

GPR212

Programming manual



.1 REVISION HISTORY

Rev.	Date	Description	Author
	7/09/2017	Preliminary	PS
A	03/May/2019	Issuing official revision	PS
B	20/May/2019	Added Printout examples and related Data files	PS

.2 TABLE OF CONTENTS

.1	Revision history.....	2
.2	Table of contents	3
.3	Introduction	4
.4	Printer/Recorder feature description.....	4
.5	Features.....	5
.6	GPR212 Operating States.....	6
.6.1	Init.....	6
.6.2	On-Line.....	6
.6.3	Off-Line.....	6
.6.4	Exception.....	6
.6.5	Failed	6
.7	Printer Mode.....	7
.7.1	Graphics in Printer Mode	7
.8	Recorder Mode	8
.8.1	Text element	8
.8.2	Traces	9
.8.3	Grids	9
.8.4	Rectangles.....	9
.8.5	Page Memory.....	9
.9	Character Codes.....	10
.10	Status messages	11
.10.1	Message format	11
.10.2	Conditions and Events description	11
.10.3	Examples	12
.10.4	Default GPR212 configuration.....	12
.11	Operating control codes summary.....	13
.11.1	Std. Control codes in alphabetical order.....	13
.11.2	Control codes grouped by functionality	15
.12	Operating control codes descriptions	18
.12.1	Printer configuration commands description.....	18
.12.2	Printer status commands description	21
.12.3	Text printing commands description	22
.12.4	Std. Graphics printing commands description.....	29
.12.5	Recorder mode commands	30
.12.6	Examples	38
.13	Details of SERIAL communication port.	46

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This manual provides technical information about A.P.S. GPR212 printer using M0 architecture.

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.3 INTRODUCTION

This document is the **Programming manual** of the GPR212 (Graphic Printer Recorder) 2", 12V, specifying how to address the printer and how to print through the Communication interfaces, Serial TTL protocol (by default) or USB (optional). **For more information about electrical and hardware interface, please refer to the "GPR212 Technical manual".**

.4 PRINTER/RECORDER FEATURE DESCRIPTION

The printer GPR212 is a 2-inch thermal printer optimized for use as a chart recorder. It interfaces to another instrument or controller, referred to as the host, through a serial data link (USB optional).

The host controls the printer by sending commands and data. It can configure the printer by setting such parameters as printing speed, number of traces, data sample rate, and grid definition. The host sends a variety of data to the printer including text, waveforms and graphics information.

The printer processes these commands and data, and can send messages to the host when necessary. It replies to various queries from the host and also automatically generates messages both periodically and when significant changes occur.

The printer can operate in one of two modes, **printer mode** or **recorder mode**.

- **In printer mode**, it acts like a simple line printer, printing every line of text or raster graphics as it is received. This mode is also used to prepare for recorder mode. The host defines the recording page, defines waveform characteristics and sets up text strings.
- **In recorder mode** it functions as a smart chart recorder, printing waveforms, grids, rectangles, bitmaps and text. Within recorder mode it can print either *real-time* or *report* recordings. *Real-time* recording, is best for printing waveform data as it is acquired with minimal delay. *Report* recording is used to print faster or slower than real-time.

In printer mode, only text and raster graphics are printed, while **in recorder mode**, the printer GPR212 prints waveform traces, superimposed on a background page that contains grids, rectangles, bitmaps, and various text elements.

These two modes are mutually exclusive, but recorder mode must be configured while in printer mode.

Text can be printed as either simple text **in printer mode**, or as text elements **in recorder mode**. The two approaches are mutually exclusive, and generally have different applications.

Characters can be printed in either of **two font sizes**, one about **10 points** and the other about **8 points**. Characters can be rotated by 90 degrees (right) when printed.

.5 FEATURES

- **Chart print speed selectable**
1, 5, 6.25, 10, 12.5, 25, 50 (mm/s)
- **Recording Mode**
Waveform (up to 4 traces drawn with one of three selectable line width), text, Graphics
- **Programmable Grids**
Grid generation is simple and flexible.
Bitmap elements can be used for custom logos or other graphic information.
- **Print resolution**
Vertical (paper width): 8 dots/mm
Horizontal (paper feeding): print waveform mode 24 dots/mm @ 25mm/s and below,
16 dots/mm @ higher than 25 mm/s
- **Full control over printing quality/speed**
- **Two fonts size (8 points and 10 points)**
The cell size of the 8-point font is 12 pixels by 26 pixels. The cell size of the
10-point font is 16 pixels by 34 pixels.
- **Powerful text printing modes**
Horizontal, vertical, invert. Horizontal, invert. Vertical
Text elements can be defined to automatically print on each page. The text printed can
be changed between pages. Text elements can be triggered by a command or by a wavef
orm data point.
- **Powerful graphic modes**
Variable width and offset
Double and quadruple width and height
- **Bitmap graphics** can be positioned on the page in recorder mode. Bitmap elements
can be used for custom logos or other graphic information.
- **Automatic status messages**
Printer can be configured to send periodic status messages to host, verifying the printer
is operational. “Door open” and “paper out” conditions.

.6 GPR212 OPERATING STATES

The operating states of the printer are described below.

.6.1 Init

After power up or reset, the unit performs a Power On Self-Test. If a fault is detected, it will go to the Exception or Failed state. Otherwise the printer software sets up the real time kernel, initializes tasks, sets up hardware, configures the printer from stored parameters, etc., and enters either the On-line, Off-line or Exception state.

.6.2 On-Line

In this state the printer can process all commands and is able to print. When the printer first goes On-line from the Init state it is in printer mode.

.6.3 Off-Line

The printer is waiting for a recoverable error condition to be fixed (such as Door Open) and printing is inhibited. The printer can communicate with the host and process only commands that don't require printing. If it has received any commands that require printing, the printer will not be able to process them or any subsequent commands until it either returns to the On-line state, or an exception occurs. When the recoverable error condition ends, the printer returns to the On-line state.

.6.4 Exception

The printer has had a non-recoverable error. Printing is not possible, and printer only can communicate with host using a few commands, other commands are ignored. Reset or Power being cycled can make printer leave this state

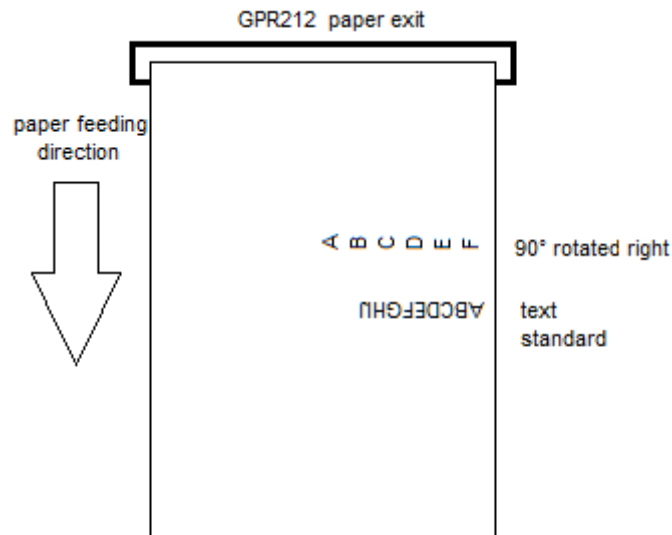
.6.5 Failed

In this state the printer has detected a fault such that it is not operational and cannot communicate with the host. The printer leaves this state only when it is reset or power is cycled.

.7 PRINTER MODE

In printer mode the host can print text simply by sending it to the printer. Each line of text is buffered and printed when a line feed is received or when the number of buffered characters exceeds the number of characters in a print line.

The host can change font size, orientation, symbol sets, etc., and can print raster graphics. **In printer mode** lines of text always run perpendicular to the direction of paper motion, but the characters themselves can be rotated 90° right.



.7.1 Graphics in Printer Mode

The printer accepts graphics in raw and compressed APS format

The printer can print graphics data sent from the host. Graphics are printed at a resolution of 8 dots/mm in both the horizontal and vertical direction.

.8 RECORDER MODE

Used for printing trace data combined with text, grid and other graphics.

.8.1 Text element

Text element is text strings (with ID number) printed while in recorder mode, which have characters, font, attributes and position on the paper.

There are two types of text elements:

- **Fixed text elements (FTEXT)** are repeated at the same position on each page. They can be used to produce the traditional “background text”.
- **Triggered text elements (TTEXT)** are printed only when triggered and can be used to produce the traditional “annotation”. TTEXTs’ contents can be changed while recording. Text elements must be defined when in printer mode, but are only printed in recorder mode. The characters within a text element are always interpreted as printable characters, never as control characters. To print a bitmap, the text element must contain only that single bitmap character code. Font size, orientation and symbol set may not be changed within a text element.

