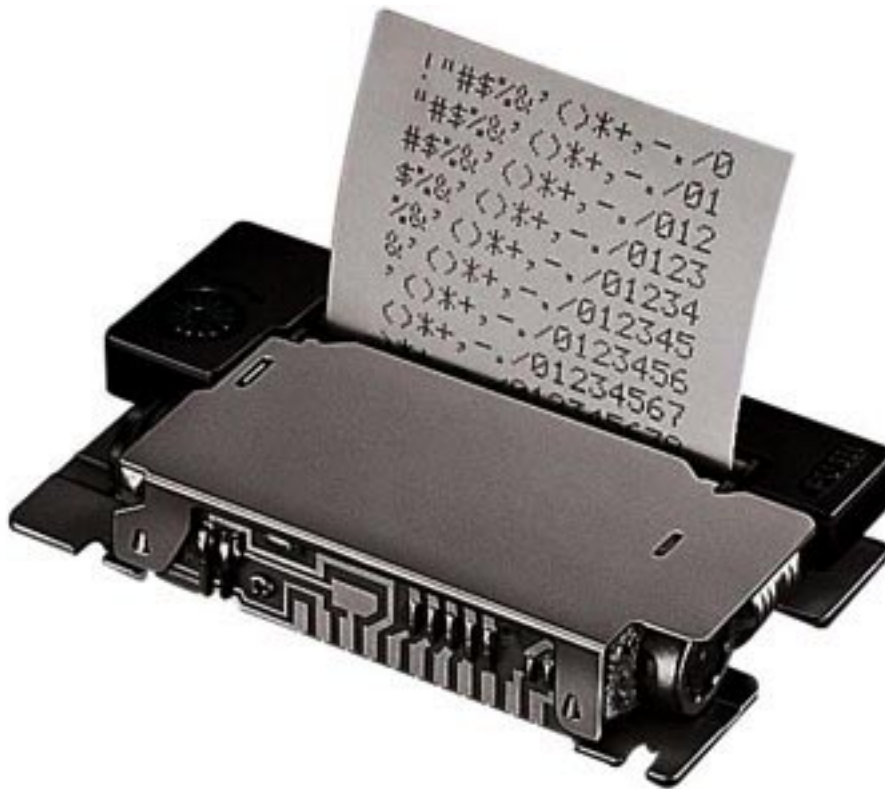
Tipycal Impact Printing Mechanism, Model Epson M-150.

These small printers are normally available with many different communication interfaces as the **Parallel**, **RS 232**, **USB**, etc. **standards** in order to cover all the possible requirements.

Tipycal Thermal Printer for Labels.

In this chapter we'll examine the **Hardware/Firmware** interface of a generic small parallel printer and a **Mini Module**.

