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**).

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.
<table>
<thead>
<tr>
<th>Pin Number (DB25)</th>
<th>Pin Number Centronics</th>
<th>Signal name</th>
<th>Direction</th>
<th>Register - Bit</th>
<th>Signal inverted by Hardware</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>/STROBE</td>
<td>Out</td>
<td>Control-0</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Data1</td>
<td>In/Out</td>
<td>Data0</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Data2</td>
<td>In/Out</td>
<td>Data1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Data3</td>
<td>In/Out</td>
<td>Data2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Data4</td>
<td>In/Out</td>
<td>Data3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>Data5</td>
<td>In/Out</td>
<td>Data4</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>Data6</td>
<td>In/Out</td>
<td>Data5</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>Data7</td>
<td>In/Out</td>
<td>Data6</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>Data8</td>
<td>In/Out</td>
<td>Data7</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>/ACK</td>
<td>In</td>
<td>Status-6</td>
<td>Yes</td>
</tr>
<tr>
<td>11</td>
<td>11</td>
<td>Busy</td>
<td>In</td>
<td>Status-7</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>Paper Empty</td>
<td>In</td>
<td>Status-5</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>Select</td>
<td>In</td>
<td>Status-4</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>/Auto Linefeed</td>
<td>Out</td>
<td>Control-1</td>
<td>Yes</td>
</tr>
<tr>
<td>15</td>
<td>32</td>
<td>/Error /Fault</td>
<td>In</td>
<td>Status-3</td>
<td>Yes</td>
</tr>
<tr>
<td>16</td>
<td>31</td>
<td>/Reset</td>
<td>Out</td>
<td>Control-3</td>
<td>Yes</td>
</tr>
<tr>
<td>17</td>
<td>36</td>
<td>Mode</td>
<td>Out</td>
<td>Control-2</td>
<td>Yes</td>
</tr>
<tr>
<td>18-25</td>
<td>19 - 30</td>
<td>Ground</td>
<td>GND</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

![Diagram showing LPT Port. Pin-Out and Signals of the DB25 Female Connector.](image)

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.
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.
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 01**, with the following electric diagram.

![Diagram of the Interface from Standard I/O and Centronics Connectors.](image)

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

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.
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!!
Example 073. Centronics Interface. Acquire Data from RS 232 Serial Line and Drives a Printer.

**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**!!
Example.074. Centronics Interface. It Emulates a Printer and it Sends the Data on a RS 232 Line.

**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!!