Text elements are defined in relation to the page. Cursor positioning commands are used to position text elements. It is a command error to define text elements that extend beyond the edges of a page, except for triggered text elements which may cross page boundaries. If a triggered text element extends above or below the page, only the part that is on the page is printed. This may result in partial characters.

Each time recorder mode is started, the current page position is reset to 0 before printing begins. Each page element begins printing as its position is reached.

If the printing from two or more text elements overlap, their text will be superimposed possibly resulting in unreadable lettering.

When recorder mode is stopped, all traces and page elements stop printing, the current page position is cleared, and XE50B goes into printer mode. The page elements remain in memory unless specifically cleared.

Cursor positioning commands are used to position page elements, i.e. grids, rectangles, and text elements, that will be printed in recorder mode. They have no effect on text printed in printer mode.

Text Element	ID Numbers	When printed	Crosses pages	Orientation	Position on page
FTEXT	0	Every page	No	Any	Fixed
TTEXT	128-131	Triggered by waveform or command	Yes	Horizontal and Inverted horizontal	Set by Trigger
Reserved	132-159	-	-	-	-
TTEXT	160-255	Triggered by command	Yes	Horizontal and Inverted horizontal	Set by trigger

.8.2 Traces

Printer can handle waveform data in recorder mode, which can draw traces with different line widths to help distinguish similar or overlapping waveforms.

The printer can simultaneously print up to four traces, each with its own sample rate, scaling, offset, and appearance. The printer interpolates between samples, printing at a constant 600 dots/25 mm resolution or 400 dots/25 mm at speeds over 25 mm/sec.

There are separate buffer for each waveform data, printer will stall when any waveform buffer is empty and will start working again when buffer receive more data. Printer will go to Exception state if one waveform's buffer overflows while printer is stopped waiting for other waveform data.

.8.3 Grids

Grid can be printed out in recorder mode, and defined only in printer mode. Maximum 2 grids can be printed out. In printer mode, a grid is defined by the position of its bottom edge and its height. Dot within the grid and darkness can also be defined. A grid need be defined first in print mode before using in recorder mode.

.8.4 Rectangles

Rectangles are solid boxes that can be used in recorder mode to draw event markers or timing ticks. Rectangles can extend across pages. There are two types of rectangles:

- **Repeating rectangles** are defined by their vertical position, height, width, repeat distance and darkness. They are printed regularly at the interval specified by their repeat distance. Repeating rectangles are ideal for printing the 75 mm time ticks typical of medical recordings.
- **Triggered rectangles** are defined by their vertical position, height, width and darkness. If its width is zero, the rectangle starts printing at the current position when commanded to by the host and continues until commanded to stop. If the width is non-zero, the host needs only to send a command to start printing the rectangle – it will stop automatically. These two kinds of triggered rectangles are known as variable-width and fixed-width, respectively. Fixed-width triggered rectangles are useful for event markers, while variable-width rectangles can highlight a time interval of interest.

.8.5 Page Memory

The page elements defined for recorder mode – traces, text elements, rectangles, grids and the bitmap character – use page memory within the printer. In the standard model, 4k bytes of page memory are provided. (Can be custom configured for differing amounts of page memory) Extremely complex page designs could run the risk of exceeding the amount available. The host can send a Query command to find how much page memory remains unused.

.9 CHARACTER CODES

All character codes belong to one of three categories, **normal**, **mapped** or **bitmap**, as described below:

Values	Group	Usage
0x00 – 0x09	Mapped	Characters not in current symbol sets.
0x10 – 0x1E	Reserved	None. simply ignore. not as a space
0x1F	Bitmap	Custom downloaded character, like a logo for example, (recorder mode)
0x20 – 0xFF	Normal	Letters, digits, punctuation, etc., from the selected symbol sets.

Normal characters have codes from 0x20 through 0xFF. The characters corresponding to these codes are determined by which symbol sets have been selected. Symbol sets differ in which languages they support, but ASCII is always present. The Symbol Set (Main) command specifies the characters printed for the codes 0x20 through 0x7F and 0xA0 through 0xFF, while the Symbol Set (Extra) commands applies to the codes 0x80 through 0x9F.

Mapped characters have codes from 0x00 through 0x09. Any character in any of the built - in symbol sets can be assigned to these codes. This allows printing up to ten characters that are not available in the selected symbol sets. For example, an instrument intended for use in Western Europe would select the ISO 8859 - 1 symbol set, but might need some of the special scientific symbols found only in the GSIL extended symbol set. Up to ten of these characters could be selected from the GSIL extended symbol set and assigned to the mapped characters' codes.

The bitmap character has the code 0x1F. The host defines a bitmap character's height and width, as well as its actual bitmap data. It's useful for a small logo or other custom character. Unlike normal and mapped characters, the bitmap character is only printed in the horizontal orientation, and must be the only character in a text element. The bitmap character is printed without regard to font or symbol set selection. It may be printed only in recorder mode. If the host tries to print a code which has no built - in character assigned to it, a space character is printed in its place.

.10 STATUS MESSAGES

When the printer is power-cycled or reset, it sends a Status message. In this case, the printer assumes that all conditions had been in their normal, default state just before the reset, and reports any that are not in the normal state. The message contains a reset event so that the host software knows that the changes in the rest of the message are relative to these default states.

Status messages report only changes in conditions and the occurrence of events, and are sent automatically when these changes or events occur. A Status message contains fields for all conditions that have changed or events that have occurred since the last Status message.

.10.1 Message format

Each message begins with an upper case letter that identifies its type, followed by a multi - character value and terminated by a line feed character. The value's format depends on the message type and is either a decimal number or a string of printable ASCII characters (codes 0x20 to 0x7E).

Status message begins with "S", message consists of one or more three - character fields plus a final **line feed**. Each field describes a single condition or event within the printer. A field consists of a two - letter name followed by a single decimal digit value.

.10.2 Conditions and Events description

Condition	Name	value
Door Status	DR	DR0: door closed DR1: door open
Paper Status	PR	PR0: paper okay PR1: out of paper
Mode	MD	MD0: printer mode MD1: recorder mode
State	ST	ST1: On-line ST2: Off-line
Reset	RE	RE0: power-up reset RE1: reset line (RES) asserted RE2: reset command executed
Printhead High Voltage Error	VH	VH0: $VDD \leq 15.0V$ VH1: $VDD > 15.0V$
Printhead Low Voltage Error	VL	VL0: $VDD \geq 10V$ VL1: $VDD < 10V$
Printhead Low Voltage Warning	VW	VW0: $VDD \geq 10.5V$ VW1: $VDD < 10.5V$
Printhead High Temperature Error	TE	TE0: $TPH < 72\text{ }^{\circ}C$ TE1: $TPH \geq 72\text{ }^{\circ}C$
Printhead High Temperature Warning	TH	TH0: $TPH < 70\text{ }^{\circ}C$ TH1: $TPH \geq 70\text{ }^{\circ}C$
Printhead Low Temperature Warning	TL	TL0: $TPH \geq 0^{\circ}C$ TL1: $TPH < 0^{\circ}C$
Command Error	CE	CE0: invalid syntax CE1: bad parameter (value, type, etc.) CE2: illegal in current mode CE3: out of page memory or font memory CE4: trace tag triggered undefined TTEXT
Communications Error	CM	CM0: framing error CM1: receiver overrun CM2: receive buffer overflow
Trace Data Stall	TD	TD0: printer is not stalled on trace data TD1: printer stalled on trace data

.10.3 Examples

In Hex:

53 52 45 31 53 54 31 0A

In ascii:

S R E 1 S T 1

If entering recorder mode, printer should send:

SMD1

If printer transfer from recorder mode to print mode

SMD0

Printer at first power on, has no self-test failures and is ready to print, it will send :

SRE0ST1

If the printer door was open when powering up, it would send: SRE0DR1PR1ST2

If the door was closed by operator: SDR0PR0ST1

If print head Voltage higher than 15v, printer shall send : SVH1

If print head Voltage returns back within 15v($\leq 15v$) , printer shall send :SVH0

.10.4 Default GPR212 configuration

The default printer configuration is loaded after power on or reset. Most of these parameters may be changed using device configuration commands, but will revert to the default settings at the next reset or power up.

