HPGL

database
Data Interface for ARISTOMAT Machines
(02/01)
Introduction to the ARISTO HPGL instruction data base

0. Foreword
The full power of the ARISTOMAT machines can today be unleashed through the most universal graphics command instruction set in the world, HPGL. This goes back to the long history of the ARISTO machines since the 1960s as computer controlled CAD drawing machines i.e. plotters. While other machines in the meantime have maintained their complex CNC programming language using G commands, which require additional programming software when hooked up to a PC based standard CAD system, the ARISTOMAT machines can be driven directly from any PC using a standard serial interface and cable.

However, the historic HPGL definition as developed in the 1950s did not provide for many requirements of a complex production machine of today, so the historic HPGL had to be enhanced by some new features since. Take one example: The historic HPGL syntax did not provide for something as basic as “drill a hole at position x,y”. All HPGL was designed for was something like “move to position x,y with pen “down””. So, we have added one command “TD” which can now instruct the ARISTOMAT to move to one position and drill a hole there.

Our following database contains historic HPGL commands and syntax as well as many enhancements we have modified or added. The historic HPGL is still used to describe the shapes of the objects to be drawn or cut, while the knowledgeable driver programmer is given enormous freedom, as to how these objects shall be processed on the machine, up to defining production cycles or sequences for mass production of these objects.

Admittedly, reading a compendium of HPGL syntax is not much fun. So, in order to make it better digestable to the reader, we have added many examples and descriptions of what our machines will do when they receive one particular command.

However, we cannot here explain all the freedom a creative user or programmer can gain through clever combination or interchanging of such commands even inside one particular instruction file.

Also, all ARISTOMAT machines offer many more features than those listed here, which may for instance be accessed locally through the machine keypad, or
through some specific ARISTO software packages like “Automatic Eye”, which will
combine machine vision with the ARISTOMAT for automatic -operatorless-
production.

Take for instance the generation of tangential control data right inside our
machines, fully automatic and synchronously with every movement instruction from
outside. Or, if one pizza blade may be used, our machine will clip given vectors
automatically to minimise “overcuts” into the material through the blades' width
dimension. These features, as vital as they are, do not enter this manual, because
they are not subject to be affected through the serial data interface of the machine.
And so for good reason: In many years we have learned that practical machine
operators wish to program some important machine features directly and quickly
into the machine through the machine keypad, rather than go through a loop of
editing HPGL instructions on a remote computer.

So, to obtain a complete reference of the features of the ARISTOMAT, a -current-
machine manual should be read alongside the HPGL interface description.

And, we always appreciate direct contact with software developers and we are
always available for questions and comments from their side. We have frequently
worked with software developers to add new features and there are also some
machine features today built in for proprietary use of special customers and
applications only. BTW, these are not disclosed here.

All in all: We love the HPGL interface. It is extremely versatile and it is still
expandable in many directions.

Consequently, there will be many more enhancements to our ARISTOMAT HPGL
in future too. That is why we always keep a current version of the interface
description and the command database on our website for convenient
downloading.

Visit us frequently at

www.ARISTO.de

for latest information.

-----------------------------------------------------------------

To make reading and understanding it easier for you, we have tried to structure the
contents of our database.

To start with, there are two different kinds of instruction, device control instructions
(DCI) and graphics instructions (HPGL):
I. Device control instructions (DCI) vs. graphic instructions (HPGL)

Through DCI, the machine can be accessed directly and immediately, regardless of what other content the machine memory may still contain. They are for instance used to obtain immediate output of available buffer space and status of specific device conditions. Additional DCI instructions are required by the RS-232-C interface mode and are used to establish plotter output conditions and handshake protocol, and to control these conditions while the machine is “Online”.

HPGL instructions, on the other hand, enter the plotter's internal buffer and are executed in first-in/first-out sequence. They will only then and there take effect, where the machine will take notice of them, i.e. when the machine will actually have them ready for execution, not before, for instance when reading them into it’s data memory buffer. DCI do not enter the buffer, but instead are executed immediately upon receipt.

DCI commands can be recognized by their “ESC” prefix, while all HPGL instructions will have a two-letter prefix.

A. Syntax of the DCI device control instructions

DCI are three-character escape code sequences comprising "ESC" and "," followed by one of the characters "(, ), @, A, B, E, H, I, J, K, L, M, N, O, P, Q, R, S, T, Y, Z". These syntax conventions are used with the instructions in the database:

- Parentheses indicate that each individual parameters is optional
- The semicolon follows and delimits parameters. If a semicolon appears without a parameter, the parameter is defaulted.
- The colon terminates any instruction which may have parameters and can occur after any valid number of parameter entries.
Integer  This symbol specifies a fixed point integer value parameter. For example, the characters 10 would represent the decimal value ten; the character 13 would represent the decimal value thirteen. All parameters have to be non floating point value and each parameter must follow a delimiter (;) or the terminator (:).

ESC  Denotes the single ASCII character, Escape.

Default Values and Omitting Parameters
Any parameter may be omitted or, if the parameter is required, it can be set to its default value by omitting the parameter and entering only the semicolon delimiter. Any parameters may be omitted and therefore set to default values by entering only the colon terminator after the instruction.

Note: There is no delimiter (semicolon) between the three-character command sequence, and the third character has to be in uppercase, e.g., ESC.P, and first parameter.

II. HPGL Graphic Instructions and more.

A. Through HPGL commands and command strings you can,

1. Set machine up for operation, “Key Machine Configuration”

2. Describe the shape of all objects, “Geometry Description”

3. Trigger the machine to respond and send information about its status, “Machine info response”

4. Instruct machine how “Geometry Description” data shall be repositioned, scaled or aligned in this case, “Positioning and Scaling”.

5. Instruct the machine how to process geometry data in a particular way, for instance to accelerate movement or to artificially smooth some contour, “Processing Parameters”

6. Instruct the machine to advance material automatically or to move it back, “Material Advance”.

7. Instruct the machine to repeat production in cycles, while automatically triggering machine features to speed up loading and unloading, “Production Control”
8. Plus, some more instructions concerning “Character Setting”, “Special” and “Developer” specifics.

B. Syntax of the “HPGL” instructions

Each HPGL instruction begins with a two-letter mnemonic, which may be upper- or lowercase. If parameters are required following the mnemonic, they must be separated from each other by at least one comma or space. HPGL instructions are terminated only by a semicolon or the first letter of the next mnemonic. Optional separators may be inserted as shown below:

```
<table>
<thead>
<tr>
<th>Instruction Mnemonic</th>
<th>Parameter Field (as required)</th>
<th>Mandatory</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sep X Sep X Sep</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parameter Sep Parameter Sep Terminus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Required Separator</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1 or more commas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and/or spaces)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Optional Separators</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0 or more commas and/or spaces)</td>
<td></td>
</tr>
</tbody>
</table>
```

Carriage return characters will be ignored, except as label characters or an output response terminator in an RS-232-C environment. Some instructions have optional parameters which, when omitted, assume a default value.

The label instruction, LB, buffer label instruction, BL and write display instruction, WD, are special cases. Each must be terminated with the label terminator character. This character defaults to the ASCII end-of-text character, ETX (decimal equivalent 3), but may be changes from its default value using the define terminator instruction, DT. The labels defined with LB and BL instruction are not plotted.

The parameter field must be specified in the format defined by the syntax of each respective HPGL instruction. The format can be of two different types:

1. Decimal Format: The parameter must be between +/-2.23* 10^{-308} and +/-1.8* 10^{308}. Rounding is automatically performed if the required format for the parameter is only integer. In the data base named “Double”.

2. Label Fields: Any sequence of characters terminated by a ETX or any terminator defined by the DT instruction. In the data base named “String”.

The syntax shown in the description of each HPGL instruction uses the following notations:

- **Mnemonic** For readability, the mnemonic is shown.
- **Name** All typeset items are required parameters. They are named after their use
III. Some Practical Hints for Programmers

a) Machine information responses
All output responses, in the data base shown in double quotes, include the default output terminator which is the carriage return character (CR). The output terminator is sent from the plotter to the computer at the end of a response to an output instruction. This terminator differs from the HPGL terminator which indicates the end of an HPGL instruction send to the plotter from the computer.

b) Reduce data amount
You may reduce the data amount up to 30% by concentration of the HPGL instructions.
- Relative coordinates need less space the absolute coordinates.
- Only use PD instruction at the beginning of the outline.
- Coordinates may set directly one after another.
- Use next mnemonic as separator.
Example:
  PAPU12300,14600PRPD100,50,200,80,130,70,120,40PUPA ...
  PAPU0,0;

c) Increase resolution
Vectors are usually sent in fixed point format with the default resolution of 0.025mm per HPGL step. If the vector length becomes less then 0.5mm the angle error between two vectors may increase due to fitting the start and end points to the 0.025mm-grid. In worst case the angle error will reach up to 90°. This will reduces the plot throughput and the outline quality.

In this case the resolution may be increased as follows:
- Transmission of floating point values. In addition to the HPGL standard floating point values are operated on the ARITOMAT machines.
- Scaling to another resolution with the IP and SC instruction sequence at the beginning of the plot:  IP0,0,1,1SC0,10,0,10; (for 0.0025 mm per HPGL step)

d) Vector Length Problem
Some drivers use fixed vector length which are not adapted to the outline of the object. Using small vectors for enlarged outlines will produce a great amount of data (increase of time for transmission) and will reduce the plot throughput. Using large vectors for small outlines will produce a cuttings of less quality.
Therefore the vector length should depend on the chord tolerance, the difference
between the cutting contour and the real contour. For example a chord tolerance of 0.02mm is used as default circle resolution on ARISTOMAT machines for high quality (see CT instruction).
For the best results we recommend to use the CI and AR instructions for non straight vectors.
e) Samples of typical sequences of instructions
Start of job: Set the ARISTOMAT in defined status and higher resolution:
   INPC7,0IP0,0,1,1SC0,10,0,10;
Set the processing parameters for the tools in the job, if not directly set in the plotter menu:
   SP1VS5AS2CR20RT10SP2VS5AS2CR20RT10 ... ;
Select tool 1 and plot first contour (start at X=50mm, Y=50mm ; plot 10mm square )
   SP1PUPA20000,20000PDPR0,4000,4000,0,0,-4000,-4000,0;
Select tool 2 and plot second contour (start at X=50mm, Y=100mm ; plot 10mm square )
   SP2PUPA20000,40000,PDPR0,4000,4000,0,0,-4000,-4000,0;
End of the job: Raises the tool.
   PUSP;
f) Some notes about the PU, PD, PA and PR instructions
The internal optimizer combines all movements with raised tool (PU) to one single movement to the next point with lowered tool (PD). The tool is not lowered if the vector length is Zero. Alternatively, the TD command is available for a “Drill” operation. Both instructions PU and PD do not raise or lower the tool directly, if they do not contain some movement instruction as well.
Note:
The PU, PD, PA, PR instructions are flags.
   P... (X-coordinate, Y-coordinate(...));
   PA set plotting mode to absolute (and moves the tool to the specified point(s))
   PR set plotting mode to relative (and moves the tool the specified distance(s))
   PD set flag pen down (and moves the tool to the specified point(s))
   PU set flag pen up (store the last point, but do not move)
The following instruction sequence force to raise the tool.
   PUSP;
The following instruction sequence forces a move with raised tool.
   PU X-coordinate, Y-coordinate SP;
g) Data transmission
The handshake mode for data transmission between host computer and ARISTOMAT can be set in the menu of the ARISTOMAT. You can choose between XonXoff and hardwired handshake. If it necessary to change the handshake mode of the ARISTOMAT programmatically, use the DCI to activate the handshake.
mode.  
We highly recommend to set both the computer and the machine to the same  
handshake mode ( e.g. hardwired (DTR) ) and then leave it unchanged.  

