OMNIPRINT
PM190/192
PANEL MOUNT PRINTER

USER'S MANUAL

Document : 990312
Revision : 02
Version : 1.00
March 12,1999

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REVISION HISTORY

REVISION	VERSION	DATE	APPROVAL	CHANGE
01	1.00	01/25/99		Initial Release
02	1.00	03/12/99		Modification

CONTENTS

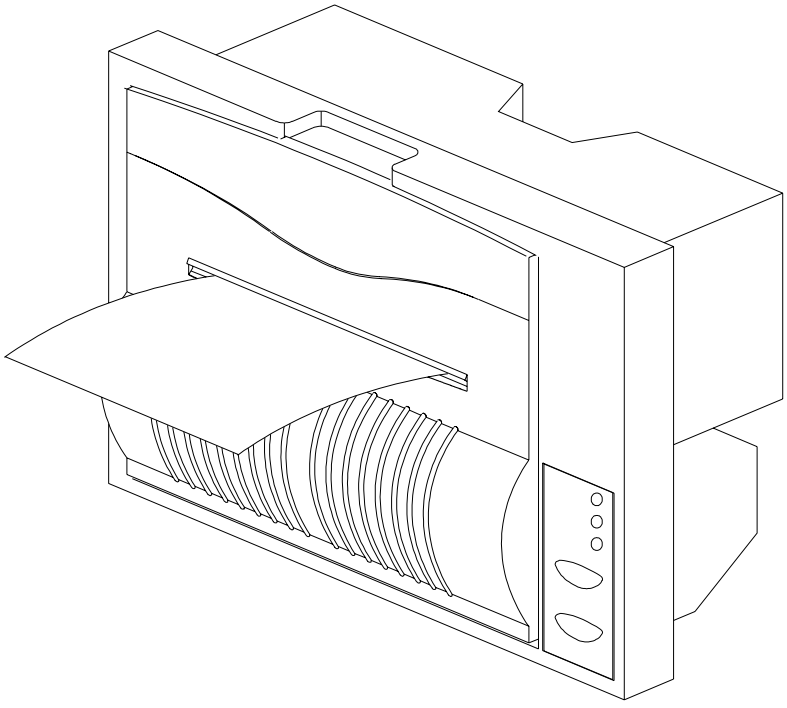
1. DESCRIPTION

1.1 GENERAL FEATURES

PM190, **PM192**, **PM180** panel printer uses the M-190 and M-192 Epson impact print mechanisms with 8-pin head, and M-180 Epson impact print mechanisms with 6-pin head, with ordinary paper in rolls 57.5 mm width and 50 mm diameter. Available in three models whose main difference is the number of characters per line and the printing rate.
It is an extremely simple and functional wall printer, the ideal solution for applications which require the immediate printing of data on a ticket, whether they be of an industrial, professional or laboratory nature. It is suitable for POS, weighing systems, receipts, as well as for security, controlling and diagnostics purposes. The PM190/192/180 printer is so light-weight and compact that it can be easily fitted on any kind of machinery.
It has 4 printer buffer (150byte, 1kbyte, 8kbyte, 16kbyte) and a 2kbyte EEPROM. Interface is distinguished Serial from Parallel on the Control board. If Control board is Serial board, TTL Serial and RS-232C Serial interface. If Control board is Parallel board, TTL Parallel and Centronics parallel interface. It can, as option, be equipped with a Clock/Calendar with rechargeable Ni-Cd battery, as Accessories, be has the Paper Take Up Device (TUD). This option enable time and date to be printer from a software command or simply by pressing a button on the front panel.

This printer is consist of two COMMAND SETS, COMMAND SET 1 and COMMAND SET 2. If Jumper J2 is opened, enter the COMMAND SET 1 mode, otherwise enter the COMMAND SET 2 mode. To activate this mode, switch the printer off and back on again.

Figure 1.



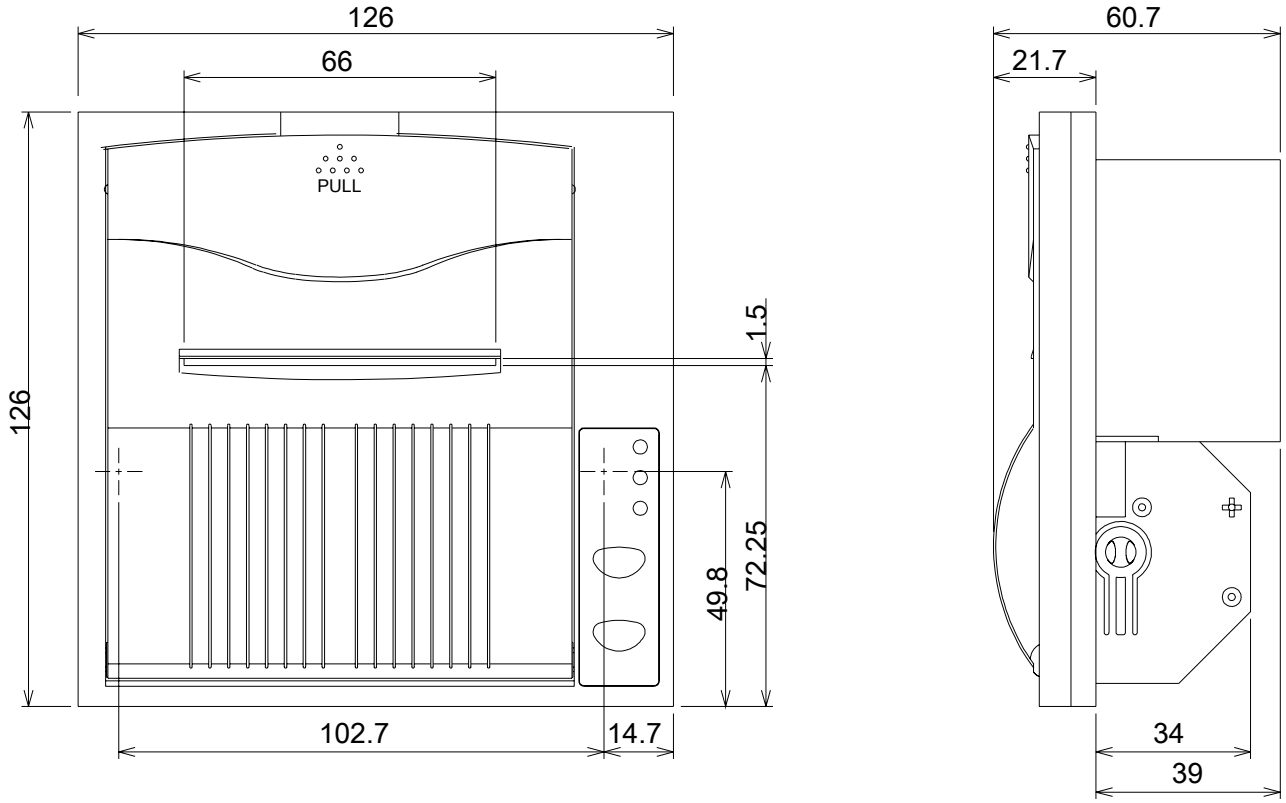
1.2 TECHNICAL SPECIFICATION

MODEL	PM190	PM192	PM180
Mechanism	EPSON M-190	EPSON M-192	EPSON M-180
No. of columns	24	40	24
Printing speed	2.5 LPS	1.5 LPS	1.7 LPS
No. of Dots/Line	144	240	144
Paper feed speed	6 LPS	3.6 LPS	4 LPS
Writing method	Straight & Reverse		
Print method	Serial Impact Dot Matrix		
Operating Temp	5℃(32°F) - 40℃(104°F)		
Operating Humidity	10 % - 80 % RH		
Storage Temp	-40℃(−40°F) - 60℃(140°F)		
Storage Humidity	5 % - 90 % RH		
Reliability(MCBF)	1.5 million lines	0.9 million lines	1 million lines
Paper feed method	Friction Feed		
Paper Roll	57.5 mm ± 0.5 mm (2.25″) wide Roll Paper × 50 mm diameter max		
No. of copies	Original + 1 copy		
Printer Ribbon	Epson ERC 09 Purple/Black ERC 22 Purple/black		
Paper Cutting	Manual		
Paper Loading	Auto Loading or By Feed Key		
Character Set	ASCII 256 IBM + International Sets + (8 - 10) Characters downloadable		
Data Buffer	150 bytes, 1 kbytes, 8 kbytes, 16 kbytes		
Interface	Serial RS-232C and Serial TTL on one board or Parallel Centronics and Parallel TTL on one board		
Sensor	Paper End and Paper Near End Detector		
Power Supply	5Vdc ±15% for the mechanism ±10% for the controller		
Operating Voltage	5Vdc - Max. 2.5 Amp.		
Electrical Input	Max 5W (average in printing)		
EEPROM	Default 2kbytes		
Overall Dimension (W ×D ×H)	126 ×126 ×60 mm (4.96 ×4.96 ×2.36 inch)		
Option	Real Time Clock/Calendar with rechargeable Ni-Cd battery back-up		
Accessories	Paper Take Up Device(TUD)		

1.3 PRODUCT DESCRIPTION

This printer has an ABS casing with a top covering the paper roll and print head.
The keyboard, located on the front of the printer, consists of the PRINT and FEED keys with their respective LEDs.
The dimensions of the printer are shown Figure 2.

Figure 2.



There are two buttons (FEED and PRINT) on the front panel and 3 LED whose function will differ according to printer status :

- At switch on :
  1) If the FEED button is pressed, a Self-test is made.
  2) If both the FEED and the PRINT buttons are pressed simultaneously, the printer is in Set-up mode
  3) If the PRINT button is pressed, the printer is in HEX DUMP mode

- Once the printer is switched on :
  1) If the FEED is pressed briefly and the optional clock/calendar is installed, the date and time are printed.
     If the optional clock is not installed, pressing the FEED button will feed the paper one line (LF) and, if
     the button is held down, the paper will continue to feed.
  2) If the PRINT button is pressed and this function is enabled, the selected character is transmitted via the serial line.

- LED Indication

Status	POWER	PRINT	PAPER
Off-Line	Off	Off	Off
On-Line	On	Off	Off
Printing	On	On	Off
Paper Not Loading	On	Flash	-
Paper Empty	On	Flash	On
Paper Low	On	-	On
Error	Flash	Flash	Off

2. INSTALLATION

2.1 REMOVING THE PRINTER FROM ITS PACKAGING

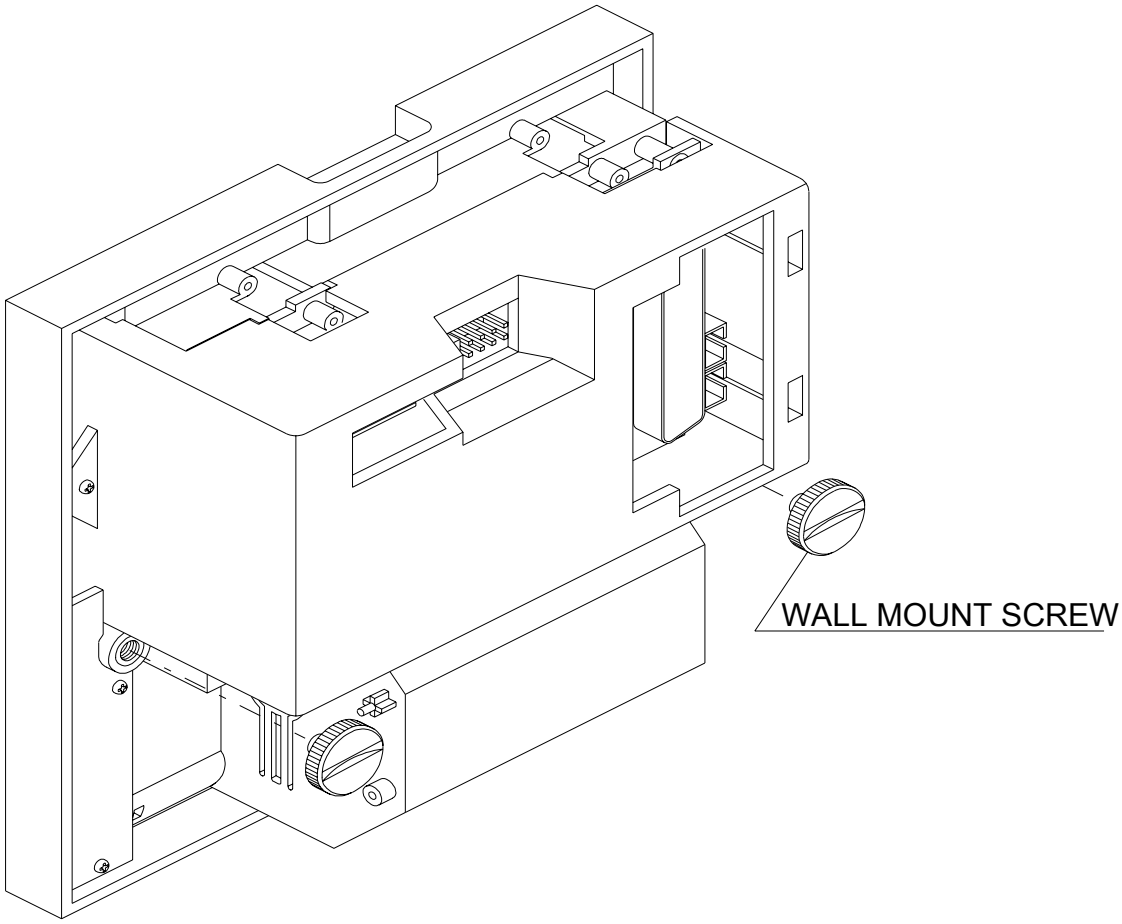
Open the package and check that :

1) none of the parts have been damaged during transportation
2) that the ribbon cartridge is fitted on the printing mechanism and the paper roll is in place
3) the two wall mount screws necessary for installing the printer are, in fact fitted on it