The power on configuration contains the following parameters with the default values in parenthesis:

- paper speed (50 mm/s in printer mode, 25 mm/s in recorder mode)
- page size (0 pixels)
- symbol sets (main and extra) (main: ISO 8859-1, extra: GSIL basic symbols)
- mapped characters (none assigned)
- dot energy (1.0)

.11 OPERATING CONTROL CODES SUMMARY

.11.1 Std. Control codes in alphabetical order

Command	Description	Valid in Printer or Recorder mode	Affects Printer or Recorder mode	Page
CR	Print and carriage return	P	P	22
ESC Space n1	Set Character Spacing	P	P	
ESC ! a n1 B	Echo data	P/R	P/R	21
ESC ! c n1 C	Select TEXT ID	P/R	R	32
ESC ! c n1 D <data..>	Define TEXT	P/R	R	32
ESC ! d 0 B	Clear page	P	R	31
ESC ! d n1 L	Page size	R	R	32
ESC ! g 0 S	Standard Grid	P	R	35
ESC ! g n1 D	Grid Horizontal Dot Repeat	P	R	35
ESC ! g n1 H	Grid Height	P	R	34
ESC ! g n1 I	Grid Interior Darkness	P/R	R	35
ESC ! g n1 L	Grid Horizontal Line Spacing	P	R	34
ESC ! g n1 P	Grid Vertical Dot Repeat	P	R	35
ESC ! g n1 S	Select Grid	P/R	R	34
ESC ! g n1 T	Grid Top/Bottom Darkness	P/R	R	35
ESC ! g n1 V	Grid Vertical Line Spacing	P	R	34
ESC ! j n1 B	Trigger TTEXT	R	R	33
ESC ! k n1 A	Set Printing Intensity	P	P/R	18
ESC ! k n1 D	Select Font	P	P/R	22
ESC ! k n1 F	Line Spacing	P	P	23
ESC ! k n1 H	Stop recorder mode	P/R	R	31
ESC ! k n1 M	Set paper printing speed	P	P/R	18
ESC ! k n1 O	Font Orientation	P	P/R	23
ESC ! k n1 S	Start recorder mode	P	R	30
ESC ! r n1 G<data>	Print raster graphic	P	P	29
ESC ! r n1 V	TTEXT Vertical position	P/R	R	33
ESC ! s n1 A	Assign Character	P	P/R	23
ESC ! s n1 C	Select Character	P	P/R	23
ESC ! s n1 E	Symbol Set (Extra)	P	P/R	24
ESC ! s n1 M	Symbol Set (Main)	P	P/R	25
ESC ! w n1 C	Trace Scaling	P	R	37
ESC ! w n1 E	Control Trace	P	R	36
ESC ! w n1 I	Trace Weight	P	R	36
ESC ! w n1 O	Trace Offset	P	R	36

ESC ! w n1 P	Trace Phase Offset	P	R	37
ESC ! w n1 R	Trace Sample Frequency	P	R	37
ESC ! w n1 S	Select Trace	P	R	36
ESC * p #X	Cursor Positioning (X)	P	R	33
ESC * p #Y	Cursor Positioning (Y)	P	R	33
ESC 2 n1	Set line pre-spacing	P	P	26
ESC @	Reset printer	P	P	18
ESC b n1	Set normal/inverse video mode	P	P	27
ESC c n1	Set maximum number of columns	P	P	27
ESC C n1	Set text justification	P	P	27
ESC d	Recover factory setup parameters	P	P/R	19
ESC GS M	Enter Bootloader mode	P	P	19
ESC GS T n1	Print a self-test ticket	P	P	19
ESC I	Send printer identity	P	P	20
ESC j n1	Feed paper backward (n dot lines)	P	P	27
ESC J n1	Feed paper forward (n dot lines)	P	P	28
ESC s	Save in flash setup parameters	P	P/R	20
ESC v	Send printer status (short)	P	P	22
GS n1 <data>	Waveform data	R	R	37
HT	Horizontal tab	P	P	28
LF	Print and line feed	P	P	28

.11.2 Control codes grouped by functionality

The following sections split the various commands in different categories.

.11.2.1 Printer configuration commands

Command	Description	Valid in Printer or Recorder mode	Affects Printer or Recorder mode	Page
ESC ! k n1 M	Set Paper printing speed	P	P/R	18
ESC @	Reset printer	P	P	18
ESC d	Recover factory setup parameters	P	P/R	19
ESC GS M	Enter Bootloader mode	P	P	19
ESC GS T	Print a self-test ticket	P	P	19
ESC I	Send printer identity	P	P	20
ESC s	Save in flash setup parameters	P	P/R	20
GS / n1	Set Maximum peak current via dynamic division	P	P/R	Erreur ! Signal non défini.
GS B n1	Set serial communication settings	P	P/R	20
ESC ! k n1 A	Set printing intensity	P	P/R	18

.11.2.2 Printer status commands

Command	Description	Valid in Printer or Recorder mode	Affects Printer or Recorder mode	Page
ESC ! a n1 B	Echo data	P/R	P/R	16
ESC v	Send printer status (short)	P	P	20

.11.2.3 Text printing commands

Command	Description	Valid in Printer or Recorder mode	Affects Printer or Recorder mode	Page
CR	Print and carriage return	P	P	22
ESC ! k n1 D	Select Font	P	P/R	22
ESC ! k n1 F	Line Size (from Font)	P	P	23
ESC ! k n1 O	Font Orientation	P	P/R	23
ESC ! s n1 A	Assign Character	P	P/R	23
ESC ! s n1 C	Select Character	P	P/R	23

ESC ! s n1 E	Symbol Set (Extra)	P	P/R	24
ESC ! s n1 M	Symbol Set (Main)	P	P/R	25
ESC 2 n1	Set line pre-spacing	P	P	26
ESC b n1	Set normal/inverse video mode	P	P	27
ESC c n1	Set maximum number of characters	P	P	27
ESC C n1	Set text justification	P	P	27
ESC j n1	Feed paper backward (n1 dot lines)	P	P	27
ESC J n1	Feed paper forward (n1 dot lines)	P	P	28
HT	Horizontal tab	P	P	28
LF	Print and line feed	P	P	28

Table 1: Text printing command set.

.11.2.4 Graphics printing commands

Command	Description	Valid in Printer or Recorder mode	Affects Printer or Recorder mode	Page
ESC ! r n1 G <data..>	Print raster graphic	P	P	29

Table 2: Graphics printing command set.

.11.2.5 Recorder mode commands

Command	Description	Valid in Printer or Recorder mode	Affects Printer or Recorder mode	Page
ESC ! k n1 S	Start recorder mode	P	R	30
ESC ! k n1 H	Stop recorder mode	P/R	R	31
ESC ! d 0 B	Clear page	P	R	31
ESC ! d n1 L	Page size	R	R	32
ESC ! c n1 C	Select TEXT ID	P/R	R	32
ESC ! c n1 D <data..>	Define TEXT	P/R	R	32
ESC ! j n1 B	Trigger TTEXT	R	R	33
ESC ! r n1 V	TTEXT Vertical position	P/R	R	33
ESC * p n1 X	Cursor Positioning (X)	P	R	33
ESC * p n1 Y	Cursor Positioning (Y)	P	R	33

.11.2.6 Traces / Grids commands

Command	Description	Valid in Printer or Recorder mode	Affects Printer or Recorder mode	Page
ESC ! g n1 S	Select Grid	P/R	R	34
ESC ! g n1 H	Grid Height	P	R	34



ESC ! g n1 L	Grid Horizontal Line Spacing	P	R	34
ESC ! g n1 V	Grid Vertical Line Spacing	P	R	34
ESC ! g n1 D	Grid Horizontal Dot Repeat	P	R	35
ESC ! g n1 P	Grid Vertical Dot Repeat	P	R	35
ESC ! g n1 T	Grid Top/Bottom Darkness	P/R	R	35
ESC ! g n1 I	Grid Interior Darkness	P/R	R	35
ESC ! g 0 S	Standard Grid	P	R	35
ESC ! w n1 S	Select Trace	P	R	36
ESC ! w n1 E	Control Trace	P	R	36
ESC ! w n1 O	Trace Offset	P	R	36
ESC ! w n1 I	Trace Weight	P	R	36
ESC ! w n1 C	Trace Scaling	P	R	37
ESC ! w n1 P	Trace Phase Offset	P	R	37
ESC ! w n1 R	Trace Sample frequency	P	R	37
GS n1 <data>	Waveform data	R	R	37

.12 OPERATING CONTROL CODES DESCRIPTIONS

.12.1 Printer configuration commands description

ESC ! k n1 A

Description: Set printing intensity.

Format: <1Bh> <21h> <6Bh> <n1><41h>

Comments: n1=80h (128d): nominal printing intensity (default value).
 n1>80h (128d): printout becomes darker (until n1 = FFh: +60% intensity).
 n1<80h (128d): printout becomes lighter (until n1 = 00h: -60% intensity).

ESC ! k n1 M

Description: Set paper printing speed.

Format: <1Bh> <21h> <6Bh> <n1><4Dh>

Comments: This control code is used to adjust the printing speed.