For more details refer to the command and instruction data base.

IV. ARISTO Driver Programmer Support

You can contact our cutter firmware support group

- through Email:  
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- by fax  
+49-(0)40- 54747-111
Instruction: AA

Parameter: X, Y, Arc angle (,Chord tolerance)

Group: Geometry description
HPGL Level: Historic HPGL
Recommended: yes
Definition: Arc Absolute

Since: earlier than V2.0

Param. Type: Double
Scaled: yes

Return Value: -
Range: - , - [units],
± 360 [°],
0 .. 8 [°] / 0 .. 100 [units]

Function: Draws arc centred at X,Y coordinate, starts at current tool position

Default: -, -, -, 5 / 0.8

Example: AA4000,4000,-270;
IF TOOL IS DOWN: Move from current position on an arc around point 4000/4000 clockwise for 270°

Comment: Maximum angle size depends on the radius and the plotter size combined with the scaling.
Negative angles are plotted clockwise, positive angles counter clockwise.
Chord tolerance mode is set by the command CT, for range and default values for the chord tolerance see CT command
ARISTO Data Interface Description Database

Instruction: **AF**

Group: Material advance  
HPGL Level: Historic HPGL

Recommended:  
Definition: Advance Full Page

Since: earlier than V2.0

Parameter: -

Param. Type: -

Scaled: no

Return Value: -

Range: -

Function: Programmatically advances roll material one full-page length

Default: -

Example: AF;  
Advances material on machine for "sheetsize" configured in machine keypad

Comment: Form feed - form size is set in plotter menu (FORMAT), default is A3
Instruction: **AH**

Group: Material advance
HPGL Level: Historic HPGL

Parameter: -
Param. Type: -
Scaled: no

Definition: Advance Half Page

Return Value: -
Range: -

Since: earlier than V2.0

Function: Programmatical advances roll material one half-page length

Default: -

Example: AH;
Advances material on machine for half "sheetsize" configured in machine keypad menu.

Comment: Half form feed - form size is set in plotter menu (FORMAT), default is A3
ARISTO Data Interface Description Database

Instruction: AR

Parameter: X, Y, Arc angle (,Chord tolerance)

Group: Geometry description
HPGL Level: Historic HPGL
Recommended: yes
Definition: Arc Relative
Since: earlier than V2.0

Function: Draws arc centred at point relative to current tool position

Default: -, -, -, 5 / 0.8

Example: AR40,40,200;
IF TOOL IS DOWN: oves tool along 200° arc around point 40/40 greater current position.

Comment: Maximum angle size depends on the radius and the plotter size combined with the scaling.
Negative angles are plotted clockwise, positive angles counter clockwise.
Chord tolerance mode is set by the command CT, for range and default values for the chord tolerance see CT command

Param. Type: Double
Scaled: yes
Return Value: -
Range: -, - [units],
± 360 [°],
0 .. 8 [°] / 0 .. 100 [units]
Instruction: AS

Parameter: Acceleration (,Tool number)

Group: Processing parameters
HPGL Level: ARISTO modified HPGL
Recommended: yes
Definition: Acceleration Select

Since: earlier than V2.0
last changes V3.4

Function: Sets acceleration for the active tool

Default: 2

Example: AS1.4;
Sets acceleration -rounded- to "1", approx. 50% of max "2".

Comment: The tool number is ignored, the command only affects the active tool
1 <=> 50% , 2 <=> 100% , 3 <=> 150 % ,
Since V3.3 the increased acceleration (up to 150%) is only available on ARISTOMAT II machines.
Since V3.4 the increased acceleration is available on every new ARISTOMAT machine.
Instruction: **BL**

Parameter: Terminated string

Group: Character setting
HPGL Level: ARISTO modified HPGL

Recommended:
Definition: Buffered Label String

Since: earlier than V2.0

Function: Reads the label, but does not store it

Default:

Example:

```
BLhello world!\3;
```

ARISTOMAT will ignore this command, which on other machine may produce "hello world!" in print.

Comment: This command is not supported
**ARISTO Data Interface Description Database**

**Instruction:**

CB

**Parameter:**

-  

**Param. Type:**

-  

**Scale:**

-  

**Return Value:**

Remainig bytes

**Range:**

0 .. Memmax [bytes]

**Definition:**

Clear Buffer

**Function:**

Clears plot buffer after interpretation

**Default:**

0

**Example:**

CB;"0"

Machine keeps moving until this command is next in memory. Then Machine stops and deletes memory.

**Comment:**

Returns 0 on success or any other number on fault. It is important to wait for this answer before new commands are sent to the plotter. Data received before CB has answered may be deleted.
Instruction: CI

Parameter: Radius (chord tolerance)

Param. Type: Double
Scaled: yes
Range: 0 .. 8 [°] / 0 .. 100 [units]

Default: -

Group: Geometry description
HPGL Level: Historic HPGL
Recommended: yes
Definition: Circle
Since: earlier than V2.0

Function: Draws a circle, centred at current tool position

Example: CI8000;
Moves one full circle with radius 8000 plotter units (approx. 200 mm on ARISTO machine).

Comment: Maximum radius depends on the plotter size and the scaling.
Chord tolerance mode is set by the command CT, for range and default values for the chord tolerance see CT command.
Instruction: CR

Parameter: Upper angle

- Group: Processing parameters
- HPGL Level: ARISTO specific HPGL
- Recommended: yes
- Definition: Corner Recognition

Since: earlier than V2.0

Param. Type: Double
Scaled: no

Return Value: -
Range: 0 - 90 [°]

Function: The corner recognition defines the lifting of the tool before turning through an angle greater than the Upper angle.

Default: 20

Example: CR45;
When encountering angle between current and new vector greater 45° machine lifts tool and turns lifted.

Comment: This command affects all tools with non MultiHead systems, and only the actual tool position with MultiHead systems.
Instruction: **CT**

Group: Geometry description

HPGL Level: Historic HPGL

Recommended:
Definition: Chord Tolerance

Since: earlier than V2.0

Function: Determines whether chord tolerance parameter of CI, AA and AR instructions is interpreted as degrees or as a deviation distance in plotter units.

Default: 0

Example: **CT1;**

Comment: 0 - degree mode (default), 1 - deviation mode

Default for degree mode: 5°

Default for deviation mode: 0.8 unscaled HPGL units
**ARISTO Data Interface Description Database**

**Instruction:**

DF

**Parameter:**

- 

**Group:** Key Machine Configuration

**HPGL Level:** ARISTO modified HPGL

**Recommended:** yes

**Definition:** Default

**Since:** earlier than V2.0

**Function:**

Sets plotter to default conditions

**Default:** -

**Example:**

DF;

machine is (re-) set to default key configuration and processing parameters; see below for details.

**Comment:** The following default values are activated:

- Clears all HPGL errors,
- Input window is set to hardclip limits and user-unit scaling is switched off,
- Raises the tool and sets the absolute plot mode, sets default values for chord tolerance,
- Sets the label terminator to ETX,
- Switches off ARISTO Scan'n'Cut mode and resets all counters,
- Switches off the special scan mode set with MS1;,
- Switches off the automatic repetition mode and enters normal plot mode

The DF command equals the following command sequence: OE;IW;PU;PA;CT;CI0,0,5;DT; MS;PC0;
Instruction: **DT**

**Group:** Character setting  
**HPGL Level:** Historic HPGL  
**Recommended:**  
**Definition:** Define Terminator

Since: earlier than V2.0

**Parameter:** Terminator

**Param. Type:** Character  
**Scaled:** -  
**Return Value:** -  
**Range:** \x00 .. \x7F

**Function:** Defines the label terminator used in LB, BL and WD instruction

**Default:** ETX (end of text, \x03)

**Example:**  
DT+;  
Sets the label terminator to "+".

**Comment:** Any character with a decimal equivalent between 0\(\times 00\) and 127\(\times 7F\) can be defined as label terminator, default is 3
Instruction: **FC**

Parameter: (Width, Starting point)

**Group:** Material advance

**HPGL Level:** ARISTO specific HPGL

**Recommended:** yes

**Definition:** Foil Cut

**Since:** V3.0

**Param. Type:** Double

**Scaled:** no

**Range:**
- Width: 0 .. Max [units]
- Starting point: 0 .. Max/10 [units]

**Return Value:** -

**Function:** Programmed cutting off the material at the front end of the plotter

**Default:** Max, Max/10

**Example:**

FC24000,4000;

Machine moves to starting point (0,4000) and cuts for 20000 plotter units in positive Y direction returns to the starting point and cuts the remaining 4000 plotter units in the opposite direction.

**Comment:** The material advance command (PGx;) before the FC command must include an additional length of 4.5cm between the parts of the plot.

This command works not with a MultiHead.

If the film cutting device is installed neither the SP6 command nor the menu setting marker must be used.
Instruction: **FS**

**Parameter:** Tool force

- **Param. Type:** Double
- **Scaled:** -
- **Return Value:** -
- **Range:** 0 .. 29 / 1 .. 8 / 1 or 2

**Group:** Processing parameters

**HPGL Level:** ARISTO modified HPGL

**Recommended:**
- **Definition:** Force Select

**Since:** earlier than V2.0

**last changes:** V2.01

**Function:** Sets tool force (Standard cutting device)/ Set laser pointer brightness (MultiHead)/ Sets cutting depth (double head only)

**Default:** -

**Example:**

FS8;

Instructs machine to apply "Tool Pressure 8" when command is reached.

**Comment:** The FS command has no effect on MultiHead systems if the laser pointer is not the active tool
Instruction: \textbf{IN}

Group: Key Machine Configuration
HPGL Level: ARISTO modified HPGL
Recommended: yes
Definition: Initialize

Since: earlier than V2.0
last changes V3.21

Function: Initializes the plotter

Default: -

Example:
\[\text{IN;}\]
see below.

Comment: Activates the tool position 1 with all depending parameters (e.g. accel., speed, ...),
resets the HPGL 90° rotation and places the sheet on the plotter (for plotter and format emulation),
resets the status port bits (see OS),
and executes the DF instruction.

The IN command equals the following command sequence: SP1;RO; DF
**ARISTO Data Interface Description Database**

**Instruction:**

<table>
<thead>
<tr>
<th>IP</th>
</tr>
</thead>
</table>

**Parameter:**

| P1x,P1y (,P2x,P2y) |

**Group:** Positioning and Scaling

**HPGL Level:** Historic HPGL

**Recommended:** yes

**Definition:** Input P1 and P2

**Since:** earlier than V2.0

**Function:** Sets scaling points in plotter units.

**Default:** without parameter

**Example:**

IP0,0,1,1;

**Comment:** This command is used together with the SC command to scale plot data.

The IP command without parameter sets P1 and P2 to default coordinates (depending on the plotter and sheet size)."

For ultimate precision programming and best speed performance ARISTO recommends experienced programmers to use initial IP0,0,1,1; SC0,10,0,10 string and subsequently plotter units which are tenfold against HP standard resolution. The reasons are complex and difficult to explain, but it works much better that way. Ommitting only the last two parameter, P2 is moved the same relative distance as P
**Instruction:**

IW

**Parameter:**
X1, Y1, X2, Y2

**Group:** Positioning and Scaling

**HPGL Level:** Historic HPGL

**Recommended:**
Definition: Input Window

**Since:** earlier than V2.0

**Function:**
Sets window inside which plotting can occur

**Default:**
without parameter

**Example:**
IW0,0,32000,40000;

Machine will move within defined area. All protruding vectors will be cut short (clipped).