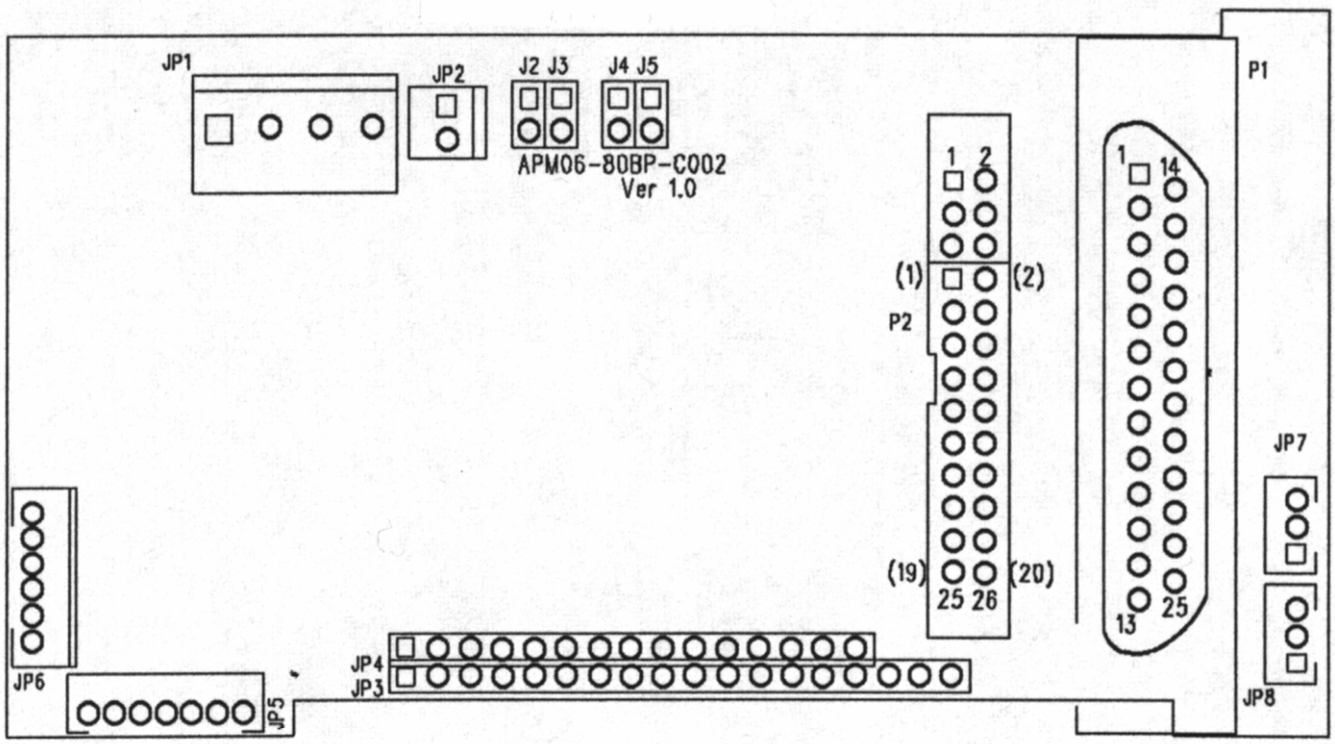
2.2 INSTALLATION

Make a 112 mm × 112 mm square hole in the wall where the printer is to be installed. Unscrew the two wall mount screws. Insert the printer into the hole on the wall, and from the back, manually screw in the two wall mount screw, until the printer is firmly in place.
Insert the interface and the power supply connectors, located on the control board.

Figure 3.



2.3 CONNECTION



JP5 For the optional clock/calendar (7-pin wafer)

Pin No	Signal Name	Pin No	Signal Name
1	SIN	5	/RTC WR
2	SOUT	6	Vcc
3	/SCK	7	GND
4	/RTC		

JP2 For the optional TUD (paper take up) (2-pin wafer)

Pin No	Signal Name
1	GND
2	+ Vdc

P2 For the TTL Serial or TTL Parallel interface (20-pin/26-pin male)
Refer to paragraph 3.1 TTL Serial and 3.2 TTL Parallel

P1 For the RS-232C Serial or Centronics Parallel interface (25-pin female)
Refer to paragraph 3.3 RS-232C Serial and 3.4 Centronics Parallel

JP6 Connection Control panel PCB (6-pin wafer)

Pin No	Signal Name	Pin No	Signal Name
1	Power LED (green)	4	Feed SW
2	Print LED (green)	5	Print SW
3	Paper Low (red)	6	GND

JP7 Connection Paper Loading sensor PCB (3-pin wafer)

Pin No	Signal Name
1	GND
2	Detect signal
3	Diode power

JP8 Connection Paper Low sensor PCB (3-pin wafer)

Pin No	Signal Name
1	GND
2	Detect signal
3	Diode power

J2 Selection COMMAND SET 1(closed) / COMMAND SET 2(open) (2-pin jumper)

Operation	Emulation setting
Open	Command Set 1
Closed	Command Set 2

J3 Selection Internal(closed) / External(open) (2-pin jumper)

Operation	Setup setting
Closed	Internal
Open	Command Set 1 : External Command Set 2 : if D7 = “1” : Internal if D7 = “0” : External

J4 Reserved (2-pin jumper)

J5 Reserved (2-pin jumper)

JP1 Power Supply

This printer has a standard AMPMODU1 4-pin male (JP1) type connector.

It is separated controller power and mechanism power.

The power supply connector pins as follows :

Pin No	Signal Name
1	GND
2	GND
3	+VT : 5 V_{CC} ± 15% (mechanism power supply)
4	+VCC : 5 V_{CC} ± 10% (controller power supply)

♦ **Cable length**

Connecting with the power supply connector(JP1) can be avoid by using the flat 20-Pin connector(P2) of the logic or by replacing the latter, by special request at the order stage, with a similar 26-Pin one, thus connecting the power supply and the printer signals with a single cable. In this case, however, the maximum length of the flat cable must not exceed 0.3 m for the 20-Pin version and 0.7 m for the 26-Pin version. The reason for this is that current running along inside narrow wires can lead to power failures which could interfere with the correct functioning of the printer.

If the printer has the RS-232C or CENTRONICS options, it must be supplied by means of the JP1 connector. For the pin pattern required for supplying power through the logic flat cable.

Power supply connector	Max cable length	
	PM180, PM192	PM190
JP1 AMP MODU1 4Pin	1.5 m	1.0 m
P2 Flat 20 Pin	0.3 m	0.2 m
P2 Flat 26 Pin	0.7 m	0.5 m

[NOTES]

- Any voltage peak or drop can damage the printer or cause malfunctioning and should be avoided.
- Switching power supplies : we recommend using only switching power supplies with high switching frequency so that the recovery time from load transients is as short as possible.

2.4 CONFIGURATION

2.4.1 This printer allow the Configuration of default parameters:

◆ **COMMAND SET 1**

- Flow (DTR/DSR , XON/XOFF)
- No. of bit in communication (8 Bits , 7 Bits)
- Parity bit (None, odd, even)
- Baud rate (9600, 4800, 1200, 2400, 600, 300)
- Tx chr menu which defines the character the printer transmits
  (Tx CHR = ENABLE / DISABLE)
- Buffer size (150 Bytes, 1kBytes, 8kBytes, 16kBytes)
- Character mode (LITTLE, DOUBLE WIDTH, DOUBLE HEIGHT, EXPANED)
- Font (FONT1, FONT2)
- Print mode (TEXT ENABLE / DISABLE)
- CR-LF mode (IGNORE / HONOR CR)
- Printing method (NORMAL / REVERSE)
- Real Time Clock setting (ENABLE / DISABLE)
- Second display (ENABLE / DISABLE)

◆ **COMMAND SET 2**

- Flow (DTR-DSR , XON/XOFF)
- No. of bit in communication and Parity bit
  (8 Bits, None, 1 stop / 7 Bits, Even, 1 stop)
- Baud rate (1200, 2400, 4800, 9600, 19200)
- Buffer size (150Bytes, 1kBytes, 8kBytes, 16kBytes)
- Font (FONT1 mode A1, FONT1 mode A2, FONT1 mode P, FONT2)
- CR-LF mode (CR ignored / recognized)
- Print mode (TEXT / DATA MODE)
- Tx chr menu which defines the character the printer transmits
  (Tx char is n ; $0 \leq n \leq 255$)

The settings made are saved on the 2kbytes EEPROM.

2.4.2 Configuration setting

If, when the printer is power on, both keys are pressed simultaneously, the printer enters configuration mode and prints the first modifiable parameter. Each time the PRINT key is pressed subsequent to this, the variation of the parameter is shown and the its current value is printed. After entering the desired parameter, press the FEED key to go on to the next parameter, and so on. The available time for selection in each menu is 15 seconds. Once this time has elapsed, the printer moves to the next menu leaving the previous parameter unchanged. When all the parameters have been entered, the printer prints "PRINTER READY..." to indicate that setting procedure has been completed.

◆ **COMMAND SET 1**

The printer enters configuration mode and, with a serial interface, prints set Flow control, with a parallel interface, prints set character printer transmits.

- The user can configure printer Flow control by selecting from those listed and pressing the PRINT button as follow table.

PRINT Number	Type of Flow control
0	DTR/DSR
1	Xon/Xoff

Once the selection is confirmed with the FEED button, the printer moves on to the next menu

- After confirming the entry or a time out, the next step is the No. of bit in communication menu used to select the print mode

PRINT Number	No. of bit in communication
0	8 Bits
1	7 Bits

- After confirming the entry or a time out, the next step is the Parity bit menu used to select the print mode

PRINT Number	Parity bit
0	None
1	Odd
2	Even

- After confirming the entry or a time out, the next step is the Baud rate menu used to select the print mode

PRINT Number	Baud rate
0	9600
1	4800
2	1200
3	2400
4	600
5	300

- After confirming the entry or a time out, the next step is the Tx chr menu used to select the print mode

PRINT Number	Tx chr
0	Enable
1	Disable

- After confirming the entry or a time out, the next step is the Buffer size menu used to select the print mode

PRINT Number	Buffer size
0	150 byte
1	1 kbyte
2	8 kbyte
3	16 kbyte

- After confirming the entry or a time out, the next step is the Character mode menu used to select the print mode

PRINT Number	Character mode
0	LITTLE
1	DOUBLE WIDTH
2	DOUBLE HEIGHT
3	EXPANED

- After confirming the entry or a time out, the next step is the Font menu used to select the print mode

PRINT Number	Font
0	Font 1
1	Font 2

- After confirming the entry or a time out, the next step is the Print mode menu used to select the print mode

PRINT Number	Print mode
0	Text Enable
1	Text Disable

- After confirming the entry or a time out, the next step is the CR-LF mode menu used to select the print mode

PRINT Number	CR-LF mode
0	Ignore CR
1	Honor CR

- After confirming the entry or a time out, the next step is the Printing method menu used to select the print mode

PRINT Number	Printing method
0	Normal
1	Reverse

- After confirming the entry or a time out, the next step is the Real Time Clock setting menu used to select the print mode

PRINT Number	Real Time Clock setting
0	Enable
1	Disable

- After confirming the entry or a time out, the next step is the Second display menu used to select the print mode

PRINT Number	Second display
0	Enable
1	Disable

After confirming the entry or a time out, the printer is ready for data.

◆ COMMAND SET 2

The printer enters configuration mode and, with a serial interface, prints set flow control, with a parallel interface, prints set Buffer size.

- The user can configure printer Flow control by selecting from those listed and pressing the PRINT button as follow table.

PRINT Number	Type of Flow control
0	DTR/DSR
1	Xon/Xoff

Once the selection is confirmed with the FEED button, the printer moves on to the next menu

- After confirming the entry or a time out, the next step is the Flow menu used to select the print mode

PRINT Number	Flow
0	DTR/DSR
1	XON/XOFF

- After confirming the entry or a time out, the next step is the No. of bit in communication and Parity bit menu used to select the print mode

PRINT Number	No. of bit in communication and Parity bit
0	8 bits None 1 stop
1	7 bits Even 1 stop

- After confirming the entry or a time out, the next step is the Baud rate menu used to select the print mode

PRINT Number	Baud rate
0	1200
1	2400
2	4800
3	9600
4	19200

- After confirming the entry or a time out, the next step is the Buffer size menu used to select the print mode

PRINT Number	Buffer size
0	150 byte
1	1 kbyte
2	8 kbyte
3	16 kbyte

- After confirming the entry or a time out, the next step is the Font menu used to select the print mode

PRINT Number	Font
0	A1
1	A2
2	Font1
3	Font2

- After confirming the entry or a time out, the next step is the CR-LF mode menu used to select the print mode

PRINT Number	CR-LF mode
0	CR ignored
1	CR recognized

- After confirming the entry or a time out, the next step is the Print mode menu used to select the print mode

PRINT Number	Print mode
0	Text Mode
1	Data Mode

- The next step is the Tx chr menu which defines the character the printer transmits when the PRINT button is pressed

PRINT Number	Character transmitted when the PRINT button is pressed
0	PRINT function disabled
1 ≤n ≤254	Character to be transmitted
255	PRINT function disabled

Each time the PRINT key is pressed subsequent to this, the variation of the parameter isn't printed but its only determined value is printed, because of a wasteful use paper.

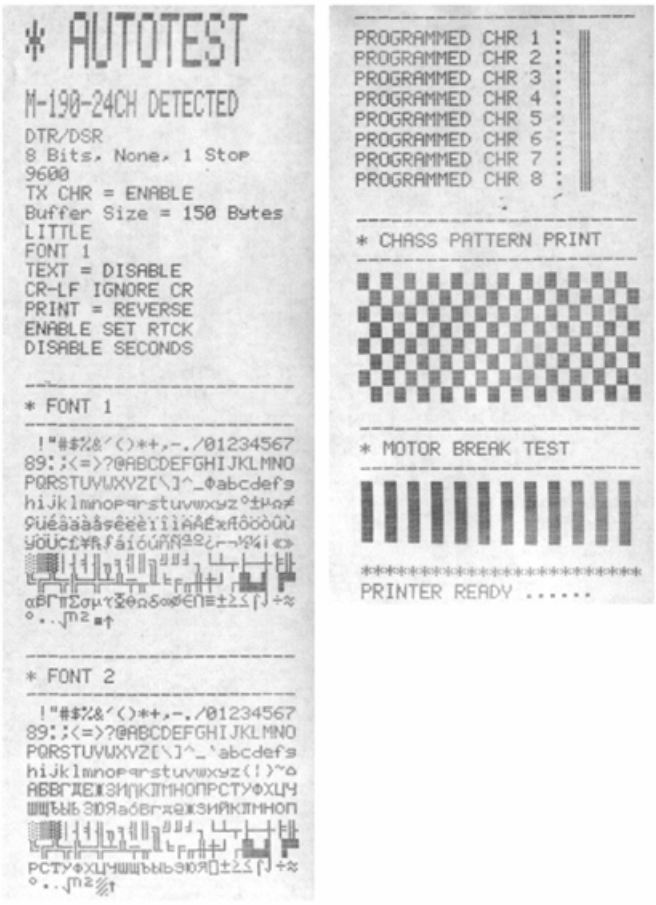
After confirming the entry or a time out, the printer is ready for data.