Values can be:

1.0 mm/sec	5.0 mm/sec
6.25 mm/sec	10.0 mm/sec
12.5 mm/sec	25 mm/sec
50 mm/sec.	

Default: 25 mm/sec.

Example: (ESC! k50.0M) => printing speed => 50.0 mm/sec

ESC @

Description: Reset printer.

Format: <1Bh> <40h>

Comments: This request performs an hardware reset of the printer. A hardware reset is the equivalent of a power cycle. After issuing this command, the printer will disconnect from the HOST then reconnect, just like during power cycles. The printer will wake up in default state will all parameters reset to their default values. Internal buffers are cleared.

ESC d

Description: Recover factory setup parameters.

Format: <1Bh> <64h>

Comments: Put all setup parameters to their factory default values. This updating is temporary. Indeed, if printer is reset or power is cycled, setup parameters will be initialized with the last set saved in flash (with “ESC s”). If you want to permanently set the parameters to their factory default values, you must send an “ESC d” “ESC s” sequence. Combining the use of this command and the “Reset printer” one enables you to compare the effects of the new saved values with default ones without altering them.

Printer returns 0x01 when recovering is done. It is advised for host to wait for this acknowledgement before resuming printing operations so as to be sure to work with coherent parameters. As above, timeout value is function of action in progress when request has been sent.

Note: be careful regarding possible change of RS232 baudrate. Indeed, after sending this request, host should quickly update its baudrate too in order to be able to receive printer acknowledgement. Basically, it is advised to keep baudrate constant between default and new parameters values.

ESC GS M

Description: Enter Bootloader mode.

Format: <1Bh> <1Dh><4Dh>

Comments: The host application sends this sequence to switch the printer in bootloader mode. The command is issued by the flashing utility application prior firmware update.

ESC GS T n1

Description: Print a self-test ticket.

Format: <1Bh> <1Dh><54> <n1>

Comments: Printer will print a different types of self-test tickets. If n1=0 the self-test ticket is same as printed with <ON/OFF> + 2 x <PF>key combination. If n=1 the self-test ticket is as the periodic one.

ESC I

Description: Send printer identity.
Format: <1Bh> <49h>
Comments: Printer returns an ASCII string ended by zero (00h) that reflects the printer identity.
 The string is formed by the concatenation of printer mechanism name and firmware revision, as below: (for example)

GPR212 0.09

ESC s

Description: Save in flash setup parameters.
Format: <1Bh> <73h>
Comments: Setup parameters are saved in the internal flash memory of controller. Therefore, they are not lost when power is removed or printer is reset, and are recovered at each power-on/reset.

Printer returns 1 byte representing the status of this request:

- 0x01: saving successful,
- 0x00: saving failure.

Saving can take more or less time in function of action in progress. During saving, communication is not guarantee (risk of loss of data in RS232) because flashing operation cannot be performed simultaneously with normal operating function. So it is advised for host to wait for printer return status with a sufficient timeout before resuming communication (100ms minimum, more if printing operation was in progress when request has been sent).

GS B n1

Description: Set serial communication settings.
Format: <1Dh> <42h> <n1>
Comments: Sets serial communication speed and handshaking mode.

Bit 7: b7 = 0: "Xon/Xoff" handshaking mode (software control),
 b7 = 1: "RTS or CTS" handshaking mode (hardware control).
Bits 6, 5, 4: not used.
Bits 3, 2, 1, 0: speed.

b3b2b1b0	Speed (bauds)
0000	1200
0001	2400
0010	4800
0011	9600
0100	19200

0101	38400
0110	57600
0111	115200
1000	230400
1001	460800
1010	921600

Table 3: Bauds rate table.

Default: n = 87h : “RTS or CTS” handshaking mode, 115200 bauds, 8 bits of data, no parity bit, 1 stop bit.

Note : this command is not activated, only default mode is allowed

.12.2 Printer status commands description

ESC ! a n1 B

Description: echo data

Format: <1Bh> <21h> <61h><n1> <42h>

Comments: n1: 0 to 4294967295 (any 32-bit unsigned number) = number to echo

The printer sends a message back to the host containing the numeric value sent with this command. The format of the reply is given bellow.

Format: E + number

Example:

Host send : ESC!a0B

Printer Reply: E0

Host send: ESC!a4294967295B

This command can be used by the host to synchronize with the printer command execution.

ESC v

Description: Send printer status (short).

Format: <1Bh> <76h>

Comments: Printer returns a single byte that reflects its status in accordance with the following table:

Bit	Description	Bit = 0	Bit = 1
0	Head temperature	OK	Too high or too low
1	Head-up/door opened	OK	The Heap is UP
2	End of Paper	OK	End of paper is reach
3	Power supply	OK	Too high or too low
4	Printer in use	OK	Action in progress
5			
6			
7			

Table 4: This is a real time request.

.12.3 Text printing commands description

CR

Description: Do a carriage return.

Format: <0Dh>

Comments: This command is ignored. To go to the next line and/or to print the current text line, use the LF command instead.

ESC ! k n1 D

Description: Select Font.

Format: <1Bh> <21h> <6Bh><n1> <44h>

Comments: (default value is 0)

1 = 8 point font, 0 = 10 point font

This command selects the font size. The cell size of the 8-point font is 12 pixels by 26 pixels. The cell size of the 10-point font is 16 pixels by 34 pixels.

For printing text in printer mode, different font sizes cannot be combined within a single line. When the Select Font command changes the font size, any characters that have been received but not yet printed will print just as though a Line Feed command had been sent. If the new size is the same as the current size, or if there are no characters waiting to print, the printer will not perform a Line Feed.

ESC ! k n1 F

Description: Line Size (from Font).
 Format: <1Bh> <21h> <6Bh><n1> <46>
 Comments: n1: (default value is 3: adds no space)
 0 = normal (adds 50% of current font dimension)
 1 = expanded (adds 75% of current font dimension)
 2 = condensed (adds 25% of current font dimension)

This command sets the Line Size variable, which controls the amount of blank space inserted between lines of printer-mode text, in terms of the current font size and orientation. For vertical font orientations (normal and inverted), the Line Size is relative to the height of the current font. For horizontal font orientations (normal and inverted), the Line Size is relative to the width of the current font. After this command the current active position is defined as being at the top of a line of the specified size.

The normal, expanded and condensed choices vary the spacing between lines in the direction parallel to the edge of the paper.

ESC ! k n1 O

Description: Font Orientation.
 Format: <1Bh> <21h> <6Bh><n1> <4Fh>
 Comments: 0 : vertical (portrait), (default value)
 1 : horizontal (landscape)
 2: inverted vertical
 3 : inverted horizontal

ESC ! s n1 A

Description: Assign Character.
 Format: <1Bh> <21h> <73h><n1> <41h>
 Comments: n1: 32 to 255 = character in symbol set to assign to the current mapped character code (default value is none assigned)

This command assigns the specified character to the previously selected mapped character code. The command value specifies a character in the current symbol set.

ESC ! s n1 C

Description: Select Character.
 Format: <1Bh> <21h> <73h><n1> <43h>
 Comments: n1: 0 to 9 = mapped character code

This command sets the current **mapped character** code. It is normally followed by an Assign Character command which assigns (or “maps”) a specific character from the current symbol set to the code specified by this command.

ESC ! s n1 E

Description: Symbol Set (Extra).

Format: <1Bh> <21h> <73h><n1> <45h>

Comments: n1: (default value is 0)

- 0 = GSIL basic symbols - (medical and scientific)
- 1 = MS cp1252_WinLatin1 (only codes 0x80 through 0x9F)
- 2 = MS cp1250_WinLatin2 (only codes 0x80 through 0x9F)
- 3 = MS cp1257_WinBaltic (only codes 0x80 through 0x9F)
- 4 = MS cp1254_WinTurkish (only codes 0x80 through 0x9F)
- 5 = Not used
- 6 to 15 = Not used

This command selects the symbol set for the 32 character codes in the range 0x80 through 0x9F.

The GSIL basic symbol set is listed in Table below:

Code		Description	Code		Description
0x80	(Superscript left parenthesis	0x90	▸	solid right-pointing triangle
0x81)	Superscript right parenthesis	0x91	◀	solid left-pointing triangle
0x82	–	Minus	0x92	▼	solid down-pointing triangle
0x83	±	Minus Plus	0x93	▲	solid-up pointing triangle
0x84	≥	greater-than or equal to	0x94	↓	down arrow
0x85	≤	less-than or equal to	0x95	←	left arrow
0x86	≈	approximately equal to	0x96	→	right arrow
0x87	≠	not equal to	0x97	↑	up arrow
0x88	≡	identical to	0x98	↕	up down arrow
0x89	√	square root	0x99	↔	left right arrow
0x8A	∞	infinity	0x9A	♥	solid heart
0x8B	∫	integral	0x9B	!!	double exclamation
0x8C	♪	single note	0x9C	€	euro-currency sign
0x8D		double note	0x9D	₣	french franc sign
0x8E	♂	male sign	0x9E	°	Degree
0x8F	♀	female sign	0x9F	□	open rectangle

ESC ! s n1 M

Description: Symbol Set (Main).