For this purpose it is used the **Centronics** interface section, available on didactic board **DEB 0 1**, with the following electric diagram.
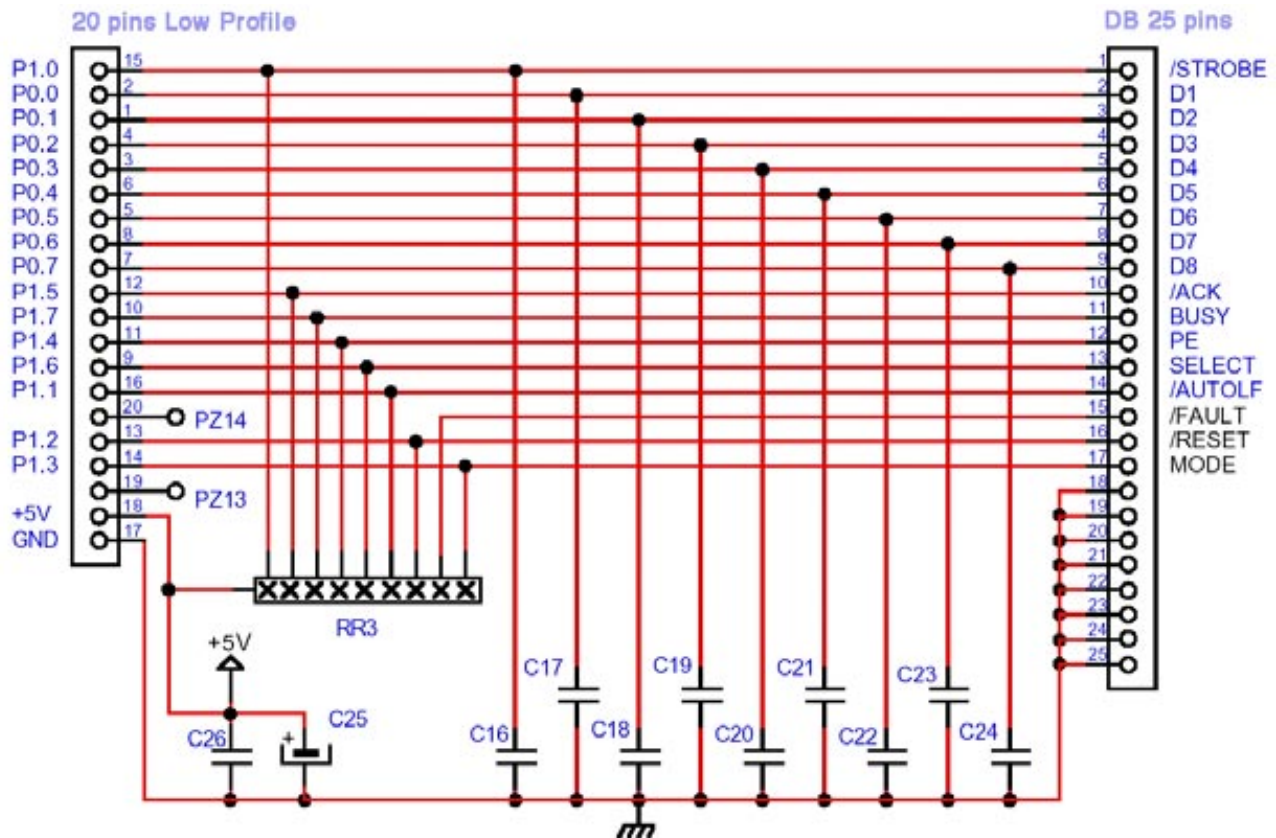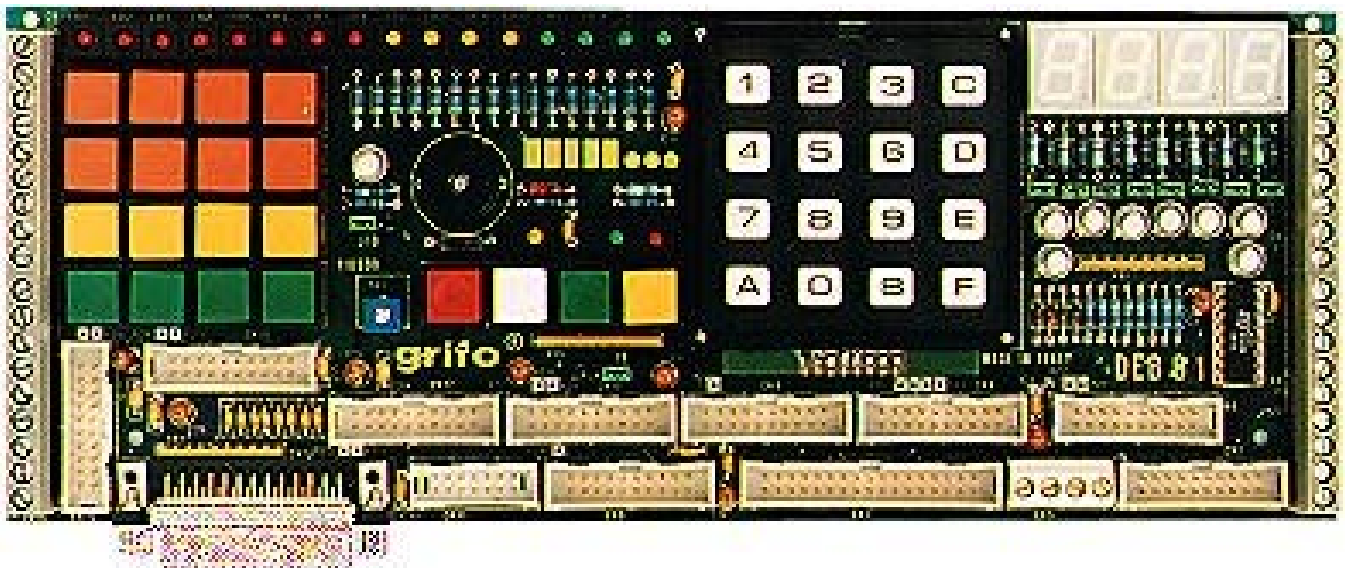

Diagram of the Interface from Standard I/O and Centronics Connectors.

DEB 01 (Didactics Experimental Board) Card.

For the connections it is necessary to use the **CN4** and **CN3** connectors of **GMM TST3**. On the program sources you can find all the detailed information about required connections.

Added Definitions:
None

Added Declarations:
None

Added Instructions:
None

Added Operators:
None

Example program **072** of **BASCOM AVR** course.

It prints a string, typed from console, on a parallel printer provided of **CENTRONICS** interface.

First of all the string is acquired and then it is sent with additional codes **CR (Carriage Return)** and **LF (Line Feed)** that ensure the correct printing.

The **CENTRONICS** interface of the printer must be connected to **I/O** lines of **Mini Module**; this connection must be performed with the relationship described below in the definitions, and it can be easily performed with the card **GMM TST3** and a card that wires the signals.