2.5 SELF TEST

To print out the self-test, hold down the FEED key while switching on the printer. The self-test consists of the printing of the printer's currently CONFIGURATION, ASCII CHARACTER of each Font, CHESS PATTERN PRINT, MOTOR BREAK TEST, The self-test is executed once and the printer prints "PRINTER READY..." to indicate that ready to receive data.

Figure 5.

<COMMAND SET 1 self-test>



<COMMAND SET 2 self-test>

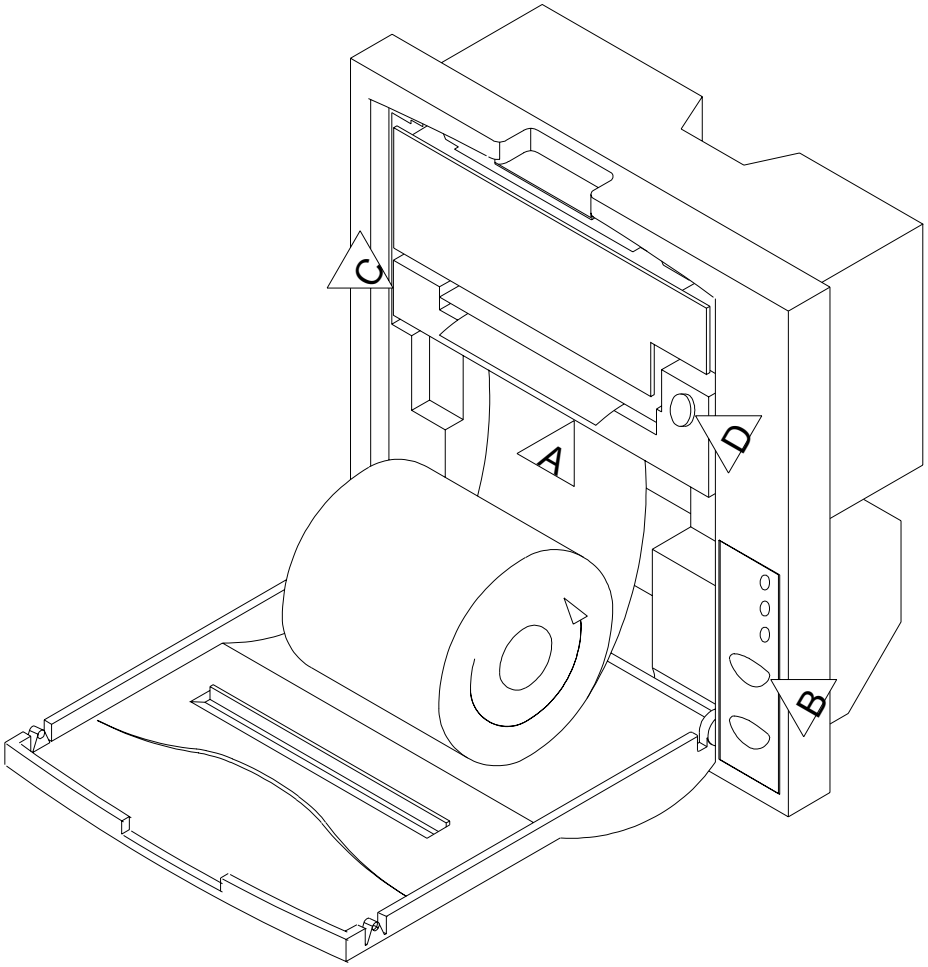
2.6 MAINTENANCE

2.6.1 CHANGING THE PAPER ROLL

To change the paper roll, proceed as follows

1) open the top cover of the printer and place the paper roll in position, following the arrow, as indicated in Figure 6.
2) insert the end of the roll in the slit (A) of the print mechanism, then auto-loading is performed after a few delay time.
3) in the case of auto-loading is uninstalled, press the FEED key (B) so that a few centimeters of paper come out of the printer
4) insert the end into the slit on the top of the printer and close it.

Figure 6.

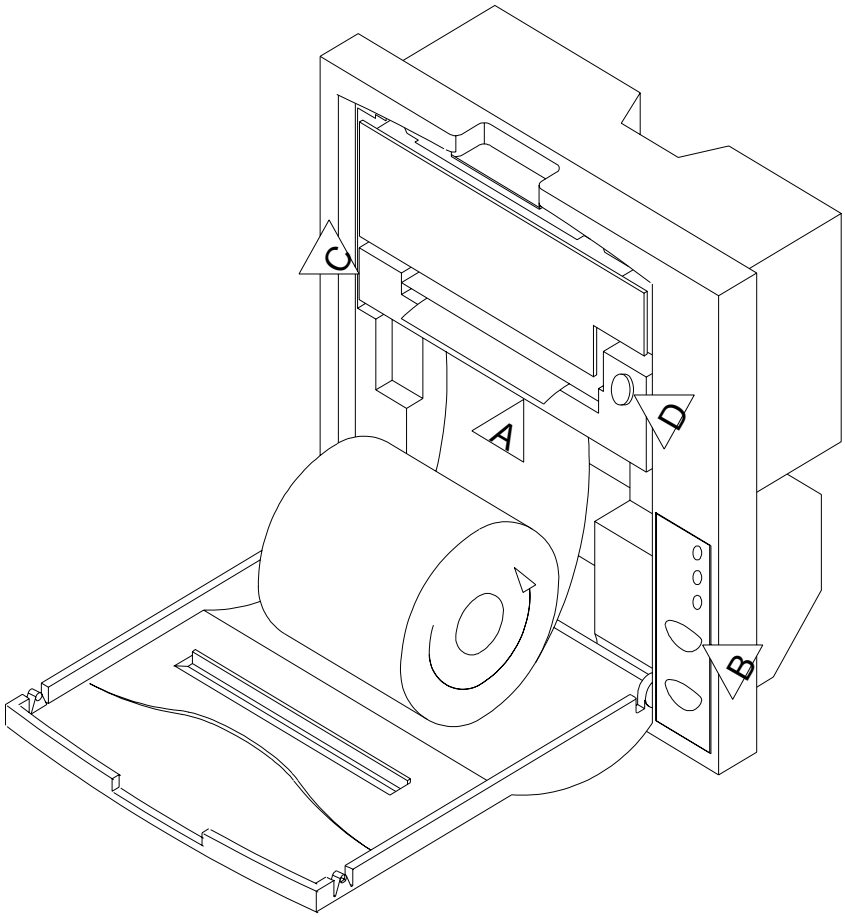


2.6.2 CHANGING THE RIBBON

1) open the top of the printer and remove the old ribbon cartridge, by pressing down at point (C), as shown in Figure 6.
2) insert the new ribbon, making sure that it is correctly positioned
3) pull the ribbon tight by turning the knurled knob (D) and close the top down again

2.7 PRECAUTIONS

- Do not print when there is no paper and/or ribbon
  ; this leads to rapid deterioration of the headpin
- Do not put objects inside the printer
- Do not pull the printer carriage manually when the printer is ON.
- Before connecting the printer to the mains, check that the power supply or system ON/OFF switch is in the OFF position.
- Avoid blows to any part of the printer, both during and after installation.



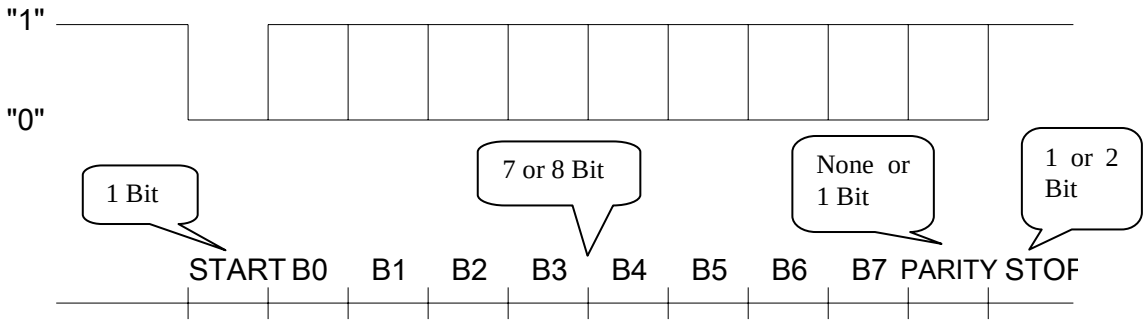
3.INTERFACE

Interface is distinguished Serial from Parallel on the Control board. It is able to TTL Serial and RS-232C Serial communication that printer is equipped with Serial board, it is able to TTL Parallel and Centronics Parallel communication that printer is equipped with Serial board.

3.1 TTL SERIAL

The default format is 1 start bit, 8 data bits, no parity and 1 stop bit. The communication connector used is the P2 whose pinout is given in the Table 3-1.
Figure 7 illustrates the serial character transmission bit frame showing the start, data and stop bits.

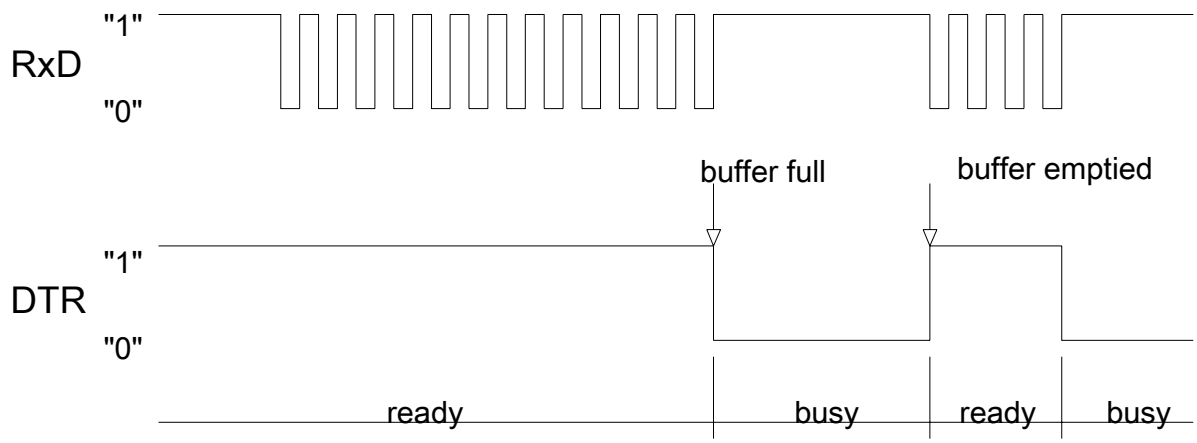
Figure 7.



<Serial transmission bit frame>

The signals characterizing the communication are TxD, RxD and DTR if a "Flag Hardware" communication protocol is used. If the XON-XOFF protocol has been selected, the only signals used are TxD and RxD.
In the communication protocol with Flag Hardware the DTR signal, at high logic, indicates that the printer is ready to receive data. At low logic, it means that the receive buffer is full and will have to be partly emptied for the printing to begin. In the XON-XOFF protocol, the DTR signal is always at high logic.
The transmission bit frame for a line with Flag Hardware protocol when the input buffer is full and, consequently, transmission from host to printer is interrupted. After the buffer have been emptied, the DTR signal returns to high logic level and the transmission can restart.

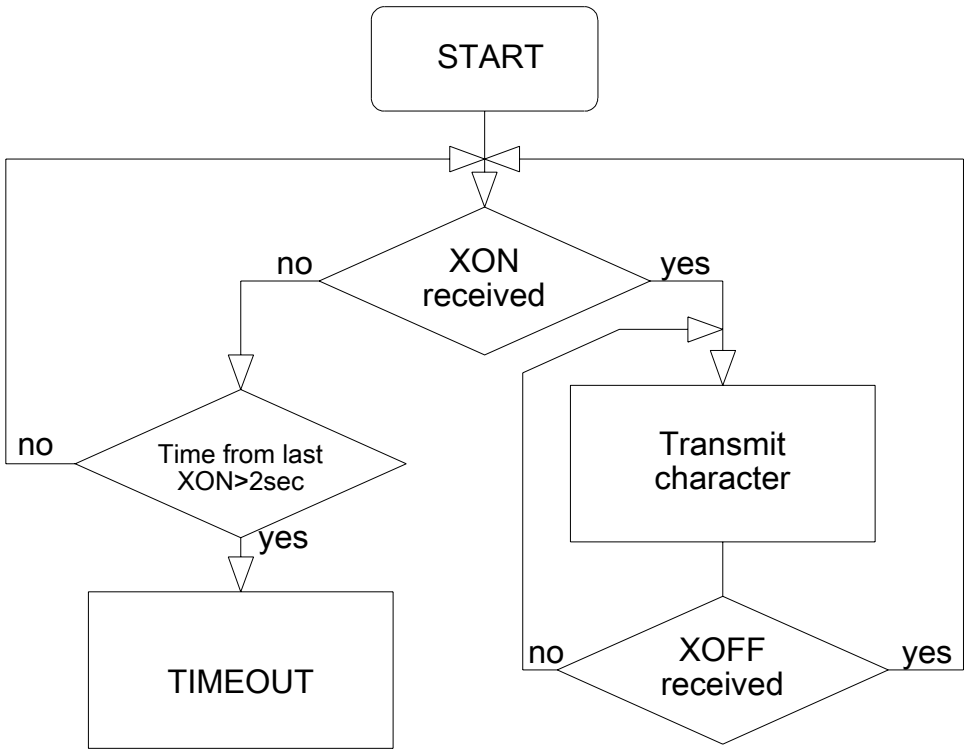
Figure 8.



<Line transmission with "Flag Hardware" protocol>

In XON-XOFF protocol, if the printer can receive data, it transmits the character XOFF(13_{Hex}) and XON(11_{Hex}) just once. If it cannot receive data, it transmits the character XOFF(13_{Hex}) just once.

Figure 9.



<Flow chart for the XON-XOFF protocol>

Table 3-1 TTL Serial Communication connection

NAME	DESCRIPTION	20-PIN	26-PIN
V_T	Printhead power supply alternative to JP1	1,2	5,6,7,8
V_{CC}	Logic controller board power supply alternative to JP1	3,4	9-10
GND	Ground	5,6	1,2,3,11,12
TxD	Data Serial output. When idle the transmission line level is high.	7	4,13
D6	External setting parameter	8	14
D5	External setting parameter	9	15
D4	External setting parameter	10	16
D3	External setting parameter	11	17
D2	External setting parameter	12	18
D1	External setting parameter	13	19
D0	External setting parameter	14	20
D7	External setting parameter	15	21
DTR	Output signal: at high level, the printer is ready to receive data; at low level, the print buffer is full and data cannot be received (busy). If the XON-XOFF serial communication protocol has been selected, the signal is always high.	18	24
$\overline{\text{FEED}}$	Input or output If the jumper on the board is between LF and FEED, this line is Parallel to the Line Feed button and it causes: - a paper feed if at low logic level during normal operation - a self-test if low when the printer is switched on - time and date printout (only if the optional clock/calendar board is installed) if a low logic impulse is sent whose duration is D < 0.3 sec If the jumper on the board is between P and FEED, the line is parallel with the Print button. In this case the line is considered as an output	19	25
RxD	Input RxD data receive line. When idle, the line is at high logic level	20	26

◆ External setting parameter

Jumper J3 is closed, the printer will enter into the Internal Setting mode. Otherwise, It will enter Into the

External Setting mode.