**Comment:**
The IW command without parameters sets the plot window to the plotter size and switches user-unit scaling off.
Instruction: LB

Group: Character setting
HPGL Level: ARISTO modified HPGL
Recommended: 
Definition: Label

Since: earlier than V2.0

Function: Reads the label, but does not plot it

Default: - 

Example: 

Example: LBhello world! \x03;
ARISTOMAT will accept command without error, but will ignore it.

Comment: This command is not supported
**Instruction:** MS

**Group:** Special  
**HPGL Level:** ARISTO specific HPGL

**Definition:** Mode Scan

**Parameter:** On/Off

**Param. Type:** Double  
**Scaled:** -  
**Range:** 0 / 1

**Default:** -

**Function:** Sets ARISTOMAT to a special scan mode for special scanner hardware

**Example:**

```
MS0;
```

Special scanner command (usable only with special scanner attachment).

**Comment:** A special scanner hardware is required for this command

- In scan mode, the plotter ignores any HPGL instructions except the scan mode off MS0; command
- The "scanner" is not moved with vector instructions but with a stepper controller
Instruction: NR

Group: Key Machine Configuration
HPGL Level: ARISTO modified HPGL

Recommended:
- Definition: Not Ready

Since: earlier than V2.0

Function: Switches the plotter in offline mode

Default: -

Example: NR;
- Switches machine to "Offline" mode.
- Comment: To enter online mode press the Start/Stop key at the panel (for security)
Instruction: OA

Group: Machine info response
HPGL Level: Historic HPGL
Recommended:
Definition: Output Actual Position
Since: earlier than V2.0

Parameter: -

Param. Type: 
Scaled: yes

Return Value: Xa, Ya, Tool status
Range: -, - [units]

Function: Outputs the current physical tool position

Default: -

Example: OA;
If machine is currently at approx. 100,200mm it will respond "4000,8000,0". 0 means "Tool up".

Comment:
Instruction: OC

Parameter: -

Group: Machine info response
HPGL Level: Historic HPGL
Recommended: -
Definition: Output Commanded Position
Since: earlier than V2.0

Param. Type: Recommended: Group: Machine info response
Since: earlier than V2.0

Function: Outputs the tool position associated with last valid tool position instruction

Default: -

Example: OC;
Machine responds "4000,8000,0" as last position it is currently destined for, with raised tool.

Comment:
ARISTO Data Interface Description Database

Instruction: OD

Parameter: -

Group: Machine info response
HPGL Level: ARISTO modified HPGL
Recommanded: Group: Machine info response
Definition: Output Digitized Point
Since: earlier than V2.0

Param. Type: Scaled: no
Return Value: Xc, Yc, Tool status
Range: -, -, [units]
   0 / 1

Function: Outputs the tool position associated with last valid tool position instruction

Default: -

Example: OD;
       Machine responds for instance "4000,8000,0". Same meaning as "OC;"

Comment: Outputs the commanded position and the tool status
Instruction: **OE**

- **Group:** Machine info response
- **HPGL Level:** Historic HPGL
- **Recommended:**
  - **Definition:** Output Error
- **Since:** earlier than V2.0

**Function:** Outputs the last HPGL error

**Parameter:** -

**Default:** -

**Return Value:** Last error

**Range:** 0 .. 8

**Example:**

```
OE;
```

Machine responds "0" indicating no error has occurred.

**Comment:**

- "0": No error
- "1": Unknown instruction
- "2": Wrong number of parameters
- "3": Parameter out of range
- "4" to "7": Not used
- "8": Page advance instruction without material advance
Instruction: OF

Parameter: -

Group: Machine info response
HPGL Level: Historic HPGL
Recommended:
Definition: Output Factors
Since: earlier than V2.0

Function: Outputs the number of unscaled HPGL units per millimeter in X- and Y-axes

Default: -

Example:
OF;
ARISTOMAT will always respond "40,40" indicating its internal fixed scaling value.

Comment: This command is not supported. A fixed string is output
Instruction: OH

Parameter: -

Group: Machine info response
HPGL Level: Historic HPGL
Recommended: 
Definition: Output Hard-Clip Limits
Since: earlier than V2.0

Param. Type: 
Scaled: no
Return Value: Xmin, Ymin, Xmax, Ymax
Range: -, -, -, - [units]

Function: Outputs the hard-clip limits at the time the instruction was received

Default: -

Example: OH;
Machine will respond "0,0,98000,64000" as ultimate permissible area for that machine in question.

Comment:
Instruction: OI

Parameter: -

Group: Machine info response
HPGL Level: ARISTO modified HPGL

Recommended:
Definition: Output Identification

Since: earlier than V2.0

Param. Type: -
Scaled: -

Return Value: Emulation
Range: -

Function: Outputs the selected plotter emulation

Default: -

Example:

Example OI:
Machine responds to what emulation it has been set to through keypanel menu. Here: "ARISTO"

Comment: Outputs the plotter emulation set in the plotter emulation menu, either "ARISTO" or "7475A" or "7580B"
Instruction: **OL**

Group: Character setting  
HPGL Level: Historic HPGL

Recommended:  
Definition: Output Label Length

Since: earlier than V2.0

Parameter: -

Param. Type: -

Scaled: -

Return Value: "0,0,0"

Range: -

Function: Outputs information on the label contained in the buffer

Default: -

Example: OL;  
Machine does ignore OL command, but will not detect error but reply: "0,0,0"

Comment: This command is not supported. A fixed string is output
Instruction: OO

Group: Machine info response
HPGL Level: Historic HPGL
Recommended:
Definition: Output Options

Since: earlier than V2.0

Function: Outputs implemented options

Default: -

Example: OO;
This command is ancient HPGL history, without known meaning. "0,0,0,0,1,0,0,0" is compatible answer.

Comment: This command is not supported. A fixed string is output.
Instruction: **OP**

Parameter: -

Param. Type: Historic HPGL

Scaled: no

Return Value: P1x, P1y, P2x, P2y

Range: -, -, -, - [units]

Default: -

Group: Machine info response

Definition: Output P1 and P2

Since: earlier than V2.0

Function: Outputs the plotter unit coordinates of the scaling points P1 and P2

Example:

```
OP;
```

machine responds "0,0,1,1" as values put in previously through IP command.

Comment:
Instruction: OS

Group: Machine info response
HPGL Level: Historic HPGL

Recommended:
Definition: Output Status

Since: earlier than V2.0

Function: Outputs the status of the plotter

Default: -

Example: OS;
See below "8"

Parameter: -

Param. Type: -

Scaled: -

Return Value: Plotter status
Range: 0 .. 127

Comment: "0": None of the following conditions
"1": Tool is lowered
"2": Point P1 or P2 has changed
"4": Digitized point is available
"8": Unit is initialised, is cleared by OS
"16": Buffer is empty and ready for data
"32": HPGL error, is cleared by OE
"64": Request service
Instruction: **OT**

Group: Machine info response
HPGL Level: Historic HPGL
Recommended:
Definition: Output Carousel Type
Since: earlier than V2.0

Function: Outputs the installed carousel type

Default: -

Example: OT;
As we do not have tool crousels, ARISTOMAt responds "-1,255" compatible with HPGL standard.

Comment: This command is not supported. A fixed string is output
Instruction: **OV**

- **Group:** Machine info response  
- **HPGL Level:** ARISTO specific HPGL  
- **Recommended:** 
  - **Definition:** Output Version  
  - **Since:** earlier than V2.0

**Function:** Outputs the firmware version

- **Default:** -  
- **Example:** 
  - **OV;**  
  - Currently fixed response "AG130 SIGNLINE V2.0"

**Comment:** This fixed string is not to be updated for compatibility causes
Instruction: **OW**

Parameter: -

Group: Machine info response

Parameter Type: -

HPGL Level: Historic HPGL

Scaled: yes

Recommended: -

Return Value: X1, Y1, X2, Y2

Definition: Output Window

Range: -, -, -, - [units]

Since: earlier than V2.0

Function: Outputs the coordinates of the points set by the IW command

Default: -

Example: OW;

IF soft Clip window set through IW is this, "0,0,32000,40000" will be responded by machin upon OW.
Instruction: PA

Parameter: (X,Y, (X,Y, ........))

Group: Geometry description
HPGL Level: Historic HPGL
Rec队mended: yes
Definition: Plot Absolute

Since: earlier than V2.0

Param. Type: Double
Scaled: yes
Return Value: -
Range: - , [units]

Function: Plots to the X, Y coordinates in the order listed using current tool up/down status

Default: -

Example:
PA800,400;
IF TOOL IS DOWN, machine moves to point 800, 400 -with tool down-.

Comment: A complete set of coordinates is required. If one of the two coordinates is missing the command is ignored.
**Instruction:**

**PC0**

**Parameter:**
- 

**Group:** Production control
**HPGL Level:** ARISTO specific HPGL
**Recommended:**
- 
**Definition:** Production Control

**Since:** V2.02

**Function:** Clears production control mode status (normal plotter function)

**Default:** -

**Example:**

```
PC0;
```

The machine will reset itself to non-production cycle operation. Best used at top of -every- new file.

**Comment:** This command makes the plotter return to normal mode after one of the following commands PC6, PC9 or PC10.
ARISTO Data Interface Description Database

Instruction: PC1

Group: Production control
HPGL Level: ARISTO specific HPGL
Recommended: Definition: Production Control

Since: V2.02

Parameter: (Time)

Param. Type: Double
Scaled: -
Return Value: -
Range: 0 .. 9.999 [s]

Function: Switches on vacuum and waits default waiting time or specified waiting time

Default: 4

Example: PC1,7.2;
Machine will switch on vacuum and after delay period of 7.2 seconds will continue operation normally.

Comment:
Instruction: **PC2**

Group: Production control  
HPGL Level: ARISTO specific HPGL

Recommended:  
Definition: Production Control

Since: V2.02

Parameter:  
(Time)

Param. Type: Double

Scaled: -

Return Value: -

Range: 0 .. 9.999 [s]

Function: Switches off vacuum, waits the specified delay time and resumes job afterwards without key press etc.

Default: 0

Example: PC2;

As no delay parameter is given, command will switch off vacuum and carry on cutting without delay.

Comment:
ARISTO Data Interface Description Database

Instruction: **PC3**

Group: Production control  
HPGL Level: ARISTO specific HPGL  
Recommended:  
Definition: Production Control  
Since: V2.02

Parameter: (Time)

Param. Type: Double  
Scaled: -  
Return Value: -  
Range: 0 .. 9.999 [s]

Function: Switches vacuum pump action to "blowing" and waits default wait time or specified waiting time

Default: 2

Example: PC3,3.0;  
Machine will stop, reverse vacuum action to blowing and will wait for specified time, 3,0 secs, before continuing. That delay time is to allow vacuum pump sufficient time to synchronise.

Comment:
Instruction: PC4

Parameter: (Time)
- Scaled: -
- Range: 0 .. 9.999 [s]

Group: Production control
HPGL Level: ARISTO specific HPGL
Recommended:
Definition: Production Control
Since: V2.02

Default: 0

Function: Switches blowing to "OFF" and waits the specified delay time

Example: PC4,3.0;

IF VACUUM PUMP HAS BEEN IN BLOWING MODE: Switches vacuum pump off and resumes cutting after specified time, 3.0 seconds.

Comment:
Instruction: **PC5**

Group: Production control  
HPGL Level: ARISTO specific HPGL  
Recommended: Production Control

**Parameter:**  
**Time**

Param. Type: Double  
Scaled: -  
Return Value: -  
Range: 0 .. 9.999 [s]

**Since:** V2.02

Function: Waits the specified delay time

**Default:** 0

Example: PC5,2.5;  
Interrupts job at present position (with tool position up or down) and resumes job after 2.5 seconds.