Format: <1Bh> <21h> <73h><n1> <4dh>

Comments: n1: (default value is 1)

0 = GSIL extended symbols (scientific, etc.)

1 = ISO 8859-1 - Latin alphabet No. 1 (Danish, Dutch, English, Faeroese, Finnish, French, German, Icelandic, Irish, Italian, Norwegian, Portuguese, Spanish and Swedish)

2 = ISO 8859-2 - Latin alphabet No. 2 (Albanian, Czech, English, German, Hungarian, Polish, Rumanian, Serbo-Croatian, Slovak and Slovene)

3 = ISO 8859-3 - Latin alphabet No. 3 (Afrikaans, Catalan, Dutch, English, Esperanto, German, Italian, Maltese, Spanish and Turkish)

4 = ISO 8859-4 - Latin alphabet No. 4 (Danish, English, Estonian, Finnish, German, Greenlandic,

Lappish, Latvian, Lithuanian, Swedish and Norwegian)

5 = ISO 8859-9 - Latin alphabet No. 5 (Danish, Dutch, English, Finnish, French, German, Irish, Italian, Norwegian, Portuguese, Spanish, Swedish and Turkish)

6 to 15 = Not used

The **Symbol Set (Main)** command specifies the characters printed for the codes 0x20 through 0x7F and 0xA0 through 0xFF, while the **Symbol Set (Extra)** commands applies to the codes 0x80 through 0x9F.

This command selects the symbol set for the 192 character codes in the ranges 0x20 through 0x7F and 0xA0 through 0xFF.

ISO symbol sets are defined by the following parts of International Standard ISO 8859, distributed in the United States by the American National Standards Institute (ANSI):

Part 1: Latin alphabet No. 1, 1st ed., 1987, ref. no. ISO 8859-1:1987 (E)

Part 2: Latin alphabet No. 2, 1st ed., 1987, ref. no. ISO 8859-2:1987 (E)

Part 3: Latin alphabet No. 3, 1st ed., 1988, ref. no. ISO 8859-3:1988 (E)

Part 4: Latin alphabet No. 4, 1st ed., 1988, ref. no. ISO 8859-4:1988 (E)

Part 9: Latin alphabet No. 5, 1st ed., 1989, ref. no. ISO/IEC 8859-9:1989 (E)

The GSIL extended symbol set is listed in Table below:

Code		Description	Code		Description
0xA0	Γ	Greek capital letter Gamma	0xAB	θ	Greek small letter Theta
0xA1	Δ	Greek capital letter Delta	0xAC	μ	Greek small letter Mu
0xA2	Θ	Greek capital letter Theta	0xAD	π	Greek small letter Pi
0xA3	Σ	Greek capital letter Sigma	0xAE	σ	Greek small letter Sigma
0xA4	Φ	Greek capital letter Phi	0xAF	τ	Greek small letter Tau
0xA5	Ω	Greek capital letter Omega	0xB0	φ	Greek small letter Phi
0xA6	α	Greek small letter Alpha	0xB1	Σ	N-ary summation
0xA7	β	Greek small letter Beta	0xB2	Π	N-ary product
0xA8	δ	Greek small letter Delta	0xB3	∈	Element of
0xA9	ε	Greek small letter Epsilon	0xB4	◇	Open diamond
0xAA	η	Greek small letter Eta	0xB5	□	Open rectangle

ESC 2 n1

Description: Set line pre-spacing.

Format: <1Bh> <32h> <n>

Comments: Set the number of dot lines to insert before starting actually character dot lines. This is very useful when printing in inverse video mode some characters which pixels start from first dot line.
n may vary from 0 to 15 dot lines. Line pre-spacing pitch is 1/8mm.

Default: 0.

CAUTION: actual line pre-spacing is calculated from this user value n and updated proportionally in function of current height mode (simple (n*1), double (n*2), quadruple (n*4)).

ESC b n1

Description: Set normal/inverse video mode.

Format: <1Bh> <62h> <n1>

Comments: n1 = 0: normal video mode,
n1 = 1: inverse video mode.

Default: normal video.

Note: this setting is valid for the whole printing text line. Spaces at the beginning of a text line will be printed as a dark rectangle. In order to shift the black printing from the left margin, one can send TAB (ASCII 0x09) instead SP (ASCII 0x20). This enables an accurate control of white/black edges.

ESC c n1

Description: Set maximum number of columns.

Format: <1Bh> <63h> <n>

Comments: Set the maximum number of printable characters that printer accepts in a same text line before automatically going to the next text line.
n may vary from 3 to 255.

Default: 255.

ESC C n1

Description: Set text justification.

Format: <1Bh> <43h> <n1>

Comments: Set how text will be justified:
n1 = 0: text will be centred,
n1 = 1: text will be right justified,
n1 = 2: text will be left justified.

Default: left justification.

ESC j n1

Description: Feed paper backward (n1 dot lines).

Format: <1Bh> <6Ah> <n1>

Comments: n may vary from 1 to 255.

Paper is fed backward for n dot lines. Print position is set to the beginning of the next dot line.

ESC J n1

Description: Feed paper forward (n1 dot lines).

Format: <1Bh> <4Ah> <n1>

Comments: n1 may vary from 1 to 255.

Paper is fed forward for n1 dot lines. Print position is reset to the beginning of the next dot line.

HT

Description

Format: <09h>

This command jumps to the next tab position.

LF

Description: Do a text line feed.

Format: <0Ah>

Comments: Move the print position to the beginning of the next text line and print the previous text line is.

.12.4 Std. Graphics printing commands description

.12.4.1 *Important notes for graphics:*

- It is advised when graphic printing is required with **RS232** line to set up communication speed at its maximum value (115200 bauds). Indeed, because there is a lot of data to transmit to printer, communication speed is then the main limitation factor on resulted printing speed. In addition, when user maximum printing speed is too high in comparison with RS232 communication speed and graphic features (width, zoom), it may cause some “stop&go” events which affects printing quality. To avoid this bad behaviour, firmware limits automatically and temporary maximum printing speed in function of all these previous parameters (=> lower but constant printing speed without “stop&go” event, better printing quality). However, this automatically setting is performed only in full mode. In line mode, user should set himself the right setting.

.12.4.2 *Commands:*

ESC ! r n1 G <data,...>

Description: Print Raster Graphics

Format: <1Bh> <21h> <72h><n1> <47h><data,...>

Comments: n1: 0 to 72 = number of bytes of binary raster data to follow
<data, ...> = raster graphics binary data

This command prints a single stripe of raster graphics data at the current print position, and then advances the current print position by one pixel.

The raster graphics resolution is fixed at one pixel horizontally and vertically.

The first byte of decoded raster data is located at the left end of the text print area, which contains text column 0. The least significant bit of a byte is drawn next to the most significant bit of the next byte.

.12.5 Recorder mode commands

.12.5.1 Recorder mode , waveform printing commands description

Text element is used to print text in recorder mode, which contain characters , attributes and position on the page.

Text elements must be defined when in printer mode, but are only printed in recorder mode.

ESC ! k n1 S

Description: Start recorder mode.

Format: <1Bh> <21h> <6Bh><n1> <53h>

Comments: n1:

0 = real-time recording

1 = report recording

Starts printing in recorder mode. Printing starts only when the recorder has received enough data to begin drawing all enabled traces. Note that the recorder must already have been configured to specify page size, print speed, grids, trace scaling and appearance..etc.

If any text sent in printer mode remains to be printed when the Start Recording command is executed, the printer will execute a line feed. This prints the text before entering recorder mode.

If mode reporting is enabled, the printer will send a Status message with the proper “MD” field value when it enters recorder mode. If mode reporting is disabled, an Echo Data command may be sent after the Start Recording command.

Each time the Start Recording command is issued, the page position is reset, and recording begins at the start of the page.

Real-time recording is intended for recording trace data in real-time. Printing speed is set by the Paper Speed command, and the spacing of trace samples on the time axis is computed from paper speed divided by sample frequency. After recording starts the host should send each enabled trace’s samples at the frequency specified.