In case of COMMAND SET 2 External mode : If D7 is “1”, the settings Internal mode. If it is “0”, the settings External mode

J2 \ J3	CLOSED	OPEN
OPEN	COMMAND SET 1 Internal Setting	COMMAND SET 1 External Setting
CLOSED	COMMAND SET 2 Internal Setting	COMMAND SET 2 D7 = 1 : Internal Setting D7 = 0 : External Setting

(1) In the case COMMAND SET 1

: speed of communication and transmission protocol can be selected from the following table.

D0	D1	D2	BAUD
0	0	1	300
1	0	1	600
1	1	1	1200
0	1	1	2400
0	0	0	4800
1	0	0	9600

D3	1	Flag-type transmission protocol
	0	XON/XOFF type transmission protocol
D4	1	When the PRINT key is pressed, nothing happens
	0	When the PRINT key is pressed, the signal CR($0D_{Hex}$) is transmitted to the TxD pin

D7	D6	D5	TRANSMISSION FORMAT
1	1	1	8 bits without parity and 1 stop bit
0	1	1	8 even parity bits and 1 stop bit
0	1	0	8 odd parity bits and 1 stop bit
1	1	0	7 bits without parity and 2 stop bit
1	0	1	7 even parity bits and 1 stop bit
1	0	0	7 odd parity bits and 1 stop bit

(2) In the case COMMAND SET 2

: If D7 is “1”(high), the settings given with the buttons on the front panel or configuration program hold good. If it is “0”(low), speed of communication and transmission protocol can be selected from the following table.

D0	D1	D2	BAUD RATE
1	0	0	1200
0	1	0	2400
1	1	0	4800
1	0	1	19200
All the other combinations			9600

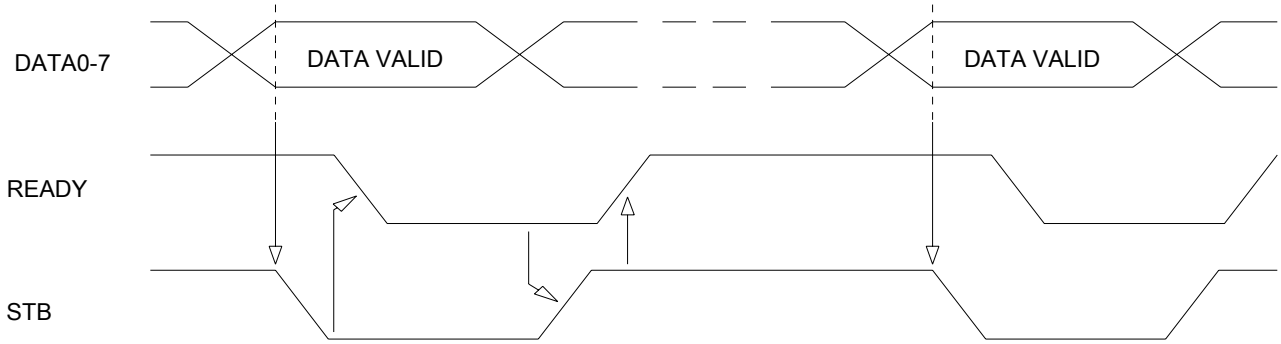
D3		Communication protocol
	0	DTR
	1	XON, XOFF
D4		Parity
	0	NONE
	1	EVEN
D5		Data/Text Mode
	0	TEXT
	1	DATA

3.2 TTL PARALLEL

The connector is, as always, P2 whose pinout is detailed in the Table 3-1.
In parallel communication the useable signals are :

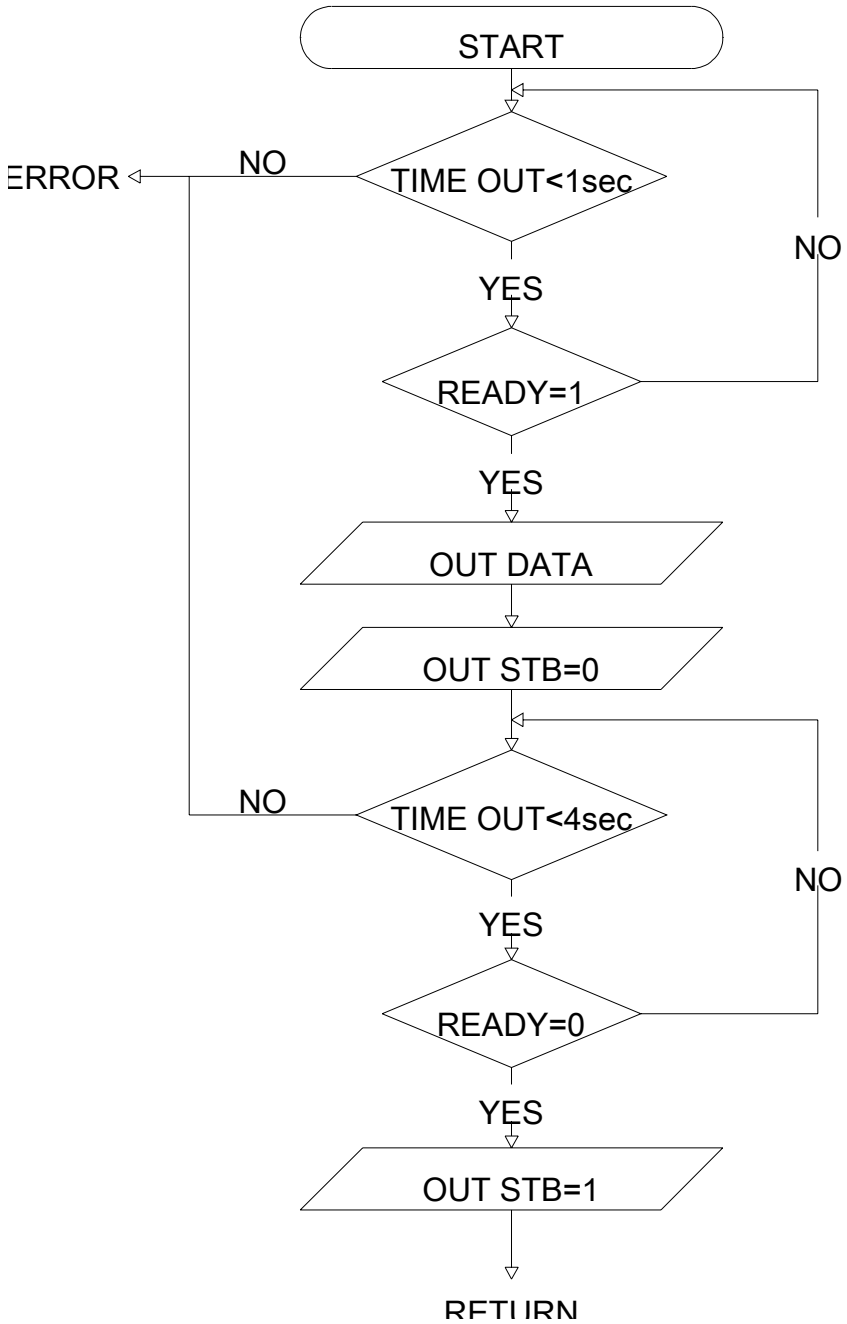
1) 7 or 8 bit data bus
2) STROBE signal indicating data validity
3) READY signal indicating that the printer is ready to receive data

Figure 10.



<Transmission format valid data>

Figure 11.



<TTL Parallel interface flow chart>

Table 3-2 TTL Parallel Communication connection

NAME	DESCRIPTION	20-PIN	26-PIN
V_T	Printhead power supply alternative to JP1	1,2	5,6,7,8
V_{CC}	Logic controller board power supply alternative to JP1	3,4	9-10
GND	Ground	5,6	1,2,3,11,12
D6	Data 6	8	14
D5	Data 5	9	15
D4	Data 4	10	16
D3	Data 3	11	17
D2	Data 2	12	18
D1	Data 1	13	19
D0	Data 0	14	20
D7	Data 7	15	21
$\overline{\text{INIT}}$	Printer reset input, active low. Initializes printer parameters and causes the following actions : - erases the printer buffer - selects normal printing - performs a self-test if the Feed button on the front panel is pressed or Feed line is low	16	22
READY	Output signal: at high level the printer is ready to receive data; at low level the printer is busy	18	24
$\overline{\text{FEED}}$	Input or output If the jumper on the board is between LF and FEED, this line is Parallel to the Line Feed button and it causes: - a paper feed if at low logic level during normal operation - a self-test if low when the printer is switched on - time and date printout (only if the optional clock/calendar board is installed) if a low logic impulse is sent whose duration is D < 0.3 sec If the jumper on the board is between P and FEED, the line is parallel With the Print button. In this case the line is considered as an output	19	25
$\overline{\text{STB}}$	Input Informs the printer that the data at input D0-D7 are valid	20	26

3.3 RS-232C SERIAL INTERFACE

The connection is made with a 25-pin rectangular female connector. The signals on the connector pins are indicated in Table 3-3. The pins which are not indicated are not connected.

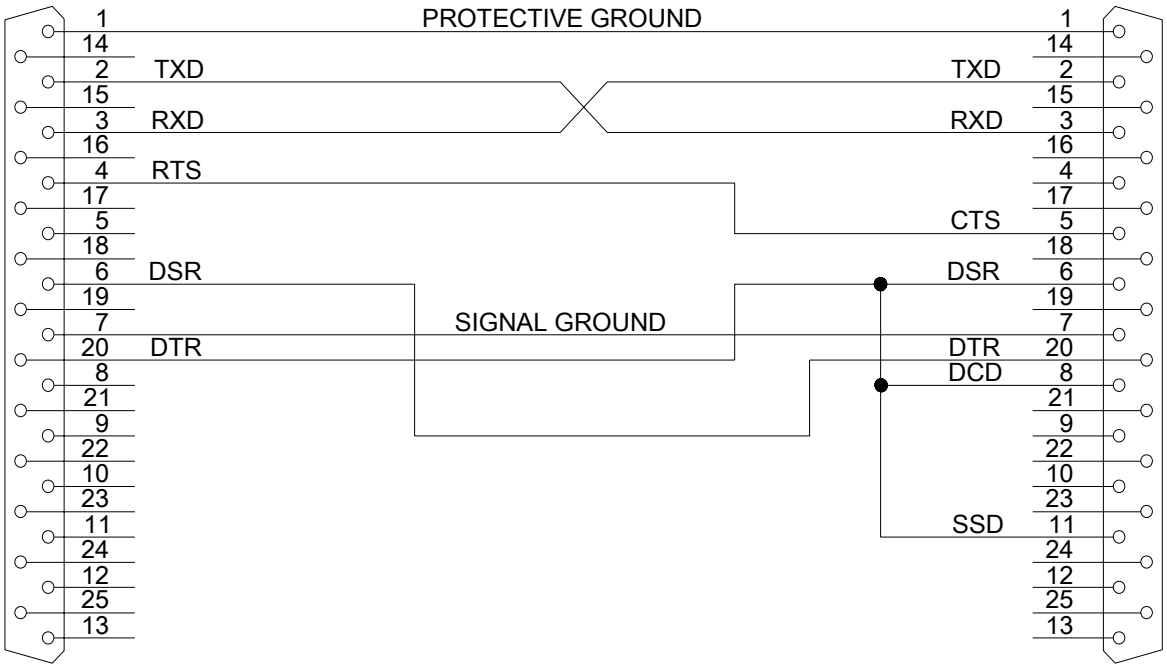
The signals characterizing the communication are TxD, RxD and DTR if a "Flag Hardware" communication protocol is used. If the XON-XOFF protocol has been selected, the only signals used are TxD and RxD.
In the communication protocol with Flag Hardware the DTR signal, at high logic, indicates that the printer is ready to receive data. At low logic, it means that the receive buffer is full and will have to be partly emptied for the printing to begin. In the XON-XOFF protocol, the DTR signal is always at high logic.
The transmission bit frame for a line with Flag Hardware protocol when the input buffer is full and, consequently, transmission from host to printer is interrupted. After the buffer have been emptied, the DTR signal returns to high logic level and the transmission can restart.

Refer to 3.1 TTL SERIAL INTERFACE

Table 3-3.

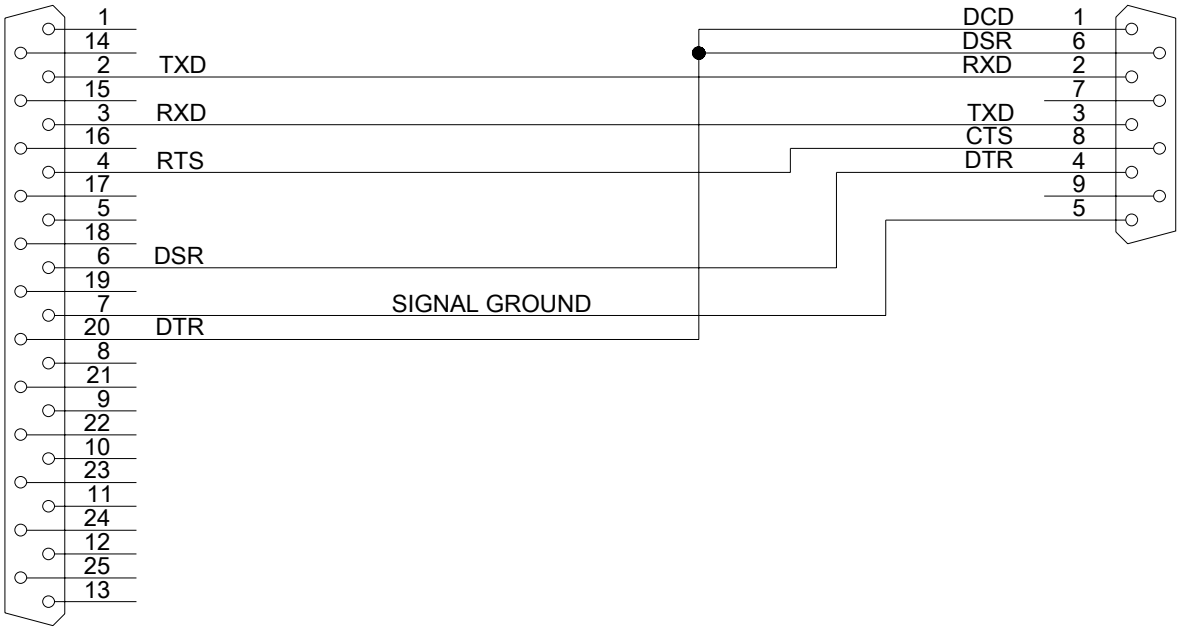
PIN	SIGNAL	DESCRIPTION	DIRECTION
1-7	GND	Ground	-
2	TxD	Transmit Data	OUT
3	RxD	Receive Data	IN
4	RTS	Request To Send	OUT
6	DSR	Data Set Ready	IN
20	DTR	Data Terminal Ready. Printer on and operating (active at RS-232C level high)	OUT

Figure 11.