Comment:
Instruction: **PC6**

- **Parameter:** -
- **Param. Type:** -
- **Scaled:** -
- **Range:** -
- **Return Value:** -

**Group:** Production control  
**HPGL Level:** ARISTO specific HPGL  
**Recommended:** Production Control  
**Definition:** Production Control  
**Since:** V2.02  
**last changes V3.23**

**Function:** Automatic repetition of the plot memory with the drive switch and switching vacuum off at the end of the plot

**Default:** -

**Example:**

```
PC6;
```

Machine stops, switches off vacuum and motor drives. Upon pressing "green" key, job is re-started from machine memory. This command must be positioned at end of HPGL file. Typical machine loading/unloading situation.

**Comment:** Compare also PC9, PC10 and PC12
**Instruction:**

**PC7**

**Parameter:** Filter

- **Param. Type:** Double
- **Scaled:** -
- **Return Value:** -
- **Range:** 0 .. 7

**Group:** Processing parameters
**HPGL Level:** ARISTO specific HPGL
**Recommended:**
**Definition:** Production Control

**Since:** V2.07
**last changes V3.3**

**Function:** The internal contour smoothing filter operator is set to specified level

**Default:** 2

**Example:**

```
PC7,0;
```

Switches all contour smoothing off.

**ATTENTION:** This will lead to extreme precision of movement, at cost of throughput. USE WISELY.

**Comment:** The meaning of these parameters is:

- **0:** no filtering
- **1 .. 6:** filter level 1 to 6
- **7:** string filter

For filter behaviour refer to plotter manual

The string filter adds vectors until the resuming chordt tolerance exceeds the chordt tolerance set in the menu or with HPGL command CT.
Instruction: PC8

Parameter: Switch, Time

Group: Processing parameters
HPGL Level: ARISTO specific HPGL
Recommended:
Definition: Production Control

Since: V2.06

Param. Type: Double
Scaled: -
Return Value: -
Range: 1 / 2,
0 .. 9.999 [s]

Function: SPECIAL COMMAND FOR WATER JET OR SIMILAR: Set times for forerun or afterrun of the waterjet

Default: -

Example: PC8,1,2;PC8,2,4;

IF WATERJET IS FITTED: Machine stops, switches water jet on, waits 2 seconds before moving on. At stopping point, machine will wait 4 seconds before switching water jet off and move to new object.

Comment: Both parameters are required in a valid range, if one or more is missing or is invalid the command is ignored
Instruction: PC9

Parameter: (Time)

Group: Production control
HPGL Level: ARISTO specific HPGL
Recommended:
Definition: Production Control

Since: V2.07
last changes V3.23

Function: Automatic repetition of the plot memory with the drive switch, switching vacuum off at the end of the plot and switching vacuum on at the start of the plot

Default: 0

Example: PC9;
Machine stops at end of job, switches vacuum off. Upon keypress "green" vacuum pump is switched on, machine will wait specified delay time and job is restarted from machine memory.

Comment: Waits after execution if specified. Compare also PC6, PC10 and PC12
ARISTO Data Interface Description Database

**Instruction:**

**PC10**

**Parameter:**

(Time)

**Group:** Production control

**HPGL Level:** ARISTO specific HPGL

**Recommended:**

**Definition:** Production Control

**Since:** V2.07

last changes V3.23

**Function:** Automatic repetition of the plot memory with the drive switch, switching blowing on at the end of the plot and again switching vacuum on at the start of the plot

**Default:** 0

**Example:**

PC10;

PC10 defines end of production cycle. Machine will stop, reverse vacuum to blowing, and wait for operator to press green key to repeat full production cycle after specified delay time. This command must be at absolute end of HPGL file.

**Comment:** Waits after execution if specified. Compare also PC6, PC9 and PC12

**Param. Type:** Double

**Scaled:** -

**Return Value:** -

**Range:** 0 .. 9.999 [s]
**Instruction:**

**PC11**

Parameter: **Thickness**

- **Param. Type:** Double
- **Scaled:** -
- **Return Value:** -
- **Range:** 0, 1, 2, 3

**Group:** Processing parameters  
**HPGL Level:** ARISTO specific HPGL  
**Recommended:**  
**Definition:** Production Control

**Since:** V2.07

**Function:** ONLY IN CONNECTION with "Standard" Toolhead: The lower the tool is lifted above the material, the shorter the overall cutting time. However, if tool is lifted unsufficiently, this may cause tool error.

**Default:** 0

**Example:**  
```
PC11,1;
```

IF STANDARD CUTTING TOOLHEAD IS FITTED: Sets characteristics of tool lifting to approx thickness of material. "Medium", representing a lifting of 1.5mm approx.. This command may shorten cutting time.

**Comment:** The thickness levels are  

- 0: Thin  
- 1: Medium  
- 2: Thick  
- 3: Masking Film  

The correct setting of material thickness is only important for the standard cutting device.
Instruction: **PC12**

- **Parameter:** -
- **Param. Type:** -
- **Scaled:** -
- **Return Value:** -
- **Range:** -

**Group:** Production control

**HPGL Level:** ARISTO specific HPGL

**Recommended:**
- **Definition:** Production Control

**Since:** V3.0
**last changes V3.23**

**Function:** Automatic repetition of the plot memory with the drive switch and without activating blowing or vacuum

**Default:** -

**Example:**

```
PC12;
```

This command is equivalent with PC 10, PC 6, PC9, except in this case the vacuum pump action is not affected.

**Comment:** Compare also PC6, PC9 and PC10
Instruction: **PC13**

Group: Material advance  
HPGL Level: ARISTO specific HPGL  
Recommended:  
Definition: Production Control  
Since: V3.0

Parameter:  
(Length)  
Param. Type: Double  
Scaled: no  
Return Value: -  
Range: 0 .. Xmax [units]

**Function:** Page advance backwards by the actual page length or by the given length

**Default:** Xmax

**Example:**  
PC13;  
IF MATERIAL TRANSPORT MEANS IS FITTED: As length parameter is omitted here, command moves material back over full length of machine. In connection with parameter for length, this would instruct machine to move back as specified.

**Comment:** Xmax is the length of the plotter. This command works complementarily to the PG command
Instruction: **PC14**

Parameter: Pmax, Pmin, Pp1, Dp1, Pp2, Dp2

- **Group**: Processing parameters
- **HPGL Level**: ARISTO specific HPGL
- **Recommended**: Production Control

Since: V3.3

**Function**: Sets the power parameter for start- and end pulse for laser cutting

**Default**: -

**Example**: PC14,100,5,0,0,0,0;

**SPECIAL COMMAND IF LASER IS FITTED**: see below.

**Comment**: The meaning of these parameters is:
- Pmax / Pmin: max. and min. used power
- Pp1 / Pp2:  power of the pulse at beginning and end of a contour with lowered tool
- Dp1 / Dp2:  duration of the pulse at beginning and end of a contour with lowered tool

All parameters are required in a valid range, if one or more is missing or is invalid the command is ignored.
Instruction: **PC15**

Parameter: Before, After, Corner, Start

**Group:** Processing parameters

**HPGL Level:** ARISTO specific HPGL

**Recommended:**

**Definition:** Production Control

**Since:** V3.3

**Param. Type:** Double

**Scaled:** -

**Return Value:** -

**Range:**
- 0 .. 9.9 [s], 0 .. 99 [s],
- 0 .. 0.999 [s], 0 .. 0.999 [s]

**Function:** Sets the process times for laser cutting

**Default:** -

**Example:** PC15,2.5,10.6,0,0;

LASER COMMAND: similar to PC 14; see below for specific action

**Comment:** The meaning of these parameters is:
- **Before:** time between the lower command and the pulse at beginning of the plotted contour
- **After:** time counted after the pulse at end of the plotted contour for additional devices (e.g. cooling)
- **Corner:** time that is waited in a recognized corner
- **Start:** time between the pulse at begin of a lowered contour and the contour itself

All parameters are required in a valid range, if one or more is missing or is invalid the command is ignored
Instruction: **PC16**

Parameter: -

Group: Processing parameters
HPGL Level: ARISTO specific HPGL
Recommended: -
Definition: Production Control

Since: V3.23

Function: Switches the plotter to "offline" mode and switches the drives off. Then the plotter is waiting for pressing the drive "green" key to continue the interrupted plot

Default: -

Example: PC16;
If this command comes up, machine will stop moving -where it is- and allow operator to remove parts, before re through pressing of key the machine will continue.

Comment: To continue the plot you only need to press the green button (drives on).
Attention: You do not have to press the Start/Stop key at the panel like usual, the plotter starts directly after pressing the drives button.

Instruction: **PC17**

Parameter: On/Off

- Group: Processing parameters
- Param. Type: Double
- Scaled: -
- Return Value: -
- Range: 0 / 1

**Group:** Processing parameters  
**HPGL Level:** ARISTO specific HPGL  
**Recommended:**  
**Definition:** Production Control  
**Since:** V3.23

**Function:** ONLY IF PASSEPARTOUT TOOL IS FITTED: Switches between the tool type 'Passepartout Smart' and 'Passepartout' at the tool head oscillator.

**Default:** 1

**Example:**  
```
PC17,0;
```

**WITH PASSEPARTOUT TOOL:** Blade only is retracted from material, while toolhead itself is not lifted up.

**Comment:** "The meaning of these parameters is:

- 0: Corner lifting off - tool type = Passepartout Smart
- 1: Corner lifting on - tool type = Passepartout"
**Instruction:**

**PC18**

**Group:** Processing parameters

**HPGL Level:** ARISTO specific HPGL

**Recommended:**

**Definition:** Production Control

**Since:** V3.3

**Parameter:** On/Off

**Param. Type:** Double

**Scaled:** -

**Return Value:** -

**Range:** 0 / 1

**Function:** ONLY IN CONNECTION WITH OSCILLATING MULTIHEAD: Switches the oscillation action of the one oscillating tool on or off. ATTENTION: If used when non-scillating tool is active, this will be ignored.

**Default:** 1

**Example:**

PC18,1;

IF OSCILLATING MULTI-TOOLHEAD IS FITTED AND OSCILLATING TOOL IS CURRENTLY ACTIVATED THROUGH "SP" COMMAND: Switches oscillation ON.

**Comment:** "The meaning of these parameters is:

0: Oscillating off - tool type = Blade
1: Oscillating on - tool type = Oscillator"
Instruction: **PC19**

Parameter: **Sync**

- **Param. Type:** Double
- **Scaled:** -
- **Return Value:** -
- **Range:** 0 / 1

Group: Production control

HPGL Level: ARISTO specific HPGL

Recommended:

Definition: Production Control

Since: V3.3

Function: IF EXTRA VACUUM PUMP IS FITTED: Switches extra vacuum pump and to synchronous vacuum mode with standard fitted pump.

Default: -

Example:

```
PC19,0;
```

Switches extra vacuum pump -where fitted- to OFF. To reactivate pump, another PC19,1 will be required.

Comment: The extra vacuum pump is synchronous switched with the first pump by default. This command allows to deaktivate the vacuum direction of the extra pump, the blow direction still remains synchronous. If the the parameter Sync is set to 0 the extra pump is switched off when the the first pump is sucking. If Sync is set to 1 the extra pump gets in the same state as the first pump is (off or vacuum).
### Instruction: **PC20**

**Group:** Processing parameters  
**HPGL Level:** ARISTO specific HPGL  
**Recommended:**  
**Definition:** Production Control  
**Since:** V3.3

<table>
<thead>
<tr>
<th>Parameter: DeltaForce</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Param. Type:</strong> Double</td>
</tr>
<tr>
<td><strong>Scaled:</strong> -</td>
</tr>
<tr>
<td><strong>Return Value:</strong> NewForce</td>
</tr>
<tr>
<td><strong>Range:</strong> -29 .. 29</td>
</tr>
<tr>
<td><strong>Ret. Val:</strong> 0 .. 29</td>
</tr>
</tbody>
</table>

**Function:** **ONLY IF ELECTRONIC STANDARD TOOL IS FITTED:** Increase or decrease tool force (i.e. downward pressure) relative to present setting.