Report recording is useful for printing either faster or slower than real-time. Trace Sample Frequency values combined with the value set by the Time Axis Scale command determine the time-axis (horizontal) scaling of trace data. While printing the host must be able to transfer samples to the recorder at the rate specified by the Sample Throughput command. The recorder will print at the highest speed it can support without requiring samples from the host at a rate exceeding its sample throughput or exceeding its maximum print speed. The maximum print speed is 50 mm/sec when peak current limiting is disabled, and substantially slower if it has been enabled.

Both the Sample Throughput and Time Axis Scale values must be specified before starting a report recording. Otherwise, the Start Recording command will generate a command error.

The unit remains in recorder mode until a Stop Recording or Reset command is received.

ESC ! k n1 H

Description: Stop recorder mode.

Format: <1Bh> <21h> <6Bh><n1> <48h>

Comments: n1:

- 0 = immediate stop
- 1 = buffered stop
- 2 = end of page stop

Stops printing in recorder mode and returns to printer mode. If already in printer mode the command has no effect.

After a buffered or end of page Stop Recording command, recorder mode printing continues until the stopping conditions have been met. No host commands are processed while waiting for the stopping conditions. The commands following the Stop Recording command are interpreted in printer mode. printer will remain in printer mode until it receives Start Recording command. If mode reporting is enabled, the printer will send a Status message with the proper "MD" field value when it actually stops recording.

If mode change reporting is disabled, an Echo Data command may be sent after the Stop Recording command. The printer will reply to the Echo Data command only after recording has stopped.

An immediate Stop Recording command ceases recording at once. Any remaining trace data, TTEXT triggers and triggered rectangles are cleared.

A buffered Stop Recording command continues until at least one enabled trace buffer is empty, then executes an immediate stop. If no traces are enabled, it executes an immediate stop at once.

An end of page Stop Recording command waits until at least one enabled trace buffer is empty (if any traces are enabled). After that, no more traces are drawn but all other text and graphic elements on the page are printed. Printing continues through the end of the page in which the traces ended, then it executes an immediate stop. If this command is received when the printer is stalled before the first stripe of a page is printed, it is equivalent to an immediate Stop Recording command.

If the printer has been temporarily paused due to a Pause Recording command, both buffered and end of page are equivalent to an immediate Stop Recording command

ESC ! d 0 B

Description: Clear page

Format: <1Bh> <21h> <64h><30h> <42h>

Comments: This command deletes all configured elements of a page (reverts to default values*); this includes all traces, text elements, the bitmap character, grids, and rectangles. This frees up the memory allocated for these page elements so a new page can be configured.

Sending this command when no elements are defined has no effect.

*10 points Font size, vertical orientation and x,y pixel position (0,0)

ESC ! d n1 L

Description: Page size

Format: <1Bh> <21h> <64h><n1> <4Ch>

Comments: n1 : [80, 2400] pixels

This command defines the size of a logical page in pixels, ranging from 80 to 2400 pixels (10 to 300 mm), and refers to the dimension in the direction of paper movement. The Page Size command defines the size of the recorder-mode logical page. This controls the way in which the various page elements (grids, text, and rectangles) are laid out, and the distance at which these elements repeat. If the page size differs from that currently defined, the printer executes the Clear Page command.

The Page Size command also determines the size of the printer-mode logical page, controlling how far paper will advance when a Form Feed is received in printer mode. A new printer-mode logical page is begun, starting from the current print position, when Page Size is re-defined.

ESC ! c n1 C

Description: Select TEXT ID.

Format: <1Bh> <21h> <63h><n1> <43h>

Comments: (n1: 0 to 255)

0: fixed text element (FTEXT)

128~131: host or waveform triggered TTEXT

160~255: host triggered TTEXT

Other value will be command error.

This cmd select text element , which will be used in following cmd.

Valid in both printer & recorder mode , and affect operations in recorder mode.

ESC ! c n1 D <data..>

Description: Define TEXT.

Format: <1Bh> <21h> <63h><n1> <44h><data>

Comments: (n1: nbr of characters ...)

n1 : 0~255 the number of bytes of character data following the command

<data, ...> contains one or more character code bytes. Must *not* have a terminating null

This command define a text element selected before (Select TEXT ID), each character in the text element is printed using the current font size, symbol set, and orientation. For FTEXTS the cursor position is advanced accordingly to point just past the end of the text. It is a command error to define a FTEXT element that extends beyond the edges of the page.

Valid in both printer & recorder mode , and affect operations in recorder mode.

Example: **ESC! c 0 c 11H D Speed : 25 mm/sec**

Is defining FTEXT as “Speed : 25 mm/sec” (in concatenate mode, c 0 to select FTEXT then c 11H D to define the text with 17 characters.

ESC ! j n1 B

Description: Trigger TTEXT
 Format: <1Bh> <21h> <6ah><n1> <42h>
 Comments: n1: [128 through 131], [160 through 255] = ID of TTEXT to print

This command prints TTEXT starting at current horizontal position. A TTEXT element may not be triggered again until it has finished printing. A second Trigger TTEXT command is ignored. The vertical position may either be absolute or relative to a trace position. If the TTEXT has an associated trace and a previous TTEXT Vertical Position command set its vertical offset, then its position is computed by adding the offset to the trace position. Otherwise the TTEXT position is absolute and equals the cursor position when it was defined or as later modified by an absolute TTEXT Vertical Position command.

ESC ! r n1 V

Description: TTEXT Vertical position
 Format: <1Bh> <21h> <72h><n1> <56>
 Comments: n1: [0, 383] pixels absolute, w/sign [-383, +383] pixels relative.

This command specifies the vertical position of the currently selected TTEXT.

Cursor positioning commands refer to the lower left corner of the character cell. From there, the text element is printed in normal left - to - right order.

ESC * p n1 X

Description: Cursor Positioning (X)
 Format: <1Bh> <2Ah> <70h><n1> <58h>
 Comments: n1 : [0, 2399] pixels absolute, w/sign [-2399, +2399] pixels relative.

This command moves the current cursor position horizontally by pixels

ESC * p n1 Y

Description: Cursor Positioning (Y)
 Format: <1Bh> <2Ah> <70h><n1> <59h>
 Comments: n1: [0, 383] pixels absolute, w/sign [-383, +383] pixels relative.

This command moves the current cursor position vertically by pixels

.12.5.2 Control sequences for Grid

ESC ! g n1 S

Description: Select Grid

Format: <1Bh> <21h> <67h><n1> <53h>

Comments: n1: [0, 255] Grid ID

This command selects a grid for use by other Grid commands, if the Grid doesn't exist, a new grid is defined whose bottom edge is set at the current cursor vertical position.

ESC ! g n1 H

Description: Grid Height

Format: <1Bh> <21h> <67h><n1> <48h>

Comments: n1: [40, 384] pixels (default value :40)

This command defines the height in pixels of the selected grid. The grid area extends upward from the current cursor position. The current cursor position is not affected by this command. It is a command error to define a grid that extends beyond the top edge of the page.

ESC ! g n1 L

Description: Grid Horizontal Line Spacing

Format: <1Bh> <21h> <67h><n1> <4Ch>

Comments: n1: 0 or [8, 383] Pixels, (0 = off)

This command sets the spacing between the interior horizontal grid lines in pixels. A value equal to zero will suppress printing the lines, and a value that is greater than or equal to the grid height is a command error. The lines are drawn starting from the bottom of the grid

ESC ! g n1 V

Description: Grid Vertical Line Spacing

Format: <1Bh> <21h> <67h><n1> <56h>

Comments: n1: 0 or [8, 2399] Pixels, 0 = off

This command sets the spacing between vertical grid lines in pixels. A value equal to zero will suppress printing the lines, and a value that is greater than or equal to the page size is a command error. The first vertical line will be drawn at the start of the recording.

ESC ! g n1 D

Description: Grid Horizontal Dot Repeat
 Format: <1Bh> <21h> <67h><n1> <44h>
 Comments: n1: [0, 2399] dots between v lines, 0 = off

This command sets the number of dots to be placed evenly between successive vertical grid lines. A value of zero in either this command or in the Grid Vertical Dot Repeat command will suppress printing the dots. A value that is greater than or equal to Grid Vertical Line Spacing will cause a command error

ESC ! g n1 P

Description: Grid Vertical Dot Repeat
 Format: <1Bh> <21h> <67h><n1> <50h>
 Comments: n1: [0, 383] dots between h lines, 0 = off

This command sets the number of dots to be placed evenly between successive horizontal grid lines. A value of zero in either this command or in the Grid Horizontal Dot Repeat command will suppress printing the dots. A value that is greater than or equal to Grid Horizontal Line Spacing will cause a command error.