25 Pins D-Sub Female connector
Printer side

25 Pins D-Sub Male connector
Host side



25 Pins D-Sub Female connector
Printer side

9Pins D-Sub Male connector
Host side

<Serial interface connection schematics>

3.4 CENTRONICS PARALLEL

The connection is made with a 25-pin rectangular female connector. Transmission is controlled by the Acknowledge ($\overline{ACK}$) and Strobe ($\overline{STB}$) signals. The signal layout is exactly the same as that used by personal computers which use the same connector, as shown in Table 3-4.

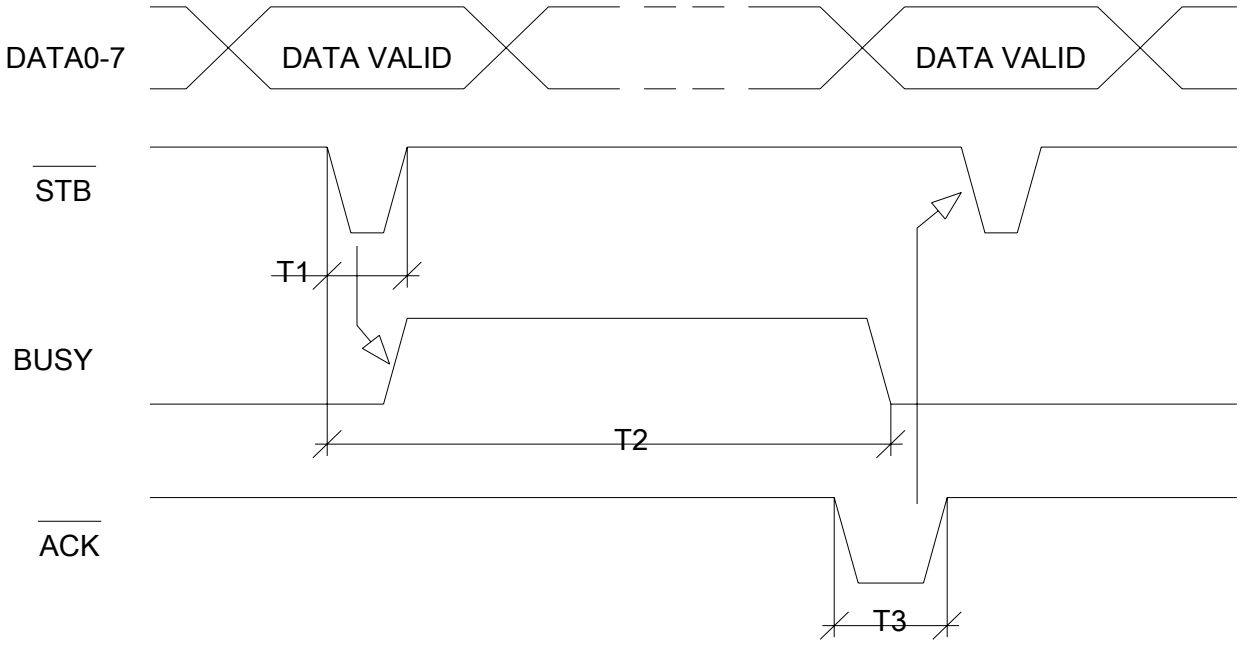
Table 3-4.

PIN	SIGNAL	DESCRIPTION	DIRECTION
1	$\overline{STROBE}$	Data read signal : a low level pulse informs the printer that the data on the D0-D7 lines are valid	IN
2	D0	Data 0	IN
3	D1	Data 1	IN
4	D2	Data 2	IN
5	D3	Data 3	IN
6	D4	Data 4	IN
7	D5	Data 5	IN
8	D6	Data 6	IN
9	D7	Data 7	IN
10	$\overline{ACK}$	Call for new data : a low level pulse indicates that the printer Is ready to receive new data	OUT
11	BUSY	Printer busy at high logic level means that the printer cannot accept new data	OUT
12	PE	Paper Empty	OUT
13	SELECT	Printer status	OUT
14	$\overline{AUTO\ FEED\ XT}$	No connection	N.C
15	$\overline{ERROR}$	Printer error	OUT
16	$\overline{INIT}$	Printer initialization	IN
17	SELECT INPUT	No connection	N.C
18~25	GND	GND	-

Regarding printer behavior when connected with a Centronics parallel interface, it should be mentioned that often the application programs transmit a sequence of control characters CR($0D_{Hex}$) and LF($0A_{Hex}$) at the end of the string to be printed.

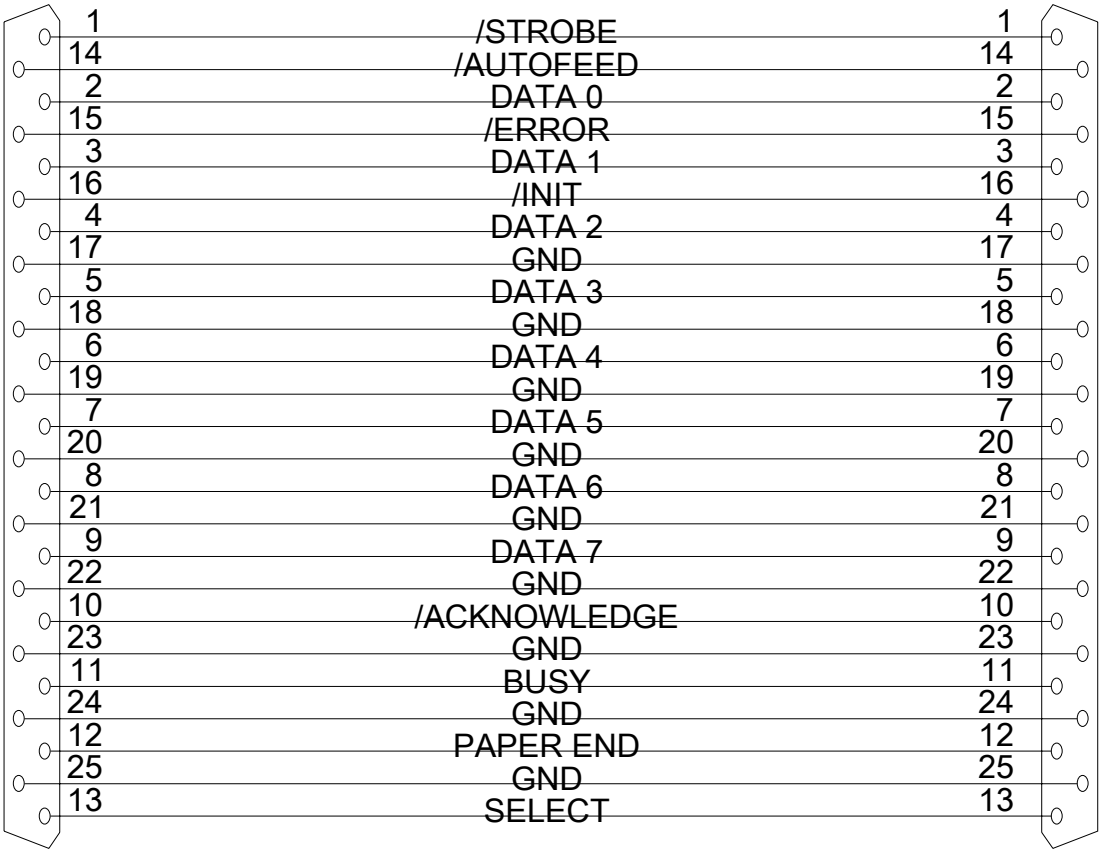
With the COMMAND SET 2 this would cause a double paper feed because the CR character, since it causes the buffer to be printed, also feeds the paper. To prevent this problem, place the printer in the "CRLF" mode in which the CR character is ignored.

Figure 12.



< Centronics parallel interface signal timing >

Figure 13



< Centronics parallel interface wiring schematics >

3.5 REAL TIME CLOCK (OPTION)

◆ The Real Time Clock is available as an option. Printing and adjustment of the clock are managed by a series of control characters :

- $<12>_{Hex}$ Print time and date
- $<13>_{Hex}$ Set clock
- $<14>_{Hex}$ Read time and date
- ESC T Print time in text
- ESC D Print date in European format (d/m/y) in text
- ESC U Print date in American format (m/d/y) in text

◆ The features of the optional Clock/Calendar are :

Data handled :	hours/minutes/day/month/year
Battery :	Ni-Cd automatically recharged at printer's switching on
Battery life :	About 40 days after a 10 hours charge

◆ How to adjust the Clock using the keyboard

The time and date can be adjusted by using the PRINT and FEED keys on the front panel of the printer. Setting procedure is as follows :

- hold down the FEED key and simultaneously press the PRINT key. The printer will print the time and date with an arrow indicating a digit to be changed
- each time the PRINT key is pressed, the digit by the arrow will increase and the updated version will be printed
- to select the next digit which requires adjusting press the FEED key again. On completion of each operation, the printer will print the updated time and date, highlighting by means of an arrow the digit currently being selected
- to terminate setting, press PRINT and FEED at the same time, or run through all the parameters.

[NOTES]

- It is advisable to leave the printer switched on, with the option installed, for, at least, 24 hours in order to charge completely the Clock/Calendar battery.
- The data stored in the RTC option are lost only if the battery is flat/discharged.
- If the option is not installed and you send the $<12>_{Hex}$, ESC T, ESC D, ESC U commands, the printer performs “3” and a question marks string.
- If the option is not installed and you send the $<14>_{Hex}$ command, the printer performs “3” and a question marks string.

4.PRINTER CONTROL COMMANDS

4.1 COMMAND SET 1

◆ ASCII : - Hex : **$00** Dec : **$00**

Printing in small characters.

The command 00_{Hex}$ is used for reverting to printing in small characters. If, for example, double height or double width printing had been set and the user wishes to return to printing in small characters, he/she transmits the code 00_{Hex}$. This command clears the print buffer. For this reason this command must not be transmitted immediately after an ASCII string, otherwise the string will be erased. It is better, therefore, to transmit the command after a (CR) $0D$_{Hex}$ so that the string is printed first and, on clearing the buffer, small character printing is restored. In many user applications the character 00_{Hex}$ is transmitted as a piece of calculation data or as a numerical value, automatically erasing the string preceding it. A small character is 6 dots wide and 10 dots tall. The ASCII characters which can be printed, as may be seen from the self-test, start from code 21_{Hex}$ through to code FF_{Hex}$.

◆ ASCII : - Hex : **$01** Dec : **$01**

Double width printing.

The command 01_{Hex}$ is used to activate double width printing. This command clears the print buffer and for this reason it must not be transmitted immediately after an ASCII string, otherwise this string will be erased. it is better, therefore, to transmit the command 01_{Hex}$ after a (CR) $0D$_{Hex}$ so that the string is printed first and, on clearing the buffer, double width printing is enabled. When this printing mode is set the number of characters per line is exactly halved in comparison with small characters: a printed line of a 24-column printer, therefore, contains 12 characters, and a 40-column printer contains 20. Double width characters are 12 dots wide and 10 dots tall. The ASCII characters which can be printed, as may be seen from the self-test, start from code $1E$_{Hex}$ through to code FF_{Hex}$.

◆ ASCII : - Hex : **$02** Dec : **$02**

Double height printing.

The command 02_{Hex}$ is used to activate double height printing. This command clears the print buffer and for this reason it must not be transmitted immediately after an ASCII string, otherwise this string will be erased. It is better, therefore, to transmit the command 02_{Hex}$ after a (CR) $0D$_{Hex}$ so that the string is printed first and, on clearing the buffer, double height printing is enabled. When this printing mode is set, the number of characters per line remains 24 for the 24-column printer and 40 for the 40-column printer. Double height characters are 6 dots wide and 20 dots tall. The ASCII characters which can be printed, as may be seen from the self-test, start from code 21_{Hex}$ through to code FF_{Hex}$.

◆ ASCII : - Hex : **$03** Dec : **$03**

Expanded printing

The command 03_{Hex} is used to activate expanded printing. This command clears the print buffer and for this reason it must not be transmitted immediately after an ASCII string, otherwise this string will be erased. It is better, therefore, to transmit the command 03_{Hex} after a (CR) $0D_{Hex}$ so that the string is printed first and, on clearing the buffer, expanded printing is enabled. When this printing mode is set, the number of characters per line is exactly halved in comparison with small characters: a printed line of a 24-column printer, therefore, contains 12 characters, and a 40-column printer contains 20. Expanded characters are 12 dots wide and 20 dots tall. The ASCII characters which can be printed, as may be seen from the self-test, start from code 21_{Hex} through to code FF_{Hex} .

◆ ASCII : - Hex : **$04** Dec : **$04**

Restores normal printing

The command 04_{Hex} is used for reverting to printing in small characters (it is identical to 00_{Hex} and is used when it is impossible to use the latter). If, for example, double height or double width printing had been set and the user wishes to return to printing in small characters, he/she transmits the code 04_{Hex}. This command clears the print buffer. For this reason this command must not be transmitted after an ASCII string, otherwise the string will be erased. It is better, therefore, to transmit the command 04_{Hex} after a (CR)$0D_{Hex}$ so that the string is printed first and, on clearing the buffer, small character printing is restored. A small character is 6 dots wide and 10 dots tall. The ASCII characters which can be printed, as may be seen from the self-test, start from code 21_{Hex} through to code FF_{Hex} .

◆ ASCII : - Hex : **$0A** Dec : **$10**

Forward feeds one line

The command $0A_{Hex}$ forward feeds the printer by one line. If there are any characters in the line buffer, the buffer itself is automatically printed. A line feed is equivalent to 10 dots of normal printing, the paper moves faster than it would when printing due to the automatic activation of a magnet which speeds up the paper feed.