**Default:** -

**Example:**  
PC20,3;  
Increases tool pressure by three "notches".

**Comment:** The tool force will be in/decreased by the DeltaForce. If the new tool force exceeds the menu range, it will automatically set to the maximum or minimum value.  
Without a parameter this command returns the actual tool force.
Instruction: **PC21**

Parameter: BeginComp, EndComp

Param. Type: Double

Scaled: no

Return Value: -

Range: 0..800, 0..800 [units]

Group: Production control

HPGL Level: ARISTO specific HPGL

Recommended: Production Control

Since: V3.3

**Function:** The overcut will be reduced by the given length at the begin or the end of an vector. This command is useful for wheel blades or similar tools.

**Default:** -

**Example:**

```
PC21,200,200;
```

Causes an overcut reduction of 5mm at the begin and at the end of an vector.

**Comment:** If you do cut material with a wheel blade you get an overcut at the begin and end of an lowered vector. Begin means an change between raised and lowered, end means an change between lowered and raised or in both cases if there is a corner between two lowered vectors where the tool must be raised (e.g. when the angle between the two vectors exceed the upper angle in menu). Both parameters are required. If one or both is missing or they exceed the valid range the command is ignored.
Instruction: **PC22**

Group: Processing parameters
HPGL Level: ARISTO specific HPGL
Recommanded: Production Control
Definition: Production Control

Parameter: On/Off

Param. Type: Double
Scaled: -
Return Value: -
Range: 0 / 1

Since: V3.3

Function: Switches speedbooster on or off.

Default: -

Example: PC22,1;
Switches speedbooster on.

Comment: The speedbooster is not longer a special smoothing level, but can be used with any smoothing level. Therefore the PC7 command has changed as well.
Instruction: PC23

Group: Production control
HPGL Level: ARISTO specific HPGL
Recommanded:
Definition: Production Control
Since: V3.3

Function: The machine moves to the farthest end, similar to pressing the VIEW button.

Default: -

Example: PC23;
The machine moves to the farthest end, similar to pressing the VIEW button.

Comment: This command is used to ease the operator the work at the end of a job. The operator only has to switch off the drives before he can pick the cutted pieces from the machine. The complete working area is accessible, because independent from the machine size the tool head always moves to the very far end of the machine.
Instruction: **PC24**

Parameter: On/Off

Group: Material advance

HPGL Level: ARISTO specific HPGL

Recommended: 
Definition: Production Control

Since: V3.3

Function: Switches the scaling mode of the material advance length on or off.

Default: -

Example: PC24,1;

Switches the scaling of the material advance length on. The advance length given with the PG or PC13 commands is scaled with the scaling set at the machines menu AND the HPGL scaling with the commands IP and SC.

Comment: This command enables the scaling of the material advance length given by the PG or PC13 command. The HPGL commands Af and AH are not affected.
**Instruction:** PC25

Parameter: 
- 

**Group:** Machine info response
**HPGL Level:** ARISTO specific HPGL
**Recommended:**
**Definition:** Production Control

**Since:** V3.6

**Function:** Outputs the drawing origin which is set

**Default:** -

**Example:** PC25;"0,0"

**Param. Type:**
- 

**Scaled:** no

**Return Value:** Xo,Yo
**Range:** -, - [units]

**Comment:** Returns the coordinates of the drawing origin relative to the machine's internal origin
Instruction: \textbf{PC26}

Group: Positioning and Scaling  
HPGL Level: ARISTO specific HPGL  
Recommended:  
Definition: Production Control  
Since: V3.6  

Parameter: \(X,Y\)  
Param. Type: Double  
Scaled: no  
Return Value: -  
Range: 0 .. Max [units]  

Function: Set origin to the named point

Default: -  
Example: \texttt{PC26,400,400;}

Comment: Valid Max is depending on the plotter size
Instruction: PR

Parameter: (X,Y(X,Y))

Group: Geometry description
HPGL Level: Historic HPGL
Recommended: yes
Definition: Plot Relative

Since: earlier than V2.0

Function: Plots, in order of coordinate pairs added, to the points indicated by the X,Y increments, relative to the previous tool position using current tool up/down status

Default: -

Example: PR0,400,400,0,0,-400,-400,0;
IF TOOL IS LOWERED PREVIOUSLY, machine moves tool around a square of 400 plotter units length, clockwise.

Comment: A complete set of coordinates is required. If one of the two coordinates is missing the command is ignored.
Instruction: **PU**

**Group:** Geometry description

**HPGL Level:** Historic HPGL

**Recommended:** yes

**Definition:** Pen Up

**Since:** earlier than V2.0

**Parameter:** 

$(X,Y(X,Y))$

**Param. Type:** Double

**Scaled:** yes

**Return Value:** -

**Range:** -, - [units]

**Function:** Plots to the $X,Y$ coordinates in the order listed with raised tool using current tool absolute/relative status

**Default:** -

**Example:** `PU0,0;`

IF MODE WAS PREVIOUSLY SET TO "RELATIVE", tool will be raised only, but not move. IF MODE WAS ABSOLUTE, tool will raise and move to job origin (resp. datum).

**Comment:** A complete set of coordinates is required. If one of the two coordinates is missing the command is ignored.
Instruction: **PV**

Group: Production control
HPGL Level: ARISTO specific HPGL
Recommended:
Definition: Punch V
Since: V3.3

Parameter: X, Y, Width, Depth, Angle
(,Length, Forerun, Overl)
Param. Type: Double
Scaled: yes
Return Value: -
Range: -, -, [units] <= 0 , <= 0 [0.025mm]
0 .. 360, [°]
<= 0 , <= 0 , <= 0 [0.025mm]

Function: FOR TEXTILE: Punches a V notch at the given position with the geometry specified

Default: -, -, -, -, 200, 0, 40

Example: PV800,400,400,600,90;
At position -absolute- 800, 400 units, machine will punch V notch 400 units wide at opening, 600 units "high", with absolute orientation of 90 degrees against -current- machine coordinates orientation.

Comment: X and Y are the coordinates where the V shall be punched. These coordinates are scaled if scaling is activ.

Width is the opening of the V and Depth is the depth. Angle is the angle between the positive x-axis and the peek of the V.
Length, Forerun and Overlap are optional and knife depending papameters.
Neither of those six parameters are scale
Instruction: **RO**

**Group:** Positioning and Scaling
**HPGL Level:** Historic HPGL
**Recommended:**
**Definition:** Rotate Coordinate System

Since: earlier than V2.0

Parameter: Angle

- **Param. Type:** Double
- **Scaled:** no
- **Return Value:** -
- **Range:** 0 / 90 [°]

**Function:** Rotates the coordinate system 90° against at the plotter coordinate origin, or reverses that back to normal.

**Default:** -

**Example:**
RO90;
Rotates coordinate system 90° clockwise. Command may be useful when changing existing job from "portrait" to "landscape" orientation.

**Comment:**
Instruction: RT

Parameter: Lower Angle

Group: Processing parameters
HPGL Level: ARISTO specific HPGL
Recommended: yes
Definition: Lower Angle

Since: earlier than V2.0

Param. Type: Double
Scaled: no

Return Value: -
Range: 0 - 45 [°]

Function: The lower angle defines the threshold angle below and until where the machine will stop, turn the tool without forward movement and move on subsequently. The tool is not lifted for turning.

Default: 10

Example: RT20;
Machine turns lowered tool by force in case angle does not exceed 20°.

Comment: Important for cutting quality
This command affects all tools with non MultiHead systems, and only the actual tool position with MultiHead systems.

File: HPGL Datenbank.wdb
S. Rathke / H. Schier
Date: 22. Februar 2001
ARISTO Data Interface Description Database

Instruction: **RY**

Parameter:

- Group: Key Machine Configuration
- HPGL Level: ARISTO specific HPGL
- Recommended:
  - Definition: Reference Y-Axis
- Since: V3.0

Function: Executes reference moves on Y axis

Default:

- Example:
  
  RY;

  Machine lifts tool, does new origin referencing cycle in Y direction. Then returns. ATTENTION: see comment below.

Comment: This command may be used to advantage in precision sensitive cases to compensate any minor machine drive slipping from time to time, especially where routing or heavy toolheads and high acceleration occur. However, this command must be used wisely only at end or beginning of new job, as it will alter the machines' coordinate system. DO NOT USE INSIDE CONTOURS!!!

BTW: There is no "RX" command, because ARISTOMAT machines use a rack and pinion drive in the X axis, so there cannot be or develop any slip an that X axis.
Instruction: **SC**

Parameter: Xmin,Xmax;Ymin,Ymax

Param. Type: Double

Scaled: no

Return Value: -

Range: -,-,-,- [units]

Group: Positioning and Scaling

HPGL Level: Historic HPGL

Recommended: yes

Definition: Scale

Since: earlier than V2.0

Function: Scales the plotting area set with IP command into user units

Default: -

Example: SC0,10,0,10;

In connection with previously set command IP0,0,1,1 overcomes historic HP definition of flatbed machine with datum in center of table and rough resolution.

Comment: For ultimate precision programming and best speed performance ARISTO recommends experienced programmers to use initial IP0,0,1,1; SC0,10,0,10 string and subsequently plotter units which are tenfold against HP standard resolution. The reasons are complex and difficult to explain, but it works much better that way.
ARISTO Data Interface Description Database

Instruction: **SO**

Group: Positioning and Scaling
HPGL Level: ARISTO specific HPGL
Recommanded: yes
Definition: Set Origin
Since: earlier than V2.0

Parameter: -
Param. Type: -
Scaled: -
Return Value: -
Range: -

Function: The drawing origin is set at the actual position

Default: -

Example:

```
SO;
```
Sets new origin resp. datum at current position. VERY useful for chainlinked jobs!

Comment: Useful to move the drawing origin on the table at the end of the plot
Instruction: SP

Parameter: Position

Group: Processing parameters
HPGL Level: ARISTO modified HPGL
Recommended: yes
Definition: Select Pen

Since: earlier than V2.02
last changes V3.4

Function: Selects among available tools.

Default: 0

Example: SP6;
ONLY IF MARKER PEN IS AVAILABLE: defines marker pen to follow next instructions resp. contour.
IF MARKER PEN IS NOT PRESENT: Machine will not lower tool, but move.

Comment: MultiHead systems: SP1 = position 1 (creasing wheel), SP2 = position 2 (blade), SP3 = position 3 (marker),
SP4 = position 4 (laser pointer)
All other heads: SP6 = marker, all other numbers = main tool (blade)
On all heads (incl. MultiHead): SP81 = laser pointer, SP91 = camera

Param. Type: Double
Scaled: -
Return Value: -
Range: 0 .. 100

Instruction: **TD**

Parameter: **Tool**

- **Group:** Processing parameters
- **HPGL Level:** ARISTO specific HPGL
- **Recommended:** yes
- **Definition:** Tool type Drill
- **Since:** V3.0

**Param. Type:** Double

**Scaled:** -

**Return Value:** -

**Range:** 0 / 1

**Function:** Switches between the tool types router and drill

**Default:** 0

**Example:**

```
TD0;
```

Machine configures itself for Router (Milling) operation. In this mode, a move command is carried out with tool "Down" all the way. If set to "1" for drill, Machine would move with tool "up" and lower only at end of movement vector.