ESC ! g n1 T

Description: Grid Top/Bottom Darkness
 Format: <1Bh> <21h> <67h><n1> <54h>
 Comments: n1: 0 : off, 3: normal,
 Default : normal

This command defines the darkness of the top and bottom horizontal lines of the selected grid.
Note : only Normal level is implemented

ESC ! g n1 I

Description: Grid Interior Darkness
 Format: <1Bh> <21h> <67h><n1> <49h>
 Comments: n1: 0 : off, 3: normal,

This command defines the darkness of the interior horizontal lines and dots of the selected grid.
Note : only Normal level is implemented

ESC ! g 0 S

Description: Standard Grid
 Format: <1Bh> <21h> <67h><30h> <53h>
 Comments: standard

This command defines a standard grid (with ID=0) that can be used in many applications, with the following configuration:

select grid ID 0
 set grids height in pixel = 320
 Grid Horizontal Line Spacing = 40 pixels
 Grid Vertical Line Spacing = 40 pixels
 Horizontal Dot Repeat in single grid = 4
 Grid Vertical Dot Repeat in single grid = 4
 Grid Interior Darkness = normal
 Grid Top/Bottom Darkness = normal

Here is below the equivalent with the commands to set this grid:

ESC ! g 0 s 3 2 0 h 4 0 1 4 0 v 4 d 4 p 3 t 3 I

.12.5.3 Control sequences for Traces

ESC ! w n1 S

Description: Select Trace
 Format: <1Bh> <21h> <77h><n1> <53h>
 Comments: n1: [0,3] trace ID

ESC ! w n1 E

Description: Control Trace
 Format: <1Bh> <21h> <77h><n1> <45h>
 Comments: n1: Boolean (0: disable trace)

This command enables or disables the selected waveform. An enabled waveform will print a trace in Recorder mode. Waveform must be enabled before sending data.

ESC ! w n1 O

Description: Trace Offset
 Format: <1Bh> <21h> <77h><n1> <4Fh>
 Comments: n1: [-16384, +16384] waveform units (default value: 0)

This value is added to the 14 bit unsigned binary waveform data for the selected waveform before

ESC ! w n1 I

Description: Trace Weight
 Format: <1Bh> <21h> <77h><n1> <49h>
 Comments: 0: thin, 1 : standard, 2 : thick (default value: standard)

This command sets the line thickness used to draw the selected trace.

ESC ! w n1 C

Description: Trace Scaling
 Format: <1Bh> <21h> <77h><n1> <43h>
 Comments: n1: [0.5, 1000.0] units per pixel

This command sets the ratio of waveform data units to pixels for the selected trace.

ESC ! w n1 P

Description: Trace Phase Offset
 Format: <1Bh> <21h> <77h><n1> <50h>
 Comments: n1: [0.0, 1.0] periods

This command sets the phase offset for the selected trace as a fraction of its sample period. This allows precise horizontal positioning of traces relative to each other when recording starts.

ESC ! w n1 R

Description: Trace Sample Frequency
 Comments: n1: 1.0 to 500.0 = waveform samples per time unit (default 100.0/second)

This command sets the frequency of the samples for the selected waveform.
 The printer interpolates to print at its resolution

Example for a complete configuration: (concatenate mode)

```
ESC ! w 0 s 1 i + 9 3 o 3 . 1 c 1 0 0 r 1 E
select trace (waveform) 0
select trace weight
Trace Offset +93
Trace Scaling 3.1
Trace Sample Frequency =100 samples /seconds
```

.12.5.4 Waveform datas format

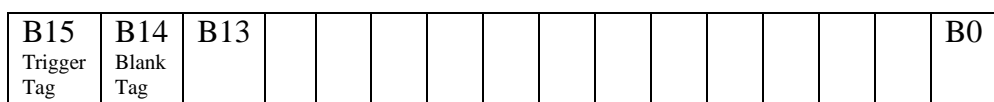
GS n1 <data...>

Description: Waveform Data
 Format: <1Dh> <n1> <data...>
 Comments: n1: 8-bit binary value specifying the number of bytes of samples to follow: Since an equal amount of data must be supplied to each channel, each sample is 2 bytes, this number must be an even multiple of 2n, where n is the number of waveforms enabled.
 <data, ...> are 16-bit samples in the binary format defined below.

This command sends samples for all enabled waveforms. It can be used only when all of the waveforms have the same sample frequency. The same number of samples is sent for each waveform. The samples must be ordered first by time, and secondarily by waveform number.

Data Sample Format

Each waveform data sample is 16 bits in size and consists of a 14 bit waveform data field plus two one bit tag fields



The **14 bit Waveform Data field in bit 0 through bit 13** is an unsigned binary value representing the amplitude of the waveform. To convert it to the value used in printing, the printer first adds an offset to it and then divides the result by a scaling divisor.

The **Blank Tag is in bit 14**. When this bit is set the printer will not draw the trace from the previous sample to this one. It can be used for invalid or missing waveform samples. Note that when blanking ends, the first trace segment starts at the last blanked trace point. The Blank Tag is not intended to be used to produce dashed waveforms. For combinations of trace sample frequencies and paper speed where there are only small distances between samples (four pixels or less), the effect of blanking a single sample may not be visible.

The **Trigger Tag bit is in bit 15**, the most significant bit. A one in this field triggers printing the TTEXT associated with the waveform. The TTEXT vertical position may either be fixed or may be set relative to the trace. In the latter case the TTEXT position is calculated by adding the trace's vertical position (after offset and scaling) to the TTEXT relative position. This makes it easy to position an annotation near a waveform feature.

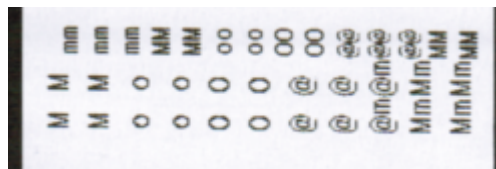
Note: The host should send samples in big-endian order: most significant byte first, followed by the least significant byte.

.12.6 Examples

Below are the printout pictures and related data files which can be opened using the APS software tool "APS Studio" downloadable on APS website, section "download":

<http://www.aps-printers.com/?p=download>

.12.6.1 90° rotated characters



.12.6.2 All ASCII_APS characters

Hex	Character	Hex	Character	Hex	Character	Hex	Character
0x20	' '	0x20	'@%	0x20	'@%	0x20	'@%
0x28	(')	0x28	(')*+,-./	0x28	(')*+,-./	0x28	(')*+,-./
0x30	01234567	0x30	01234567	0x30	01234567	0x30	01234567
0x38	89:;<=>?	0x38	89:;<=>?	0x38	89:;<=>?	0x38	89:;<=>?
0x40	@ABCDEFGHIJ	0x40	@ABCDEFGHIJ	0x40	@ABCDEFGHIJ	0x40	@ABCDEFGHIJ
0x48	KLMNOPQRSTU	0x48	KLMNOPQRSTU	0x48	KLMNOPQRSTU	0x48	KLMNOPQRSTU
0x50	VWXYZ[\]^_`	0x50	VWXYZ[\]^_`	0x50	VWXYZ[\]^_`	0x50	VWXYZ[\]^_`
0x58	xyz{ }~	0x58	xyz{ }~	0x58	xyz{ }~	0x58	xyz{ }~
0x60	^_`abcdefghijklmnopqrstuvwxyz	0x60	^_`abcdefghijklmnopqrstuvwxyz	0x60	^_`abcdefghijklmnopqrstuvwxyz	0x60	^_`abcdefghijklmnopqrstuvwxyz
0x68	hijklmno	0x68	hijklmno	0x68	hijklmno	0x68	hijklmno
0x70	pqrstuvwxyz	0x70	pqrstuvwxyz	0x70	pqrstuvwxyz	0x70	pqrstuvwxyz
0x78	xyz{ }~	0x78	xyz{ }~	0x78	xyz{ }~	0x78	xyz{ }~
0x80	Extra Code Page 0	0x80	Extra Code Page 0	0x80	Extra Code Page 0	0x80	Extra Code Page 0
0x88	Extra Code Page 1	0x88	Extra Code Page 1	0x88	Extra Code Page 1	0x88	Extra Code Page 1
0x90	Extra Code Page 2	0x90	Extra Code Page 2	0x90	Extra Code Page 2	0x90	Extra Code Page 2
0x98	Extra Code Page 3	0x98	Extra Code Page 3	0x98	Extra Code Page 3	0x98	Extra Code Page 3
0xA0	Extra Code Page 4	0xA0	Extra Code Page 4	0xA0	Extra Code Page 4	0xA0	Extra Code Page 4
0xB0	Font 0	0xB0	Font 0	0xB0	Font 0	0xB0	Font 0
0xC0	Font 1	0xC0	Font 1	0xC0	Font 1	0xC0	Font 1
0xD0	Main Code Page 0	0xD0	Main Code Page 0	0xD0	Main Code Page 0	0xD0	Main Code Page 0
0xE0	Main Code Page 1	0xE0	Main Code Page 1	0xE0	Main Code Page 1	0xE0	Main Code Page 1
0xF0	Main Code Page 2	0xF0	Main Code Page 2	0xF0	Main Code Page 2	0xF0	Main Code Page 2
0xF8	Main Code Page 3	0xF8	Main Code Page 3	0xF8	Main Code Page 3	0xF8	Main Code Page 3