◆ ASCII : - Hex : (n) **$0B** Dec : **$11**

Forward feeds (n) lines

The command $0B_{Hex}$ forward feeds the printer by the number of lines previously set. This must be an ASCII number from 0-9; obviously if the number is zero, nothing will happen. Take care because the erased. If, for example, you want the paper to forward feed by 5 lines, transmit:
35_{Hex} $0B_{Hex}$ (or, alternatively, 5 and the command $0B_{Hex}$).

◆ ASCII : - Hex : **$0D** Dec : **$13**

Prints line buffer

The command $0D$_{Hex}$ (carriage return) prints the line buffer. If the buffer is empty, nothing happens. If the CRLF option is set, the code $0D$_{Hex}$ is ignored and printing only takes place if the command $0A$_{Hex}$ is transmitted. When the printer is switched on, the default value of the CRLF option is contained in the flag of a byte called "option register" which can be manipulated through the configuration by using the two keys on the front panel of the printer or through the program from the PC.

◆ ASCII : - Hex : **$0F** Dec : **$15**

Sets CRLF mode

The command $0F$_{Hex}$ enables the CRLF option. It inhibits the action of the command $0D$_{Hex}$, and keeping only the command $0A$_{Hex}$ as a print command. This function can be useful in cases where the RETURN key is associated with the $0D$_{Hex}$ and $0A$_{Hex}$ commands, thus causing this printer to print in double spacing. To disable this option, the printer has to be reset, either by switching it off or by transmitting the reset command. When the printer is switched on, the default value of the CRLF option is contained in the flag of a byte called "option register" which can be manipulated through the configuration by using the two keys on the front panel of the printer or through the program from the PC.

◆ ASCII : - Hex : **$11** Dec : **$17**

Graphic mode

The command 11_{Hex}$ enables this printer graphic mode, i.e. to print in graphic mode transmit the command 11_{Hex}$ at the beginning of each line. One line for this printer (24 column model) corresponds to 144 horizontal points divided in 24 6-point blocks. For this printer (40 column model) one line corresponds to 240 horizontal points divided into 40 6-point blocks. For byte format in graphic configuration

◆ ASCII : - Hex : **$12** Dec : **$18**

Prints the time and date

This command prints the time and date in the following format:

hh : mm dd - mm - yy

If the expanded or double width formats are selected (i.e. with less than 15 characters per line), only the time will be printed. If seconds printing is enabled, the format will be:

hh : mm : ss dd - mm - yy

In any event this command resets the line.

◆ ASCII : - Hex : **$13** Dec : **$19**

Sets the time and date in serial

The command 13_{Hex} sets the time and date of the clock installed inside this printer. There are two ways of setting it: the first uses the 24-hour clock and the second the 12 hour a.m., p.m. clock. In the first case the 10 ASCII characters corresponding to the time and date have to be transmitted, followed by the command 13_{Hex}. If, for example, we wish to enter 12.45 of 19.01.99 we have to send the following sequence:

	1	2	4	5	1	9	0	1	9	9	13_{Hex}
i.e.	31_{Hex}	32_{Hex}	34_{Hex}	35_{Hex}	31_{Hex}	39_{Hex}	30_{Hex}	31_{Hex}	39_{Hex}	33_{Hex}	13_{Hex}

In the second case the 10 ASCII characters corresponding to the time and date preceded by "A" or "P", to indicate ante- or post-meridian, are sent to the printer followed by the command 13_{Hex}. If, for example, we wish to enter A12.45 of 19.01.99, we have to send the following sequence:

	A	1	2	4	5	1	9	0	1	9	9	13_{Hex}
i.e.	41_{Hex}	31_{Hex}	32_{Hex}	34_{Hex}	35_{Hex}	31_{Hex}	39_{Hex}	30_{Hex}	31_{Hex}	39_{Hex}	33_{Hex}	13_{Hex}

It is advisable to send the command 00_{Hex} first (normal printing mode) in order to erase the print buffer so as to ensure that there were no old characters still in it.

◆ ASCII : - Hex : **$14** Dec : **$20**

Transmits the time and date in serial

The command 14_{Hex} transmits the contents of the Real Time Clock to the printer's serial port in the format of 11 ASCII characters:

hour / minutes / day /month / year + CR $0D_{Hex}$

If the seconds option is enabled, the seconds will be transmitted after the minutes. This command can only be used if the serial port is being used: if the parallel port is being used, the printer will not be able to print anything.

◆ ASCII : - Hex : **$1E $1F** Dec : **$30 $31**

Prints the 1st (2nd) programmable character

If the hexadecimal character $1E_{Hex}$ ($1F_{Hex}$) is transmitted to this printer, it will print the corresponding programmable character. In fact, it is possible to program two characters which can be printed at any time with the codes $1E_{Hex}$ and $1F_{Hex}$. There are two ways of programming the characters: the can be saved in a non volatile memory which stores all the data, even when the printer is switched off, or alternatively, in a memory switch is automatically erased when the power is switched off. In the first case, the user can ask the technicians responsible to program the two characters, depending on his requirements. In the second case, the user can form the characters at the same time as he is

transmitting the text to be printed: the advantage of this approach is that an infinite number of symbols can be associated to a character, exactly as the user pleases, which he can print and modify as he sees fit. If the printer is new (or if the characters have not been manipulated), the following symbol will be associated with codes $\$1E_{Hex}$ and $\$1F_{Hex}$: each time the printer is switched on, the above mentioned codes will contain the last characters programmed in the non volatile memory.

◆ ASCII : - Hex : **$17 $18 $19 $1A $1C $1D $1E $1F**
Dec : **$23 $24 $25 $26 $28 $29 $30 $31**

Prints the 1st (...8th) programmable character

If the hexadecimal character $\$17_{Hex}$ (...$\$1F_{Hex}$) is transmitted to this printer, it will print the corresponding programmable character. In fact, it is possible to program eight characters which can be printed at any time with the codes from $\$17_{Hex}$ to $\$1F_{Hex}$. There are two ways of programming the characters; they can be saved in a non volatile memory which stores all the data, even when the printer is switched off, or alternatively, in a memory which is automatically erased when the power is switched off. In the first case, the user can ask the technicians responsible to program the eight characters, depending on his requirements. In the second case, the user can form the characters at the same time as he is transmitting the text to be printed: the advantage of this approach is that an infinite number of symbols can be associated to a character, exactly as the user pleases, which he can print and modify as he sees fit. If the printer is new (or if the characters have not been manipulated), the following symbol will be associated with codes $\$17_{Hex}$, ..., $\$1F_{Hex}$; each time the printer is switched on, the above mentioned codes will contain the last characters programmed in the non volatile memory.

◆ ASCII : **ESC R** Hex : **$1B $52** Dec : **$27 $82**

Sets the printer in reverse mode

The command "ESC" R selects reverse mode printing. In reverse mode printing, the ticket comes out of the printer with the writing right side up and running from left to right. When the printer is switched on, the default value is selected by the flag of a location called the "option register"; this flag can be manipulated by programming, using the two keys on the front panel of the printer with which the default value can be changed and it can be decided whether the printer is to be in reverse or normal mode when it is switched on.

◆ ASCII : **ESC N** Hex : **$1B $4E** Dec : **$27 $78**

Sets the printer in normal mode

The command "ESC" N selects normal mode printing. In normal mode printing, the ticket comes out of the printer with the writing upside down and running from right to left. When the printer is switched on, the default value is selected by the flag of a location called the "option register"; this flag can be manipulated by programming, using the two keys on the front panel of the printer with which the default value can be changed and it can be decided whether the printer is to be in reverse or normal mode when it is switched on.

◆ ASCII : **ESC @** Hex : **$1B $40** Dec : **$27 $64**

Resets the printer

The command "ESC" @ resets the printer software. This command is identical to the hardware reset command and can be used for re-initializing the printer's parameters. Obviously, after this command the receiving buffer is zero-set and all the data transmitted to the printer is lost. Once the command has been transmitted, approximately 1.5 seconds pass before the printer becomes active again. The reset command can be useful when the system is switched on in order to avoid false characters, which would corrupt the printer's receiving buffer, from being sent during the master device's initializing phases.

◆ ASCII : **ESC D** Hex : **$1B $44** Dec : **$27 $68**

Enter the date in the line buffer

The command "ESC" D is used for entering the date of the Real Time Clock fitted inside the printer in the line buffer. The format of the date is dd-mm-yy. This command can be used for entering the date in the context of a sentence without zero-setting the line buffer. If, for example, you wish to write:

DATA : 11-09-98 TEST OK

you will send : DATA : $1B$_{Hex}$ 44_{Hex}$ TEST OK $0D$_{Hex}$

If you only wish to print the date, it is enough to transmit $1B$_{Hex}$ 44_{Hex}$ $0D$_{Hex}$. The date is transmitted in 8 characters and, if there is not sufficient space left in the line buffer, it is not printed.

◆ ASCII : **ESC T** Hex : **$1B $54** Dec : **$27 $84**

Enters the time in the line buffer

The command "ESC" T is used for entering the time of the Real Time Clock fitted inside the printer in the line buffer. The format of the time is hh-mm. This command can be used for entering the time in the context of a sentence without zero-setting the line buffer. If, for example, you wish to write:

TIME : 16.45 TEST OK

you will send : TIME : $1B$_{Hex}$ 54_{Hex}$ TEST OK $0D$_{Hex}$

If you only wish to print the time, it is enough to transmit $1B$_{Hex}$ 54_{Hex}$ $0D$_{Hex}$. The time is transmitted in 5 characters and, if the seconds option is enabled in 8 characters: if there is not sufficient space left in the line buffer, it is not printed.

◆ ASCII : **ESC U** Hex : **$1B $55** Dec : **$27 $85**

Enters the date (mm-dd-yy) in the buffer

The command "ESC" U is used for entering the date, American style mm-dd-yy, of the Real Time Clock fitted inside the printer in the line buffer. This command can be used for entering the date in the context of a sentence without zero-setting the line buffer. if, for example, you wish to write:

DATE : 09-11-98 TEST OK

you will send : DATE : $1B$_{Hex}$ 55_{Hex}$ TEST OK $0D$_{Hex}$

If you only wish to print the date, it is enough to transmit $1B$_{Hex}$ 55_{Hex}$ $0D$_{Hex}$. The date is transmitted in 8 characters and, if the seconds option is enabled in 8 characters: if there is not sufficient space left in the line buffer, it is not printed.

◆ ASCII : **ESC S** Hex : **$1B $53** Dec : **$27 $83**

Enables the printing of seconds

The command "ESC" S enables the printing of seconds when the time is requested with command "ESC" T. When the printer is switched on the default value, which determines whether or not the seconds are to be printed, is contained in the flag of a byte called the "option register"; this flag can be manipulated by programming, using the two keys on the front panel of the printer.

◆ ASCII : **ESC O** Hex : **$1B $4F** Dec : **$27 $79**

Transmits operating hours in serial

The command "ESC" O transmits the total operating hours of the printer to the serial port. These hours are allocated in the battery-driven RAM of the Real Time device fitted inside the printer. If, therefore, there is no Real Time Clock, this command will produce no effect. In addition, if the user utilizes the parallel port, the operating hours will not be transmitted since the parallel port is unidirectional. The hours begin to increase as soon as the printer is switched on. The increase is in actual fact, on a minute to minute basis but the printer only counts the completed hours. The transmission format is in ASCII standard and four characters are transmitted: in order of importance. The transmission protocol is the same as that set by the user on the serial interface. As there are four characters it can reach a maximum of 9999 operating hours; it then automatically zero-sets and continues counting.

◆ ASCII : **ESC H** Hex : **$1B $48** Dec : **$27 $72**

Zero-sets total operating hours

The command "ESC" H zero-sets the printer's total operating hours. If you are using the total hours option, it is advisable to use this command immediately after switching on the printer so as to synchronize the operating hours of the printer itself with those of the master device.

◆ ASCII : **ESC o** Hex : **$1B $6F** Dec : **$27 $111**

Prints total operating hours

The command "ESC" o enters the total operating hours in the line buffer. These hours are allocated in the battery-driven RAM of the Real Time device fitted inside the printer. If, therefore, there is no Real Time Clock, this command will produce no effect. The hours begin to increase as soon as the printer is switched on. The increase is, in actual fact, on a minute to minute basis but the printer only counts the completed hours. As there are four characters it can reach a maximum of 9999 operating hours: it then automatically zero-sets and continues counting. If, for example, you wish to write:

TOTAL HOURS : 0123 TEST OK

you will send: TOTAL HOURS : $1B$_{Hex}$ $6F$_{Hex}$ TEST OK

The hours are printed in four characters and if there is not enough space in the line buffer, they will not be printed.

◆ ASCII : **ESC B** Hex : **$1B $42** Dec : **$27 $66**

Sets character font 1

The command "ESC" B selects the first character font. The complete font is printed during the self-test. The font may be selected at any time, keeping in mind that the printer cannot print a line containing two different fonts and will print, therefore, the last font selected. When the printer is switched on the default value, which establishes which printing font is to be used, is selected by a flag in a location called the "option register"; this flag can be manipulated by programming, using the two keys on the front panel of the printer, by means of which the default values can be changed.

◆ ASCII : **ESC b** Hex : **$1B $62** Dec : **$27 $98**

Sets character font 2

The command "ESC" b selects the second character font. The complete font is printed during the self-test. This font contains Cyrillic characters. It may be selected at any time, keeping in mind that the printer cannot print a line containing two different fonts and will print, therefore, the last font selected. When the printer is switched on the default value, which establishes which printing font is to be used, is selected by a flag in a location called the "option register"; this flag can be manipulated by programming, using the two keys on the front panel of the printer, by means of which the default values can be changed.

◆ ASCII : **(aa) ESC r** Hex : **(aa) $1B $72** Dec : **(aa) $27 $114**

Reads a piece of data at an address

The command "ESC" r makes it possible to read in a location of the non volatile memory (EEPROM). This command can only be used with the serial port as it is bi-directional. The communication protocol is defined by the dip-switches on the serial interface. There are 199 legible locations, starting from the 00_{Hex}$ location up to the $C7$_{Hex}$ location. The address of the location to be read must be defined before the "ESC" r command is transmitted, i.e. if we wish to read address 01_{Hex}$, we have to transmit in ASCII:

0 1 "ESC" r or 30_{Hex}$ 31_{Hex}$ $1B$_{Hex}$ 72_{Hex}$

In reply to this reading, the printer transmits the data of address 01_{Hex}$. The reply also is given in ASCII: thus if, for example, address 01_{Hex}$ contains $A5$_{Hex}$, we receive:

A 5 or 41_{Hex}$ 35_{Hex}$

The entire memory bank contains the value 20_{Hex}$ by default. Since it is a non volatile memory, the user

can save the data without losing it when the power is switched off.