**Comment:** 0 (Router) or 1 (Drill)

This command has only effect on the router tool head. A HOT COMMAND!!! As historic HPGL had no intentions for drilling operations as many application require today, this is a very nice add on for us.
**Instruction:** TR

**Parameter:** On/Off

**Group:** Processing parameters

**HPGL Level:** ARISTO specific HPGL

**Recommended:**
- **Definition:** Tangential Control

**Since:** earlier than V2.0

**Function:** Enables or disables the tangential control

**Default:** 1

**Example:**

```
TR1;
```

Switches currently selected tool -where applicable- to Tangentially Controlled operation.

**Comment:**
- 0 - Off, 1 - On
- This command has only effect on the standard cutting device

**Param. Type:** Double

**Scaled:** -

**Return Value:** -

**Range:** 0 / 1

**ARISTO Data Interface Description Database**

**Instruction:**

**VS**

**Parameter:** Velocity (,Tool number)

**Group:** Processing parameters

**HPGL Level:** ARISTO modified HPGL

**Recommended:** yes

**Definition:** Velocity Select

**Since:** earlier than V2.0

**Function:** Set velocity for the tool

**Default:** 5

**Example:**

```
VS3.5;
```

Sets maximum speed of currently selected tool to \((3.5/5) = \text{approx. 70\% of max. speed.}\)

**Comment:** On the ARISTOMAT, an optional tool number is ignored, the command affects the active tool only

\[
1 \leftrightarrow 200\%, \quad 2 \leftrightarrow 400\%, \quad 3 \leftrightarrow 600\%, \quad 4 \leftrightarrow 800\%, \quad 5 \leftrightarrow 1000\%, \quad 6 \leftrightarrow 1200\%,
\]

Since V3.3 the increased speed (up to 1200\%) is only available on ARISTOMAT II machines.

Since V3.4 the increased speed is available on every new ARISTOMAT machine

**Param. Type:** Double

**Scaled:** -

**Return Value:** -

**Range:** 0 .. 6

File: HPGL Datenbank.wdb

S. Rathke / H. Schier

Date: 22. Februar 2001
### Instruction: WD

**Terminated string**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Terminated string</th>
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</thead>
<tbody>
<tr>
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<td>-</td>
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<tr>
<td>Return Value</td>
<td>-</td>
</tr>
<tr>
<td>Range</td>
<td>Printable char.</td>
</tr>
</tbody>
</table>

**Group:** Character setting  
**HPGL Level:** ARISTO specific HPGL  
**Recommended:**  
**Definition:** Write Display  
**Since:** earlier than V2.0

**Function:** Outputs letter string to LCD display at machine keypanel

**Default:** -

**Example:**

```
WDhello world! \3;
```

On machine keypanel LCD display appears "hello world!".

**Comment:** Only 24 characters should be used if the plot time option is used. NOTE: The above "\3" represents the hexadecimal value of the string terminator, here "3".
Instruction: **WK**

Parameter: -

Group: Special
HPGL Level: ARISTO specific HPGL

Recommended:
Definition: Wait Key

Since: V3.0

Function: Writes "Continue with Enter" on the LCD and waits for pressing of "ENTER" key (or any other key)

Default: -

Example:  

```
WK;
```

IF NO VECTORS FOLLOW: Machine stops. LCD display on keypanel will display "Continue with ENTER". Upon pressing ENTER key, machine will send "CR" signal to computer. WITH vectors following, machine will not wait for key.

Comment: ONLY USEFUL FOR ONLINE, INTERACTIVE control of machine. Typical case: the job requires the operator to check something while job is running. If operator is not present at that time, job will be interrupted until operator returns and presses key for continuation.

Return Value: Empty string representing <CR>

Param. Type:
Scaled: -
Range: -

HPGL Level: ARISTO specific HPGL
Param. Type: Recommended: Special
Since: V3.0

Instruction: **ESC.(**

Parameter: -

Group: Key Machine Configuration DCI

HPGL Level: Historic HPGL

Recommended: -

Definition: Programmed On

Since: earlier than V2.0

Function: Switches Com-port of the plotter in the programmed-on status

Default: -

Example: ESC.(:

Opens serial interface of plotter for further communication with computer.

Comment: Same as ESC.Y
Instruction: ESC.)

Parameter: -

Group: Key Machine Configuration DCI
HPGL Level: Historic HPGL
Recommended:
Definition: Programmed Off

Since: earlier than V2.0

Function: Switches Com-port of the plotter in the programmed-off status

Default: -

Example: ESC.):
Closes serial port of machine to further data communication; waits for next "ESC. (" instruction.

Comment: Same as ESC.Z
Instruction: ESC.@

Parameter: (Buffer size); Handshake mode

Group: Key Machine Configuration DCI
HPGL Level: ARISTO modified HPGL
Recommended:
Definition: Configuration Port

Since: earlier than V2.0

Function: Configuration Com ports parameter

Default: 0

Example: ESC.@;0:
Sets handshake to hardware handshake (see also ESC.I, ESC.H, ESC.P etc.)

Comment: Buffer size is ignored;
Handshake mode = 0 (or all even numbers) hardwired,
Handshake mode = 1 (or all odd numbers) Xon-Xoff

Param. Type: Integer
Scaled: -
Return Value: -
Range: 0 / 1
Instruction: ESC.A

Group: Machine info response DCI
HPGL Level: Historic HPGL
Recommended:
Definition: Output Identification

Since: earlier than V2.0

Function: Outputs a fixed string only for compatibility

Parameter:

Default:

Example: ESC.A:
Machine -always- responds: "AG 130 Signline L2.00"

Comment: This fixed string is not to be updated for compatibility causes
Instruction: **ESC.B**

Parameter: -

Group: Machine info response DCI

HPGL Level: Historic HPGL

Recommended:

Definition: Output Buffer Space

Since: earlier than V2.0

Function: Outputs the number of currently free memory locations in the plotter buffer

Default: -

Example: **ESC.B:**

Machine responds for instance "2097152" if currently free input memory is approx. 2MB

Comment: Maximum size depending on the plotter memory option: 32k, 400k or 2000k byte
Instruction: ESC.E

Parameter: -

Group: Machine info response DCI
HPGL Level: Historic HPGL
Recommanded:
Definition: Output Extended Error

Since: earlier than V2.0

Function: Outputs extended I/O error status

Default: -

Example: ESC.E
Machine responds "00" if no error occurred; "15" if framing error was detected.

Comment: "00": No error
"10": Output instruction received during data output; the last received instruction is ignored
"11": Invalid byte received after ESC.
"12": Invalid byte within a parameter of a ESC sequence
"13": Parameter is not in the premissible range
"14": Too many parameters received
"15": Interface error (framing, overrun, parity) was found
"16": Character buffer overflow. Handshake was not processed. Data is lost due to the error

Param. Type: -

Scaled: -

Return Value: Error code

Range: 00 .. 16
Instruction: ESC.H

Parameter: Level; (Enq.Char); TriggerChar.

Param. Type: Integer
Scaled: -
Return Value: -
Range: Level: 0 .. Memmax [byte]; Trigger Character: 0 .. 127

Definition: Set Handshake Mode

Function: Sets handshake mode and for Xon-Xoff protocol Xoff threshold level and Xon trigger character

Default: without parameter

Example: ESC.H256;;17:
Set level to 256 byte below max. avail. memory; Enq. Char. omitted; Trigger character 17

Comment: Enquire Character is ignored
Enquire/Acknowledge is not supported
Without Parameter: hardwired handshake is established
Same as ESC.I

ARISTO Data Interface Description Database

Group: Key Machine Configuration DCI
HPGL Level: ARISTO modified HPGL
Recommanded: Since: earlier than V2.0

Instruction: **ESC.I**

Parameter: Level; (Enq.Char); TriggerChar.

- **Param. Type:** Integer
- **Scaled:** -
- **Return Value:** -
- **Range:** 0 .. Memmax [byte]; 0 .. 127

Group: Key Machine Configuration DCI

HPGL Level: ARISTO modified HPGL

Recommended:
Definition: Set Handshake Mode

Since: earlier than V2.0

Function: Sets handshake mode and for Xon-Xoff protocol Xoff threshold level and Xon trigger character

Default: without parameter

Example:

```
ESC.I:  
Sets handshake mode to hardware handshake
```

Comment: Enquire Character is ignored
Enquire/Acknowledge is not supported
Without Parameter: hardwired handshake is established
Same as ESC.H

Instruction: ESC.K

Parameter: -

Group: Key Machine Configuration DCI
HPGL Level: Historic HPGL
Recommended:
Definition: Abort Graphic Instruction
Since: earlier than V2.0

Function: Aborts any partially decoded HPGL instruction

Default: -

Example:

ESC.K:
Machine stops after current vector and cannot continue. However, all data in memory are kept intact.

Comment: Actual instruction is executed to finish
Instruction: ESC.L

Parameter: -

Group: Machine info response DCI
HPGL Level: Historic HPGL

Recommended:
Definition: Output Buffer Size

Since: earlier than V2.0

Function: Outputs the available buffer size

Default: -

Example: ESC.L:
Machine responds: "32768" as installed buffer size, regardless of actual buffer usage

Comment: Maximum size depending on the plotters memory option: 32k, 400k or 2000k byte

Param. Type:
Scaled: -

Return Value: Memsize
Range: 32768 .. 2097512 [byte]
Instruction: ESC.N

Parameter: (Inter char delay,) Trigger character

Group: Key Machine Configuration DCI
HPGL Level: ARISTO modified HPGL
Recommended:
Definition: Set Xoff trigger character
Since: earlier than V2.0

Function: Sets inter character delay and Xoff trigger character

Default: 19

Example: ESC.N;19:

Comment: Inter character delay is ignored
Instruction: ESC.O

Parameter: -

Group: Machine info response DCI
HPGL Level: Historic HPGL
Recommended:
Definition: Output Extended Status

Since: earlier than V2.0

Function: Outputs the current equipment status

Default: -

Example: ESC.O:
Machine responds "8": "Buffer is currently empty" (see below)

Comment: "0": Plotter is processing a stored instruction
"8": Buffer is empty; plotter is waiting, ready to receive data
"16": View key is pressed
"32": Plotter is offline
"2^29": MenuPosition is active
"2^30": Tool head is MultiHead
"2^31": Plotter is online

Return Value: Status
Range: 0 .. 24

Param. Type: -
Scaled: -
Instruction: **ESC.P**

**Parameter:** Handshake mode

- **Param. Type:** Integer
- **Scaled:** -
- **Return Value:** 0 .. 3
- **Range:**

**Group:** Key Machine Configuration DCI  
**HPGL Level:** ARISTO modified HPGL  
**Recommended:**  
**Definition:** Set Handshake Mode  
**Since:** earlier than V2.0  
**last changes V3.3**

**Function:** Sets handshake mode either to hardwired or Xon-Xoff

**Default:** 3

**Example:**

```
ESC.P1:  
Sets handshake to Xon/ X0ff.
```

**Comment:** 
"0": Outputs the port settings in a text string, seperated with a comma between the options like:
  "Handshake, Baud rate, Bits per Byte, Parity and Stopbits"

"1": Xon-Xoff handshake  
"2": not supported  
"3": hardwired handshake
Instruction: ESC.R

Parameter: -

Group: Key Machine Configuration DCI
HPGL Level: ARISTO modified HPGL

Recommended:
Definition: Reset Handshake

Since: earlier than V2.0

Function: The unit carries on operation with hardwired handshake

Default: -

Example: ESC.R:
Sets protocol to hardwired (i.e. hardware) handshake

Comment: The effect of the instruction is identical to ESC.@:
Instruction: **ESC.S**  

**Group:** Machine info response DCI  
**HPGL Level:** ARISTO modified HPGL  
**Recommanded:**  
**Definition:** Output Buffer Size  
**Since:** earlier than V2.0  

**Parameter:** (Buffer number)  
**Param. Type:** Integer  
**Scaled:** -  
**Return Value:** Memsize  
**Range:** 32768 .. 2097512 [byte]  

**Function:** Outputs the available buffer size  

**Default:** -  

**Example:**  
**ESC.S:**  
Machine responds “32768” as currently available -free- buffer size (in byte).  

**Comment:** Buffer number is ignored, therefore same result as ESC.L
Instruction: ESC.Y

Parameter: -

Group: Key Machine Configuration DCI
HPGL Level: Historic HPGL

Recommended:
Definition: Programmed On

Since: earlier than V2.0

Function: Switches Com-port of the plotter in the programmed-on status

Default: -

Example: ESC.Y:
Opens serial interface of plotter for further communication with computer.