In details the program requires the following connections:

- **GMM AM08** mounted on socket **Z2** of **GMM TST3**;

- **CN5** of **GMM TST3** connected to serial line of console;

- **CN4** and **CN3** of **GMM TST3** connected to wiring board on a **DB25** female connector, with **CENTRONICS** pin out;

- Female **DB25** of wiring board connected to **CENTRONICS** interface of the printer, by using a proper cable (i.e. those used to connect parallel printer to **PC**).

The **CENTRONICS** interface has many signals and this program initializes all them but then it uses only a small subset reduced to **/STROBE** and **BUSY**.

The program describes its functionalities and ask for the string to print on a serial console provided of monitor and keyboard with a fixed physical protocol at **19200 Baud**, **8 Bit x chr**, **1 Stop bit**, **No parity**.

This console can be another system capable to support a serial **RS 232** communication.

In order to simplify the use it can be used a **PC** provided of one **COMx** line, that execute a terminal emulation program as **HYPERTERMINAL** or the homonym modality provided by **BASCOM AVR** (see **IDE Configuration**).

The program works only when the **GMM AM08** is mounted on **Z2** socket of **GMM TST3**!!

Added Definitions:
None

Added Declarations:
None

Added Instructions:
ON SERIAL ; ENABLE SERIAL

Added Operators:
None

Example program **073** of **BASCOM AVR** course.

It prints the characters received from **RS 232** serial line, with **Interrupt** save buffer, on a parallel printer provided of **CENTRONICS** interface.

The **CENTRONICS** interface of the printer must be connected to **I/O** lines of Mini Module; this connection must be performed with the relationship described below in the definitions, and it can be easily performed with the card **GMM TST3** and a card that wires the signals.

In details the program requires the following connections:

- **GMM AM08** mounted on socket **Z2** of **GMM TST3**;

- **CN5** of **GMM TST3** connected to serial line of console;

- **CN4** and **CN3** of **GMM TST3** connected to wiring board on a **DB25** female connector, with **CENTRONICS** pin out;

- Female **DB25** of wiring board connected to **CENTRONICS** interface of the printer, by using a proper cable (i.e. those used to connect parallel printer to **PC**).

The **CENTRONICS** interface has many signals and this program initializes all them but then it uses only a small subset reduced to **/STROBE** and **BUSY**.

The program describes its functionalities and wait the reception of characters from console serial line that are saved into a circular buffer in **FIFO** modality (first in, first out). When the **buffer** contains characters, these are acquired and sent to printer.

In other words the program acts as a converter of a parallel printer into a serial printer.

The serial line uses a fixed physical protocol at **19200 Baud**, **8 Bit x chr**, **1 Stop bit**, **No parity** and it can be any system capable to support a serial **RS 232** communication.

In order to simplify the use it can be used a **PC** provided of one **COMx** line, that execute a terminal emulation program as **HYPERTERMINAL** or the homonym modality provided by **BASCOM AVR** (see **IDE Configuration**).

The program works only when the **GMM AM08** is mounted on **Z2** socket of **GMM TST3**!!

Added Definitions:
None

Added Declarations:
None

Added Instructions:
ON INT0 ; ENABLE INT0

Added Operators:
None

Example program **074** of **BASCOM AVR** course.

It emulates a parallel printer provided of **CENTRONICS** interface, by using **GMM AM08 Mini Module**.

The data sent to emulated printer are saved into a circular buffer and displayed on serial console, in **ASCII** format.

The **CENTRONICS** interface of the system that should drive the printer (ie. **PC**) must be connected to **I/O** lines of **Mini Module**; this connection must be performed with the relationship described below in the definitions, and it can be easily performed with the card **GMM TST3** and a card that wires the signals.

In details the program requires the following connections:

- **GMM AM08** mounted on socket **Z2** of **GMM TST3**;

- **CN5** of **GMM TST3** connected to serial line of console;

- **CN4** and **CN3** of **GMM TST3** connected to wiring board on a **DB25** female connector, with **CENTRONICS** pin out;

- Female **DB25** of wiring board connected to **CENTRONICS** interface, by using a proper **DB25M+DB25M** direct cable (**1:1**).

The program describes its functionalities and shows the data sent to printer on a serial console provided of monitor, with a fixed physical protocol at **19200 Baud**, **8 Bit x chr**, **1 Stop bit**, **No parity**.
This console can be another system capable to support a serial **RS 232** communication.

In order to simplify the use it can be used a **PC** provided of one **COMx** line, that execute a terminal emulation program as **HYPERTERMINAL** or the homonym modality provided by **BASCOM AVR** (see **IDE Configuration**).

The program works only when the **GMM AM08** is mounted on **Z2** socket of **GMM TST3**!!