◆ ASCII : **(aadd) ESC w** Hex : **(aadd) $1B $77** Dec : **(aadd) $27 $114**

Writes a piece of data (dd) in an address (aa)

The command "ESC" w makes it possible to save a piece of data in a non volatile memory. There are 256 locations in which to write, starting from 00_{Hex} to $C7_{Hex}$. The pieces of data too cannot exceed $C7_{Hex}$ (199) and both the addresses and the data must be expressed in ASCII on two bytes. To save a piece of data, first transmit the address, then the data followed by the command "ESC" w. If, for example, you wish to save the data $A5_{Hex}$ in address 01_{Hex}, you will transmit:

0 1 A 5 "ESC" w or 30_{Hex} 31_{Hex} 41_{Hex} 35_{Hex} $1B_{Hex}$ 77_{Hex}

The entire memory bank contains the value 20_{Hex} by default. Since it is a non volatile memory, the user can save the data without losing it when the power is switched off.

◆ ASCII : **(dd) ESC G** Hex : **(dd) $1B $47** Dec : **(dd) $27 $71**

Writes value (dd) in option register

By means of the command "ESC" G the printer configuration can be manipulated. To do so, a byte in ASCII containing the configuration must be transmitted to the printer, followed by "ESC" G. The setting byte contains the following bits:

d7 d6 d5 d4 d3 d2 d1 d0

where:

- **d0** is used to enable the setting of the Real Time Clock using the keys on the front of the printer. If this bit is 0, it disables setting; if it is 1 it enables it. If the user disables this function the clock will not be affected by variations made either accidentally or deliberately by persons not qualified to do so.
- **d1** is used for setting the printing mode: normal or reverse. If this bit is 0 printing is in normal mode; if it is 1 it is in reverse mode.
- **d2** is used in parallel communication and enables the 7 or 8 data bit protocol. If this bit is 0 the parallel port accepts 8 bit data; if it is 1 the port accepts 7 bit data. If the 7-bit protocol is enabled, the printer will only be able to print non extended characters, i.e. those from code $0E_{Hex}$ to code $7F_{Hex}$.
- **d3 :** its purpose is to enable the printing of seconds in the clock commands. If the bit is 0 the seconds will not be printed; otherwise during the printing phase of the time the seconds will be printed too.
- **d4 :** if the bit is 0 command $0D_{Hex}$ is carried out; if it is 1 the printer ignores the carriage return command.

- **d5 :** this bit enables the printing of the first block (heading) as soon as the printer is switched on. If the bit is 0 this function is disabled; if it is 1 the function is enabled.
- **d6 :** selects the character fonts during printing. A logic state 0 selects font 1, while a logic state 1 selects font 2.
- **d7 :** 0 disables the lapsed time meter while 1 enables it.

Once the printer has been configured, the above described byte in ASCII is transmitted; for example byte = 00001001 corresponds to $\$09_{Hex}$, the whole string would therefore be:

0 9 "ESC" G or in Hex $\$30_{Hex}$ $\$39_{Hex}$ $\$1B_{Hex}$ $\$47_{Hex}$

All these bits, with the exception of bit 7, can be manipulated by programming using the front keys of the printer.

◆ ASCII : **(dd) ESC M** Hex : **(dd) $1B $4D** Dec : **(dd) $27 $77**

Writes printing mode value (dd)

Using the command "ESC" M it is possible to manipulate the printing mode by default, To do this a byte in ASCII containing the printing mode must be transmitted followed by "ESC" M. The type of writing which can be defined is described in the following table:

$\$00_{Hex}$ small character printing
$\$01_{Hex}$ double width printing
$\$02_{Hex}$ double height printing
$\$03_{Hex}$ expanded printing

If, for example, you wish to print in double height characters, you will send:

0 2 "ESC" M (or $\$30_{Hex}$ $\$32_{Hex}$ $\$1B_{Hex}$ $\$4D_{Hex}$)

Automatically the printing mode is changed to the one selected and is stored in the non volatile memory.

◆ ASCII : **ESC p** Hex : **$1B $70** Dec : **$27 $112**

Transmits the option register in serial

The command "ESC" p transmits the "option register" byte to the serial port of the printer. Obviously if the printer is using the parallel protocol, the command will produce no effect. The reply to this question is made in two ASCII bytes containing the option register value. If, for example, we receive:

0 9 (or $\$30_{Hex}$ $\$39_{Hex}$)

this means that the configuration will be 00001001.

◆ ASCII : **ESC m** Hex : **$1B $6D** Dec : **$27 $109**

Transmits the printing mode in serial

The command "ESC" m transmits the byte containing the printing mode by default to the serial port of the printer. Obviously if the printer is using the parallel protocol, the command will produce no effect. The reply to this question is made in two ASCII bytes containing the option register value. If, for example, we receive:

0 2 (or $\$30_{Hex}$ $\$32_{Hex}$)

this means that the printer is in double height printing mode.

◆ ASCII : **ESC s** Hex : **$1B $73** Dec : **$27 $115**

Transmits next character in serial

The command "ESC" s ($\$1B_{Hex}$ $\$73_{Hex}$) sets the printer to transmit the next character it receives. If, for example, we transmit "ESC" s A, the last character, A, will not be printed but will immediately be transmitted in serial. If we use this function in memorizing blocks of text, we can simulate a password which would be transmitted, for example, when the printer is switched on, or command codes on pressing the PRINT key, or connected printer tests.

◆ ASCII : **ESC W (n)** Hex : **$1B $57 (n)** Dec : **$27 $87 (n)**

Starts saving block (n)

The command "ESC" W ($1B $57) followed by a number (from 1 to 3) activates the function for saving a file in one of the three blocks defined by the number n. These blocks are contained in a non volatile memory which stores the data even when the power is switched off. The length of the files which can be memorized is of 300 bytes for the first block and 700 bytes for the second and third blocks. The files can contain all kinds of codes; it is therefore possible to store tests, data, executive commands to the printer, auto-headings, graphic files etc. If files exceeding the memory bank capacity are transmitted, the extra characters will be printed directly without being saved. Loading can be done in either serial or parallel. When you have finished loading a block, it is advisable to enter the terminating command "ESC" Z. The three blocks stored in this way can either be printed or transmitted in serial. If printer commands have been saved, these will be carried out as they would normally.

◆ ASCII : **ESC V (n)** Hex : **$1B $56 (n)** Dec : **$27 $86 (n)**

Prints block (n)

The command "ESC" V ($\$1B_{Hex}$ $\$56_{Hex}$) followed by as number (from 1 to 3) prints block n. The file continues printing until it reaches the terminating command "ESC" Z. Obviously, if the block is clear, or if all the characters are $\$20_{Hex}$, the printer will not print anything. The first block, also called heading,. will automatically be printed when the printer is switched on, if the auto-heading flag is set. The user's logo or the name of his company can, therefore, be printed each time the printer is switched on. The three blocks can also be printed one after the other, there being a total memory bank of 1700 bytes. To recall a block, you must enter the command "ESC" V and the number of the block you wish to recall.

◆ ASCII : **ESC E (n)** Hex : **$1B $45 (n)** Dec : **$27 $69 (n)**

Transmits block (n) in serial

The command "ESC" E ($1B_{Hex}$ 45_{Hex}) followed by a number (from 1 to 3), transmits in serial the memory
block defined by n. If the printer is using the parallel port this command will, of course, produce no effect. The file will be transmitted in its entirety, the first block will contain 300 bytes and the second and third blocks 700 bytes each.

◆ ASCII : **ESC Z** Hex : **$1B $5A** Dec : **$27 $90**

Block saving completed

The command "ESC" Z ($1B_{Hex}$ $5A_{Hex}$) acts as a terminator for the three memory blocks. When the line buffer reads this terminating command during printing, it stops printing the block and reverts to normal functioning. In the absence of the terminating command, the entire block will be printed.

◆ ASCII : **ESC J (n)** Hex : **$1B $4A (n)** Dec : **$27 $74 (n)**

Loads programmable character (n)

The command "ESC" J ($1B_{Hex}$ $4A_{Hex}$) followed by a number is used to generate the programmable characters. The programmable characters. The programmable characters go from code $1E_{Hex}$ to code $1F_{Hex}$ of from code 17_{Hex} to code $1F_{Hex}$. A programmable character consists of 10 lines of 6 dots each; to form a character which corresponds to code $1E_{Hex}$, therefore, you must transmit 10 bytes preceded by "ESC" J1. The bytes must have the same characteristics as the graphic mode, i.e.:

x	P7	P6	P5	P4	P3	P2	P1
d7	d6	d5	d4	d3	d2	d1	d0

where: x is not used;

P7 must be fixed at 1;

P1 to **P6** = the graphic dot data ; if it is at 1 it prints and if it is at 0 it does not print.

The P6 bit of the string of points transmitted is printed on the left with the other points running from left to right (P6, P5, P4, P3, P2, P1) as illustrated:

P6, P5, P4, P3, P2, P1	1°byte
P6, P5, P4, P3, P2, P1	2°byte
P6, P5, P4, P3, P2, P1	3°byte
P6, P5, P4, P3, P2, P1	4°byte
P6, P5, P4, P3, P2, P1	5°byte
P6, P5, P4, P3, P2, P1	6°byte
P6, P5, P4, P3, P2, P1	7°byte
P6, P5, P4, P3, P2, P1	8°byte
P6, P5, P4, P3, P2, P1	9°byte

P6, P5, P4, P3, P2, P1 10°byte.

After the tenth byte the function "ESC" J finishes. If, for example, we wish the symbol of code $\$1F_{Hex}$ to be #, we must transmit "ESC" J 2 pieces of data, i.e.:

$\$1B_{Hex}$ $\$4A_{Hex}$ $\$32_{Hex}$ $\$52_{Hex}$ $\$52_{Hex}$ $\$52_{Hex}$ $\$7F_{Hex}$ $\$52_{Hex}$ $\$52_{Hex}$ $\$7F_{Hex}$ $\$52_{Hex}$ $\$52_{Hex}$ $\$52_{Hex}$

All the data must be transmitted consecutively. This type of loading is allocated to the volatile memory; thus, when the power is switched off the character is zero-set and reverts, when the printer is switched on again, to the default character configured.

◆ **GRAPHICS**

The size of the graphic point and number of points per line vary depending on the number of columns:

Print format	24 column	40 column
Graphic point (L X H mm)	0.33 X 0.38	0.19 X 0.38
Points per line	144	240

To obtain a graphic printout, enter the command $\$11_{Hex}$ at the beginning of each line.
The graphic configuration byte format is as follows:

X	R	P6	P5	P4	P3	P2	P1
D7	D6	D5	D4	D3	D2	D1	D0

where:

X is not utilized;

R must be set at 1;

P1, ..., P6 are the data of the graphic points (1prints, 0 does not print)

The P6 bit of the string of points transmitted is printed on the left and the others (P5, P4, P3, P2, P1) follow from left to right, as shown:

1st byte						2nd byte						3rd byte					
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
P6	P5	P4	P3	P2	P1	P6	P5	P4	P3	P2	P1	P6	P5	P4	P3	P2	P1

To print a line of points transmit:

$\$11_{Hex}$, N x $\$7F_{Hex}$ (where N is the number of characters per line), $\$0D_{Hex}$.

To print an empty line, transmit:

$\$11_{Hex}$, $\$40_{Hex}$, $\$0D_{Hex}$.

4.2 COMMAND SET 2

◆ ASCII : - Hex : **$00** Dec : **$00**

Select normal print

Selects print with normal size characters. This is the default setting when the printer is switched on. It resets the line buffer.

◆ ASCII : - Hex : **$01** Dec : **$01**

Select double width print

Selects print with double width characters. It resets the line buffer.

◆ ASCII : - Hex : **$02** Dec : **$02**

Select double height print

Selects double height character print and resets the line buffer.

◆ ASCII : - Hex : **$03** Dec : **$03**

Select expanded character print

Selects expanded character print (double width + double height)

◆ ASCII : - Hex : **$04** Dec : **$04**

Select normal print

Has the same effect as character 00_{Hex} (refer to above).

◆ ASCII : - Hex : **$0A** Dec : **$10**

Line feed (LF)

Prints the line buffer and feeds the paper one line.

◆ ASCII : - Hex : **$0B** Dec : **$11**

Vertical tab (VT)

Feeds the paper an x number of lines which must be between 0 and 9 (30_{Hex},..., 39_{hex}). The vertical tab feeds the paper at a faster rate than with the LINE FEED command.
This command resets the line buffer.

◆ ASCII : - Hex : **$0D** Dec : **$13**

Carriage return (CR)

Prints the line buffer if it contains characters. It is ignored if the buffer is empty.

◆ ASCII : - Hex : **$0F** Dec : **$15**

CRLF mode

In this operating mode, when the CRLF sequence is transmitted, the CR control character is ignored. To reset to normal operating mode, switch the printer off or transmit a software reset command (ESC @).

◆ ASCII : - Hex : **$11 x_1 ... x_n** Dec : **$17 x_1 ... x_n**

Activate graphics mode

Enables graphics mode operation and prints n graphic characters each 6 points.

◆ ASCII : - Hex : **$12** Dec : **$18**

Print time and date

Print format: h:m d-m-y

If double width or expanded formats are selected, the print time/date command causes only the time (h:m) to be printed because of the lower number of characters that can be printed per line. This command resets the line buffer. If it is transmitted without the optional clock/calendar installed, it causes "3" and a series of question marks to be printed or a line feed (see note).

[NOTE] If the optional clock/calendar is not installed, the print time and date commands (12_{hex}, ESC D, ESC T, ESC U) will produce a string of "3" and question marks.

◆ ASCII : - Hex : **x_0 ... x_9 $13** Dec : **$x_0$ ... x_9 $19**

Setting the clock

The clock can be set in both the 24 and 12 hour AM/PM format. In the 24 hour format, the x_0 .. x_9 string (ten characters), are the hour-minute-day-month-year settings to be entered in the clock. For example, to set 14:45 on 19-03-98, you will transmit the following hex string:

31_{Hex} 34_{Hex} 34_{Hex} 35_{Hex} 31_{Hex} 39_{Hex} 30_{Hex} 33_{Hex} 39_{Hex} 34_{Hex} 13_{hex}

In the 12 hour AM/PM format, the x_0 ... x_9 string (ten characters) for the hour-minute-day-month-year settings are preceded by the character "A" (41_{hex}) for the AM hours or "P" (50_{hex}) for the PM hours. For example, to set 17:35 (5:35 PM) on 21-03-98, the following hex string will be transmitted:

50_{Hex} 30_{Hex} 35_{Hex} 33_{Hex} 35_{Hex} 32_{Hex} 31_{Hex} 30_{Hex} 33_{Hex} 39_{Hex} 34_{Hex} 13_{hex}

The command will be ignored if the optional clock/calendar is not installed.