Comment: Same as ESC.(}
Instruction: ESC.Z

Parameter: -

Group: Key Machine Configuration DCI
HPGL Level: Historic HPGL
Recommended: -
Definition: Programmed Off
Since: earlier than V2.0

Function: Switches Com-port of the plotter in the programmed-off status

Default: -

Example:
ESC.Z:
Closes serial port of machine to further data communication; waits for next "ESC.Y" instruction.

Comment: Same as ESC.

File: HPGL Datenbank.wdb
S. Rathke / H. Schier
Date: 22. Februar 2001
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<th>Instruction</th>
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<tbody>
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<td>ESC.)</td>
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<td>ESC.A</td>
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<td>ESC.B</td>
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<tr>
<td>ESC.H</td>
<td>Sets handshake mode and for Xon-Xoff protocol Xoff threshold level and Xon trigger character</td>
<td>Key Machine</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td></td>
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<td>Configuration DCI</td>
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</tr>
<tr>
<td>ESC.I</td>
<td>Sets handshake mode and for Xon-Xoff protocol Xoff threshold level and Xon trigger character</td>
<td>Key Machine</td>
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<tr>
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<td>ESC.K</td>
<td>aborts any partially decoded HPGL instruction</td>
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<td></td>
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<tr>
<td>ESC.L</td>
<td>Outputs the available buffer size</td>
<td>Machine info response</td>
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<tr>
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<tr>
<td>ESC.R</td>
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<td>AF</td>
<td>Programmatically advances roll material one full-page length</td>
<td>Material advance</td>
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<td>Programmatically advances roll material one half-page length</td>
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<tr>
<td>AR</td>
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<td>Geometry description</td>
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<td>Sets acceleration for the active tool</td>
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<tr>
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<td>Reads the label, but does not store it</td>
<td>Character setting</td>
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<td>CR</td>
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<tr>
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<tr>
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<td>earlier than V2.0</td>
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<tr>
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<td>Positioning and Scaling</td>
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<tr>
<td>LB</td>
<td>Reads the label, but does not plot it</td>
<td>Character setting</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>MS</td>
<td>Sets ARISTOMAT to a special scan mode for special scanner hardware</td>
<td>Special</td>
<td>V3.15</td>
</tr>
<tr>
<td>NR</td>
<td>Switches the plotter in offline mode</td>
<td>Key Machine Configuration</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>Instruction</td>
<td>Function</td>
<td>Group</td>
<td>Since</td>
</tr>
<tr>
<td>-------------</td>
<td>----------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>OA</td>
<td>Outputs the current physical tool position</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OC</td>
<td>Outputs the tool position associated with last valid tool position instruction</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OD</td>
<td>Outputs the tool position associated with last valid tool position instruction</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OE</td>
<td>Outputs the last HPGL error</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OF</td>
<td>Outputs the number of unscaled HPGL units per millimeter in X- and Y-axes</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OH</td>
<td>Outputs the hard-clip limits at the time the instruction was received</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OI</td>
<td>Outputs the selected plotter emulation</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OL</td>
<td>Outputs information on the label contained in the buffer</td>
<td>Character setting</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OO</td>
<td>Outputs implemented options</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OP</td>
<td>Outputs the plotter unit coordinates of the scaling points P1 and P2</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OS</td>
<td>Outputs the status of the plotter</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OT</td>
<td>Outputs the installed carousel type</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OV</td>
<td>Outputs the firmware version</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OW</td>
<td>Outputs the coordinates of the points set by the IW command</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>PA</td>
<td>Plots to the X,Y coordinates in the order listed using current tool up/down status</td>
<td>Geometry description</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>PC0</td>
<td>Clears production control mode status (normal plotter function)</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td>PC1</td>
<td>Switches on vacuum and waits default waiting time or specified waiting time</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td>PC10</td>
<td>Automatic repetition of the plot memory with the drive switch, switching blowing on at the end of the plot and again switching vacuum on at the start of the plot</td>
<td>Production control</td>
<td>V2.07 last changes V3.23</td>
</tr>
<tr>
<td>PC11</td>
<td>ONLY IN CONNECTION with &quot;Standard&quot; Toolhead: The lower the tool is lifted above the material, the shorter the overall cutting time. However, if tool is lifted unsufficiently, this may cause tool error.</td>
<td>Processing parameters</td>
<td>V2.07</td>
</tr>
<tr>
<td>PC12</td>
<td>Automatic repetition of the plot memory with the drive switch and without activating blowing or vacuum</td>
<td>Production control</td>
<td>V3.0 last changes V3.23</td>
</tr>
<tr>
<td>PC13</td>
<td>Page advance backwards by the actual page length or by the given length</td>
<td>Material advance</td>
<td>V3.0</td>
</tr>
<tr>
<td>PC14</td>
<td>Sets the power parameter for start- and end pulse for laser cutting</td>
<td>Processing parameters</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC15</td>
<td>Sets the process times for laser cutting</td>
<td>Processing parameters</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC16</td>
<td>Switches the plotter to &quot;offline&quot; mode and switches the drives off. Then the plotter is waiting for pressing the drive &quot;green&quot; key to continue the interrupted plot</td>
<td>Processing parameters</td>
<td>V3.23</td>
</tr>
<tr>
<td>PC17</td>
<td>ONLY IF PASSEPARTOUT TOOL IS FITTED: Switches between the tool type 'Passepartout Smart' and 'Passepartout' at the tool head oscillator.</td>
<td>Processing parameters</td>
<td>V3.23</td>
</tr>
<tr>
<td>Instruction</td>
<td>Function</td>
<td>Group</td>
<td>Since</td>
</tr>
<tr>
<td>-------------</td>
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<td>-------</td>
</tr>
<tr>
<td>PC18</td>
<td>ONLY IN CONNECTION WITH OSCILLATING MULTIHEAD: Switches the oscillation action of the one oscillating tool on or off. ATTENTION: If used when non-scillating tool is active, this will be ignored.</td>
<td>Processing parameters</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC19</td>
<td>IF EXTRA VACUUM PUMP IS FITTED: Switches extra vacuum pump and to synchronous vacuum mode with standard fitted pump.</td>
<td>Production control</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC2</td>
<td>Switches off vacuum, waits the specified delay time and resumes job afterwards without key press etc.</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td>PC20</td>
<td>ONLY IF ELECTRONIC STANDARD TOOL IS FITTED: Increase or decrease tool force (i.e. downward pressure) relative to present setting.</td>
<td>Processing parameters</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC21</td>
<td>The overcut will be reduced by the given length at the begin or the end of an vector. This command is usefull for wheel blades or similar tools.</td>
<td>Production control</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC22</td>
<td>Switches speedbooster on or off.</td>
<td>Processing parameters</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC23</td>
<td>The machine moves to the farthest end, similar to pressing the VIEW button.</td>
<td>Production control</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC24</td>
<td>Switches the scaling mode of the material advancement length on or off.</td>
<td>Material advance</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC25</td>
<td>Outputs the drawing origin which is set</td>
<td>Machine info response</td>
<td>V3.6</td>
</tr>
<tr>
<td>PC26</td>
<td>Set origin to the named point</td>
<td>Positioning and Scaling</td>
<td>V3.6</td>
</tr>
<tr>
<td>PC3</td>
<td>Switches vacuum pump action to &quot;blowing&quot; and waits default wait time or specified waiting time</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td>PC4</td>
<td>Switches blowing to &quot;OFF&quot; and waits the specified delay time</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td>PC5</td>
<td>Waits the specified delay time</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td>PC6</td>
<td>Automatic repetition of the plot memory with the drive switch and switching vacuum off at the end of the plot</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td></td>
<td>last changes V3.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC7</td>
<td>The internal contour smoothing filter operator is set to specified level</td>
<td>Processing parameters</td>
<td>V2.07</td>
</tr>
<tr>
<td></td>
<td>last changes V3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC8</td>
<td>SPECIAL COMMAND FOR WATER JET OR SIMILAR: Set times for forerun or afterrun of the waterjet</td>
<td>Processing parameters</td>
<td>V2.06</td>
</tr>
<tr>
<td>PC9</td>
<td>Automatic repetition of the plot memory with the drive switch, switching vacuum off at the end of the plot and switching vacuum on at the start of the plot</td>
<td>Production control</td>
<td>V2.07</td>
</tr>
<tr>
<td></td>
<td>last changes V3.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PR</td>
<td>Plots, in order of coordinate pairs added, to the points indicated by the X,Y increments, relative to the previous tool position using current tool up/down status</td>
<td>Geometry description</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>PU</td>
<td>Plots to the X,Y coordinates in the order listed with raised tool using current tool absolute/relative status</td>
<td>Geometry description</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>PV</td>
<td>FOR TEXTILE: Punches a V notch at the given position with the geometry specified</td>
<td>Production control</td>
<td>V3.3</td>
</tr>
<tr>
<td>RO</td>
<td>Rotates the coordinate system 90° against at the plotter coordinate origin, or reverses that back to normal.</td>
<td>Positioning and Scaling</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>RT</td>
<td>The lower angle defines the threshold angle below and until where the machine will stop, turn the tool without forward movement and move on subsequently. The tool is not lifted for turning.</td>
<td>Processing parameters</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>Instruction</td>
<td>Function</td>
<td>Group</td>
<td>Since</td>
</tr>
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<td>-------------</td>
<td>----------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>RY</td>
<td>Executes reference moves on Y axis</td>
<td>Key Machine Configuration</td>
<td>V3.0</td>
</tr>
<tr>
<td>SC</td>
<td>Scales the plotting area set with IP command into user units</td>
<td>Positioning and Scaling earlier than V2.0</td>
<td></td>
</tr>
<tr>
<td>SO</td>
<td>The drawing origin is set at the actual position</td>
<td>Positioning and Scaling earlier than V2.0</td>
<td></td>
</tr>
<tr>
<td>SP</td>
<td>Selects among available tools.</td>
<td>Processing parameters earlier than V2.02 last changes V3.4</td>
<td></td>
</tr>
<tr>
<td>TD</td>
<td>Switches between the tool types router and drill</td>
<td>Processing parameters</td>
<td>V3.0</td>
</tr>
<tr>
<td>TR</td>
<td>Enables or disables the tangential control</td>
<td>Processing parameters earlier than V2.0</td>
<td></td>
</tr>
<tr>
<td>VS</td>
<td>Set velocity for the tool</td>
<td>Processing parameters earlier than V2.0</td>
<td></td>
</tr>
<tr>
<td>WD</td>
<td>Outputs letter string to LCD display at machine keypanel</td>
<td>Character setting earlier than V2.0</td>
<td></td>
</tr>
<tr>
<td>WK</td>
<td>Writes &quot;Continue with Enter&quot; on the LCD and waits for pressing of &quot;ENTER&quot; key (or any other key)</td>
<td>Special</td>
<td>V3.0</td>
</tr>
</tbody>
</table>
# HPGL Database - in order of group identification