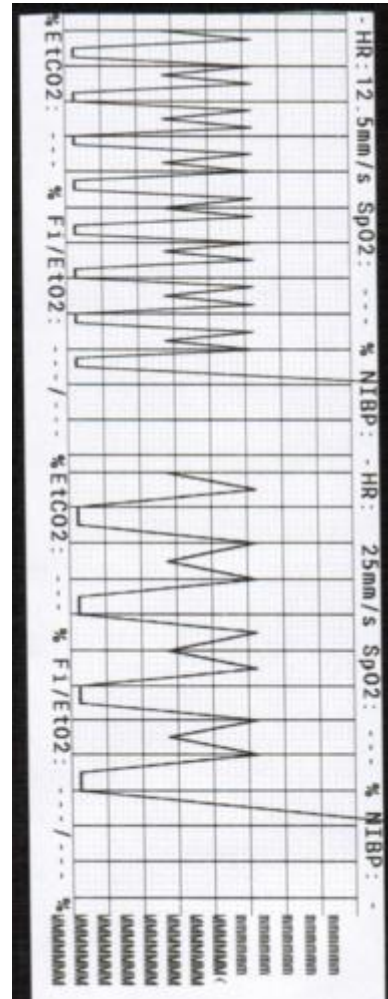
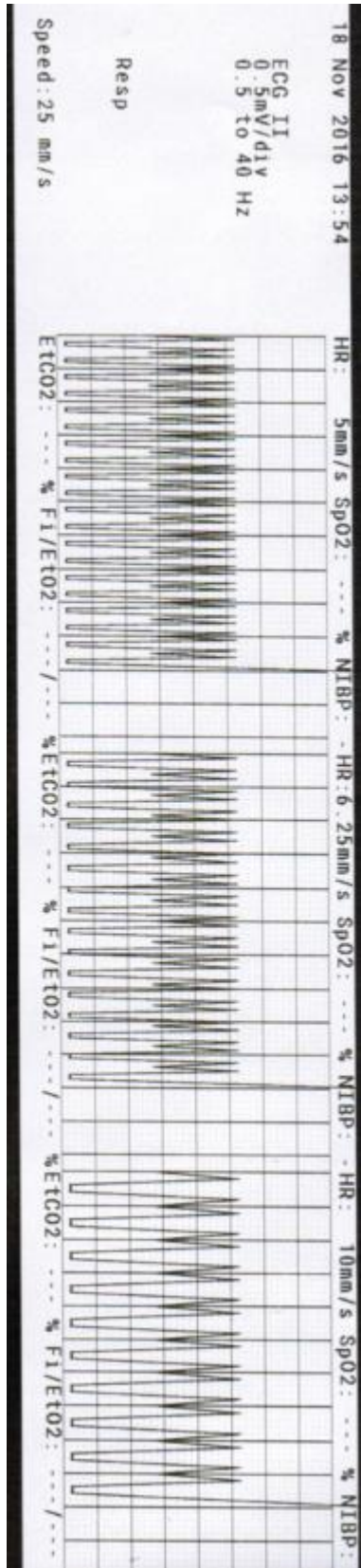
AllAcscii_APS.tik

.12.6.3 All ASCII_SPEC_APS characters

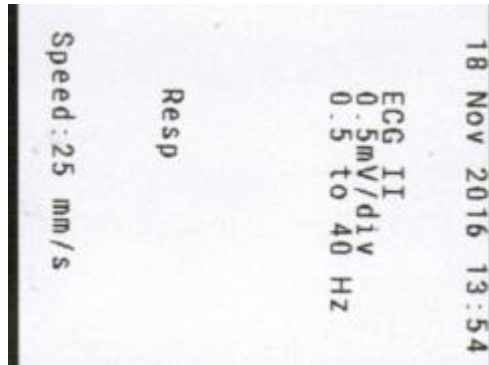


AllAcscii_spec_APS.tik

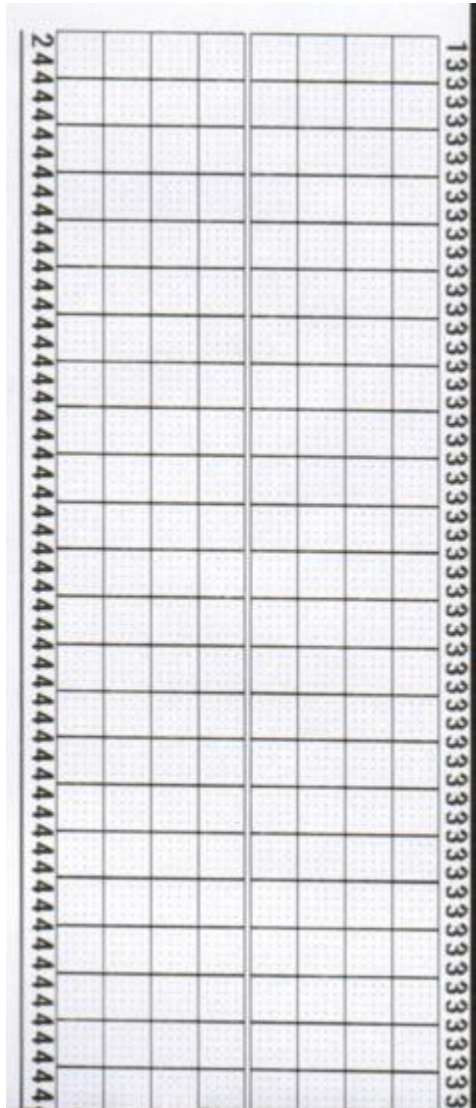
.12.6.4 APS_ALL_Speed



.12.6.5 Part1



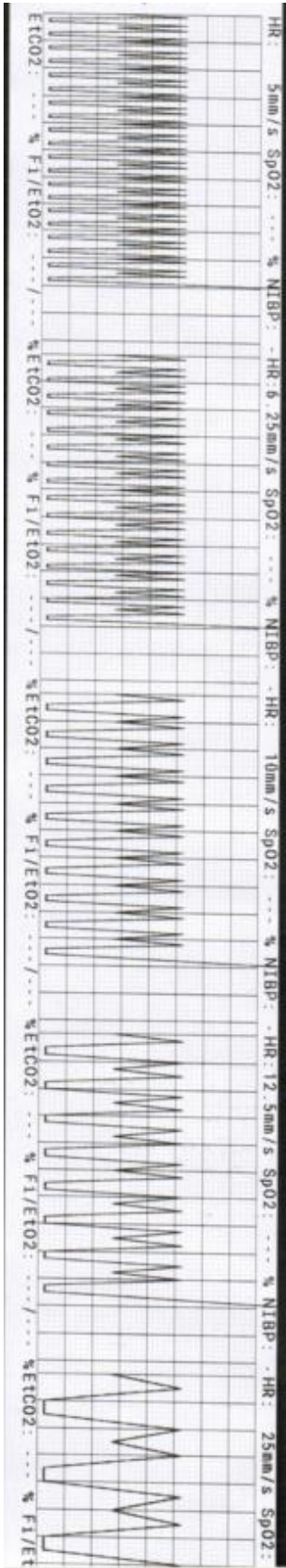
.12.6.6 Test Trigger Text



Test Trigger Text.tik



.12.6.7 Wave APS all speed 50 mm



WaveApsAllSpeed50
mm.tik

.12.6.8 Wave test



.13 DETAILS OF SERIAL COMMUNICATION PORT.

Bytes are received one after one directly by UART of microcontroller. So they can be processed whatever printer state (printer error or full buffer). In the case of full buffer (handshaking was set OFF by printer with “RTS or DTR” or Xoff), host should disable its own handshaking control before sending its real time request. Otherwise this control will prevent request to be sent.

- “**ESC v**” will be used to send a “Send printer status” request. Note that during graphic printing, it is possible that printer interprets graphic data as a “Send printer status” request (edge effect of real time processing implementation). Then printer will return its status. So when host needs to get some data from printer, it is advised to reset its receiving buffer before sending its request (in the case when this noisy answer has been received previously).
- “**ESC @**” will be used to send a “Reset printer” request. Note that this one will be processed in real time only if printer is in error so as to prevent the same edge effect explained above (fatal consequence this time!).