[NOTE]
- Before setting the time and date, transmit the 00_{hex} character (select normal print) to configure the buffer to accept all control characters e.g. 00_{hex} x_0 ... x_9 13_{hex}
- When entering the time and date settings, don't forget that the printer will not check the figures entered (thus you can set 25:72 for the time). Data check is left to the host computer.

◆ ASCII : - Hex : **$14** Dec : **$20**

Call for clock/calendar data transmission

This transmits the time/date string from the optional clock/calendar to pin TxD on the controller board.
The time/date string consists of 10 ASCII characters representing in order, the data for the hours-minutes-
day-month-year (without separators) and ending with a CR ($0D_{hex}$) character.

[NOTE] If the optional clock/calendar is not installed, printer response to a call for time and date transmission will be a string of "3" and question marks.

◆ ASCII : **ESC D** Hex : **$IB $44** Dec : **$27 $68**

Entering the date in the buffer (European format)

Enter the date line (format d-m-y) without resetting anything already in the buffer. In this way, the date can be printed in the body of the text. If the max. number of characters that can be printed per line is exceeded, the excess characters will be erased.

◆ ASCII : **ESC T** Hex : **$1B $54** Dec : **$27 $84**

Enter time in the buffer

Enters the hour and minutes in the line buffer (format h:m) without erasing anything already in the buffer. In this way, the hour and minutes can be printed in the body of the text. If the max. number of characters that can be printed per line is exceeded, the excess characters will be erased.

◆ ASCII : **ESC U** Hex : **$1B $55** Dec : **$27 $85**

Enter date in buffer (American format)

Enter the date line in the buffer without erasing anything. The date is in the American format (m-d-y). If the max. number of characters that can be printed per line is exceeded, the excess characters will be erased.

[NOTE] If the optional clock/calendar is not installed, print date and time commands (12_{Hex}, ESC D, ESC T, ESC U) generate a string of "3" and question marks.

◆ ASCII : **ESC @** Hex : **$1B $40** Dec : **$27 $64**

Reset software

Resets printer parameters to initial status; resets the buffer.

◆ ASCII : **ESC N** Hex : **$1B $4E** Dec : **$27 $78**

Data mode

Selects "DATA" print mode. The selection is good until a reset is made when the printer resets to the default mode.

◆ ASCII : **ESC R** Hex : **$1B $52** Dec : **$27 $82**

Text mode

Selects "TEXT" print mode. The selection is good until a reset is made when the printer resets to the default mode.

◆ ASCII : **ESC P** Hex : **$1B $42** Dec : **$27 $66**

Select font1

Temporary selection of Font1. If Font2 had been selected, this command selects A2 character set. If A1, P of A2 was selected, the command has no effect. The selection is good until a reset is made when the printer resets to the default mode.

◆ ASCII : **ESC p** Hex : **$1B $62** Dec : **$27 $98**

Select Font2

Temporary selection of Font2. The selection is good until a reset is made when the printer resets to the default mode.

◆ ASCII : **ESC ! x** Hex : **$1B $21 x** Dec : **$27 $33 x**

Select type of character

Selects a combination of types of character as detailed in the Table below. Here x is created by adding the codes.

Type of character	Decimal	Hexadecimal
DATA mode	04	04
Double height	08	08
Quadruple height	16	10
Double width	32	20
Quadruple	64	40
Underline	128	80

The selection is good until a reset is made when the printer resets to the default mode.

◆ ASCII : **ESC B x** Hex : **$1B $42 x** Dec : **$27 $66 x** (*)

Serial communication configuration

Configures serial transmission mode by means of the 4 least significant bits of the x character:

b3	Data flow check
0	DTR
1	Xon-Xoff

b2	b1	b0	Transmission rate
0	0	1	1200
0	1	0	2400
0	1	1	4800
1	0	0	9600
1	0	1	19200
Other combinations			9600

This command modifies printer default settings. If serial interface is used, the printer send on tx line: B x
To activate this mode, switch the printer off and back on again.

◆ ASCII : **ESC C pos char x_1, ...x_{10} ck** Hex : **$1B $43 pos char x_1, ...x_{10}** (*)
Dec : **$27 $67 pos char x_1, ...x_{10}**

Personalized character configuration

Lets you redefine 1 character in the font. You can redefine max 11 characters.
Refer to page 54

◆ ASCII : **ESC C pos char x_1, ...x_{10} ck** Hex : **$1B $43 pos char x_1, ...x_{10}** (*)
Dec : **$27 $67 pos char x_1, ...x_{10}**

Delete reconfigured characters

This lets you delete personalized characters and in this way the print resets to its resident font. The 10 characters x_1, ...x_{10} must be FF_{hex}.
Refer to page 54

◆ ASCII : **ESC W n $char_1$... $char_m$ ESC Z** Hex : **$1B $57 n $char_1$, ...$char_m$ $1B $5A** (*)
Dec : **$27 $87 n $char_1$, ...$char_m$ $27 $90**

Writing a block of data in EEPROM

n = "3": memory block with max. 150 characters available
n = "2": memory block with max. 40 characters available
n = "1": memory block with max. 40 characters available
The blocks can contain instructions.

[NOTE] 1) Control character 0 (select normal write) must not appear in the data sequence transmitted. Character 4 can be used as an alternative.
2) Memory blocks exclude the possibility of using user configured characters.
If m > than the length of the block, the excess characters will be printed. An echo of W and of the data in the blocks is made to confirm their writing to the EEPROM.

◆ ASCII : **ESC E n** Hex : **$1B $45 n** Dec : **$27 $69 n** (*)

Block transmission

n = "1" / "2" / "3"
Transmits the memory block nth on the serial line. The terminal character (Esc "Z") is also transmitted.

◆ ASCII : **ESC V n** Hex : **$1B $56 n** Dec : **$27 $86 n** (*)

Block print

n ="1" / "2" / "3"

Print the memory block nth. The terminal character (Esc "Z") is also transmitted. If serial interface is used, on line tx, V is transmitted

◆ ASCII : **ESC K n** Hex : **$1B $4B n** Dec : **$27 $75 n** (*)

Default configuration of CRLF mode

Allow the CRLF mode to be set (n=0) or disable (n=1) permanently. In the CRLF mode, the CR character is always ignored. If serial interface is used, on line tx, K and n are transmitted.

◆ ASCII : **ESC k n** Hex : **$1B $6B n** Dec : **$27 $107 n** (*)

Enable/disable access to programming with the buttons on the front panel

n = 0 1 1 1 1 1 b_1 b_0 (bin)

b_0 = 0/1 : disables/enables clock setting with the buttons for all configuration parameters except the clock.

b_1 = 0/1 : disables/enables clock setting with the buttons.

If serial interface is used The "k" and n echo is transmitted. If the command is not accepted, n is not transmitted. During the self-test you can check if programming with the keys is enabled or disabled.

◆ ASCII : **ESC F x** Hex : **$1B $46 x** Dec : **$27 $73 x** (*)

Select default Font

This lets you configure one of the three resident fonts as the default using the x character:

X	Font
1	FONT 1 mode A 1
2	FONT 1 mode P
3	FONT 2
≥ 4	FONT 1 mode A 2

If serial interface is used, the printer send on tx line : F x

To activate the change, do a printer hardware reset.

In A1 emulation the most significant bit is masked.

◆ ASCII : **ESC G x** Hex : **$1B $47 x** Dec : **$27 $71** (*)

Select print mode (DATA/TEXT)

Selects the default print mode with the x character

X	Mode
0	TEXT
4	DATA

The printer send on line tx : G x

To activate this change, do a printer hardware reset.

◆ ASCII : **ESC CR x** Hex : **$1B $0D x** Dec : **$27 $13 x** (*)

Setting character to transmit with the print button

This lets you define with the x parameter the character the printer transmits, if serial communication selected, when the PRINT button is pressed :

X	Character to transmit
0	PRINT button off-line
$1 \leq x \leq 254$	Corresponding ASCII character
255	PRINT button off-line

[NOTE] Commands marked with an asterisk (*) change the resident configurations on the EEPROM.

◆ DOWNLOADABLE CHARACTER CONFIGURATION

COMMAND SET 2 mode allows 11 characters in the selected set to be reconfigured.

ESC "C" pos char x_1, ..., x_{10} ck
Hex : $1B $43 (from 01 to B) (from 20 to FF) x_1, ..., x_{10} ck
Dec : $27 $67 (from 01 to 11) (from 32 to 255) x_1, ..., x_{10} ck

Lets you re-define 1 character in the set entered.
A maximum 11 characters can be modified by repeating the command.

pos : Byte indicating the position in the memory of the character to be re-defined. It can be changed from 1 to 11(dec)
char : Byte indication the character to be changed. It can be changed from 32 to 255(dec)
x_1, ..., x_{10} : 10 byte sequence defining the character.
ck : Control character. This is the XOR of the Byte beginning from FF(hex), that is :
FF(hex) XOR pos XOR char XOR x_1 XOR ... XOR x_{10}

NB : for an ascending pos, the car characters must absolutely be in ascending order.

If the ck check is positive and the pos and char ranges are respected, the printer transmits "C" on the serial line. If not, it transmits "c".

To delete totally the characters entered, the 11 characters (pos from 1 to 11) have to be reconfigured with car = FF(hex) and x_1, ..., x_{10} also at FF(hex).

The character map is composed as follows :

b7 b6 b0

0	0		●	●	●			Byte0(x_1)
0	0	●				●		Byte1(x_2)
0	0							Byte2(x_3)
0	0		●		●			Byte3(x_4)
0	0							Byte4(x_5)
0	0	●				●		Byte5(x_6)
0	0		●	●	●			Byte6(x_7)
0	0							Byte7(x_8)
0	0							Byte8(x_9)
0	0							Byte9(x_{10})

Dot coding is:
Black = 1,
White = 0,

b_7 and b_6 of each matrix Byte must be at 0

When composing the characters, bear in mind that the matrix is 6 ×7 (columns ×lines) for characters from 32 to 127 in the ASCII table but is 6 ×10 for the characters from 128 to 255. This means that if you are configuring a character between 32 and 127, the last 3 bytes (Bytes 7, 8, 9) will be ignored but must be transmitted.
Using characters that can be configured precludes the possibility of using the blocks.

An example of the Basic program to replace character "!" with the character given in the previous Table :

```
CLOSE:CLS
OPEN "COM1:9600,N,8,1,cs50000,ds50000" FOR RANDOM AS #1
DIM V(12)

PRINT #1, CHR$(27) +"@";   'reset

V(1) =1                    'first character to be reconfigured
V(2) =33                   'modify character "!"
V(3) =&H1C                 'set of Bytes for the reconfiguration
V(4) =&H22
V(5) =&H00
V(6) =&H14
V(7) =&H00
V(8) =&H22
V(9) =&H1C
V(10) =&H00
V(11) =&H00
V(12) =&H00
```

```
CK=&HFF
PRINT #1, CHR$(27)+"C";          'reconfigure command
FOR I=1 TO 12
        PRINT #1, CHR$(V(I));
        CK=CK XOR V(I)
NEXT I
PRINT #1,CHR$(CK)                'transmit ck
```

Example of the program to delete the configured characters.

```
CLOSE
CLS
OPEN "COM1:9600,N,8,1,cs5000,ds5000" FOR RANDOM AS #1
PRINT #1, CHR$(27)+"@";          'reset

FOR I=1 TO 11                    'delete all 11 characters
CK=&HFF
PRINT #1, CHR$(27)+"C";          'reconfigure command
PRINT #1, CHR$(I);               'reconfigure the 1st character
CK=CK XOR I
PRINT #1,CHR$(255);              'the 1st character is FF
CK=CK XOR 255
FOR J=1 TO 10                    'all FF in the new definition
PRINT #1, CHR$(255);
        CK=CK XOR 255
NEXT J
PRINT #1, CHR$(CK);              'transmit ck
NEXT I
```

◆ GRAPHICS PERFORMANCE

The graphics line is made up of 144 dots (24 characters ×6 dots) for models PM190 and PM180, 240 dots (40 characters ×6 dots) for model PM192. The dots fill the entire print area width and ideally are divided into consecutive groups each with 6 dots.
Each group is called a "graphics character" and the number of graphics characters per line is the same as the alphanumeric characters per line for the printer model under discussion.

The control character 11_{hex} activates graphics mode. It must be followed by bytes with the graphic data. If their number is the same as the number of characters per line for the printer (24, 40), the graphics line

is automatically printed when the last byte is transmitted and the printer resets to text mode. If the graphics characters are less than the characters per line, just end the graphics line with an LF ($0A_{hex}$) character in order to print the line and return to text mode.

A line of graphics characters will be printed when the paper feeds the length required for graphics spacing (0.37 mm).

The structure of the graphics character is detailed as follow

Bit	Meaning
D7	Most significant bit. Ignore
D6	Always at logic level "1"
D5	Graphics character Dot 6 (first on the left in upright print); if "0"=white, if "1"=black
D4	Graphics character Dot 5, if "0"=white, if "1"=black
D3	Graphics character Dot 4, if "0"=white, if "1"=black
D2	Graphics character Dot 3, if "0"=white, if "1"=black
D1	Graphics character Dot 2, if "0"=white, if "1"=black
D0	Graphics character Dot 1(first on the right in upright print); if "0"=white, if "1"=black

In "DATA" mode, the dots in graphics character strings are printed from left to right. The dot on the far left corresponds to bit D5 for the first character following the control character 11_{hex}. The far right character corresponds to bit D0 for the last graphics string character.
As mentioned before, if the graphics line is not the same as the maximum number of characters per line: 24, 40.
To exit graphics mode, just transmit character LF ($0A_{hex}$)
To make a line of white dots with font A1 of A2 selected, just transmit this string:

11_{hex} $0A_{hex}$

With font P transmit this string:

11_{hex} 40_{hex} $0A_{hex}$

To make a line of black dots, whatever the font, transmit this string:

11_{hex} $7F_{hex}$ ... $7F_{hex}$

Where the character $7F_{hex}$ is repeated 24, 40 times depending on the printer model.

[NOTE] The FEED button on the front panel is disabled during graphics mode printing.