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Function</th>
<th>Group</th>
<th>Since</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL</td>
<td>Reads the label, but does not store it</td>
<td>Character setting</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>DT</td>
<td>Defines the label terminator used in LB, BL and WD instruction</td>
<td>Character setting</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>LB</td>
<td>Reads the label, but does not plot it</td>
<td>Character setting</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OL</td>
<td>Outputs information on the label contained in the buffer</td>
<td>Character setting</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>WD</td>
<td>Outputs letter string to LCD display at machine keypanel</td>
<td>Character setting</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>AA</td>
<td>Draws arc centred at X,Y coordinate, starts at current tool position</td>
<td>Geometry description</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>AR</td>
<td>Draws arc centred at point relative to current tool position</td>
<td>Geometry description</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>CI</td>
<td>Draws a circle, centred at current tool position</td>
<td>Geometry description</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>CT</td>
<td>Determines whether chord tolerance parameter of CI, AA and AR instructions is interpreted as degrees or as a deviation distance in plotter units.</td>
<td>Geometry description</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>PA</td>
<td>Plots to the X,Y coordinates in the order listed using current tool up/down status</td>
<td>Geometry description</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>PR</td>
<td>Plots, in order of coordinate pairs added, to the points indicated by the X,Y increments, relative to the previous tool position using current tool up/down status</td>
<td>Geometry description</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>PU</td>
<td>Plots to the X,Y coordinates in the order listed with raised tool using current tool absolute/relative status</td>
<td>Geometry description</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>DF</td>
<td>Sets plotter to default conditions</td>
<td>Key Machine Configuration</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>IN</td>
<td>Initializes the plotter</td>
<td>Key Machine Configuration</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>NR</td>
<td>Switches the plotter in offline mode</td>
<td>Key Machine Configuration</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>RY</td>
<td>Executes reference moves on Y axis</td>
<td>Key Machine Configuration</td>
<td>V3.0</td>
</tr>
<tr>
<td>ESC.(</td>
<td>Switches Com-port of the plotter in the programmed-on status</td>
<td>Key Machine Configuration DCI</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>ESC.)</td>
<td>Switches Com-port of the plotter in the programmed-off status</td>
<td>Key Machine Configuration DCI</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>ESC.@</td>
<td>Configuration Com ports parameter</td>
<td>Key Machine Configuration DCI</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>Instruction</td>
<td>Function</td>
<td>Group</td>
<td>Since</td>
</tr>
<tr>
<td>-------------</td>
<td>----------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>ESC.H</td>
<td>Sets handshake mode and for Xon-Xoff protocol Xoff threshold level and Xon trigger character</td>
<td>Key Machine Configuration DCI</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>ESC.I</td>
<td>Sets handshake mode and for Xon-Xoff protocol Xoff threshold level and Xon trigger character</td>
<td>Key Machine Configuration DCI</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>ESC.K</td>
<td>Aborts any partially decoded HPGL instruction</td>
<td>Key Machine Configuration DCI</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>ESC.N</td>
<td>Sets inter character delay and Xoff trigger character</td>
<td>Key Machine Configuration DCI</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>ESC.P</td>
<td>Sets handshake mode either to hardwired or Xon-Xoff</td>
<td>Key Machine Configuration DCI</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>ESC.R</td>
<td>The unit carries on operation with hardwired handshake</td>
<td>Key Machine Configuration DCI</td>
<td>last changes V3.3</td>
</tr>
<tr>
<td>ESC.Y</td>
<td>Switches Com-port of the plotter in the programmed-on status</td>
<td>Key Machine Configuration DCI</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>ESC.Z</td>
<td>Switches Com-port of the plotter in the programmed-off status</td>
<td>Key Machine Configuration DCI</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OA</td>
<td>Outputs the current physical tool position</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OC</td>
<td>Outputs the tool position associated with last valid tool position instruction</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OD</td>
<td>Outputs the tool position associated with last valid tool position instruction</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OE</td>
<td>Outputs the last HPGL error</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OF</td>
<td>Outputs the number of unscaled HPGL units per millimeter in X- and Y-axes</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OH</td>
<td>Outputs the hard-clip limits at the time the instruction was received</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OI</td>
<td>Outputs the selected plotter emulation</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OO</td>
<td>Outputs implemented options</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OP</td>
<td>Outputs the plotter unit coordinates of the scaling points P1 and P2</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OS</td>
<td>Outputs the status of the plotter</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OT</td>
<td>Outputs the installed carousel type</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OV</td>
<td>Outputs the firmware version</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>OW</td>
<td>Outputs the coordinates of the points set by the IW command</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>PC25</td>
<td>Outputs the drawing origin which is set</td>
<td>Machine info response</td>
<td>V3.6</td>
</tr>
<tr>
<td>ESC.A</td>
<td>Outputs a fixed string only for compatibility</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>Instruction</td>
<td>Function</td>
<td>Group</td>
<td>Since</td>
</tr>
<tr>
<td>-------------</td>
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</tr>
<tr>
<td>ESC.B</td>
<td>Outputs the number of currently free memory locations in the plotter buffer</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DCI</td>
<td></td>
</tr>
<tr>
<td>ESC.E</td>
<td>Outputs extended I/O error status</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DCI</td>
<td></td>
</tr>
<tr>
<td>ESC.L</td>
<td>Outputs the available buffer size</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DCI</td>
<td></td>
</tr>
<tr>
<td>ESC.O</td>
<td>Outputs the current equipment status</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DCI</td>
<td></td>
</tr>
<tr>
<td>ESC.S</td>
<td>Outputs the available buffer size</td>
<td>Machine info response</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DCI</td>
<td></td>
</tr>
<tr>
<td>AF</td>
<td>Programmatically advances roll material one full-page length</td>
<td>Material advance</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>AH</td>
<td>Programmatically advances roll material one half-page length</td>
<td>Material advance</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>FC</td>
<td>Programmed cutting off the material at the front end of the plotter</td>
<td>Material advance</td>
<td>V3.0</td>
</tr>
<tr>
<td>PC13</td>
<td>Page advance backwards by the actual page length or by the given length</td>
<td>Material advance</td>
<td>V3.0</td>
</tr>
<tr>
<td>PC24</td>
<td>Switches the scaling mode of the material advance length on or off.</td>
<td>Material advance</td>
<td>V3.3</td>
</tr>
<tr>
<td>IP</td>
<td>Sets scaling points in plotter units.</td>
<td>Positioning and Scaling</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>IW</td>
<td>Sets window inside which plotting can occur</td>
<td>Positioning and Scaling</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>PC26</td>
<td>Set origin to the named point</td>
<td>Positioning and Scaling</td>
<td>V3.6</td>
</tr>
<tr>
<td>RO</td>
<td>Rotates the coordinate system 90° against at the plotter coordinate origin, or reverses that back to normal.</td>
<td>Positioning and Scaling</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>SC</td>
<td>Scales the plotting area set with IP command into user units</td>
<td>Positioning and Scaling</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>SO</td>
<td>The drawing origin is set at the actual position</td>
<td>Positioning and Scaling</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>AS</td>
<td>Sets acceleration for the active tool</td>
<td>Processing parameters</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>last changes</td>
<td>V3.4</td>
</tr>
<tr>
<td>CR</td>
<td>The corner recognition defines the lifting of the tool before turning through an angle greater than the Upper angle.</td>
<td>Processing parameters</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>FS</td>
<td>Sets tool force (Standard cutting device)/ Set laser pointer brightness (MultiHead)/ Sets cutting depth (double head only)</td>
<td>Processing parameters</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>last changes</td>
<td>V2.01</td>
</tr>
<tr>
<td>PC11</td>
<td>ONLY IN CONNECTION with &quot;Standard&quot; Toolhead: The lower the tool is lifted above the material, the shorter the overall cutting time. However, if tool is lifted insufficiently, this may cause tool error.</td>
<td>Processing parameters</td>
<td>V2.07</td>
</tr>
<tr>
<td>PC14</td>
<td>Sets the power parameter for start- and end pulse for laser cutting</td>
<td>Processing parameters</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC15</td>
<td>Sets the process times for laser cutting</td>
<td>Processing parameters</td>
<td>V3.3</td>
</tr>
<tr>
<td>Instruction</td>
<td>Function</td>
<td>Group</td>
<td>Since</td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>PC16</td>
<td>Switches the plotter to &quot;offline&quot; mode and switches the drives off. Then the plotter is waiting for pressing the drive &quot;green&quot; key to continue the interrupted plot</td>
<td>Processing parameters</td>
<td>V3.23</td>
</tr>
<tr>
<td>PC17</td>
<td>ONLY IF PASSEPARTOUT TOOL IS FITTED: Switches between the tool type ‘Passepartout Smart’ and ‘Passepartout’ at the tool head oscillator.</td>
<td>Processing parameters</td>
<td>V3.23</td>
</tr>
<tr>
<td>PC18</td>
<td>ONLY IN CONNECTION WITH OSCILLATING MULTIHEAD: Switches the oscillation action of the one oscillating tool on or off. ATTENTION: If used when non-scillating tool is active, this will be ignored.</td>
<td>Processing parameters</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC20</td>
<td>ONLY IF ELECTRONIC STANDARD TOOL IS FITTED: Increase or decrease tool force (i.e. downward pressure) relative to present setting.</td>
<td>Processing parameters</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC22</td>
<td>Switches speedbooster on or off.</td>
<td>Processing parameters</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC7</td>
<td>The internal contour smoothing filter operator is set to specified level</td>
<td>Processing parameters</td>
<td>V2.07 last changes V3.3</td>
</tr>
<tr>
<td>PC8</td>
<td>SPECIAL COMMAND FOR WATER JET OR SIMILAR: Set times for forerun or afterrun of the waterjet</td>
<td>Processing parameters</td>
<td>V2.06 last changes V3.3</td>
</tr>
<tr>
<td>RT</td>
<td>The lower angle defines the threshold angle below and until where the machine will stop, turn the tool without forward movement and move on subsequently. The tool is not lifted for turning.</td>
<td>Processing parameters</td>
<td>earlier than V2.0 last changes V3.4</td>
</tr>
<tr>
<td>SP</td>
<td>Selects among available tools.</td>
<td>Processing parameters</td>
<td>earlier than V2.02 last changes V3.4</td>
</tr>
<tr>
<td>TD</td>
<td>Switches between the tool types router and drill</td>
<td>Processing parameters</td>
<td>V3.0</td>
</tr>
<tr>
<td>TR</td>
<td>Enables or disables the tangential control</td>
<td>Processing parameters</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>VS</td>
<td>Set velocity for the tool</td>
<td>Processing parameters</td>
<td>earlier than V2.0</td>
</tr>
<tr>
<td>PC0</td>
<td>Clears production control mode status (normal plotter function)</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td>PC1</td>
<td>Switches on vacuum and waits default waiting time or specified waiting time</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td>PC10</td>
<td>Automatic repetition of the plot memory with the drive switch, switching blowing on at the end of the plot and again switching vacuum on at the start of the plot</td>
<td>Production control</td>
<td>V2.07 last changes V3.23</td>
</tr>
<tr>
<td>PC12</td>
<td>Automatic repetition of the plot memory with the drive switch and without activating blowing or vacuum</td>
<td>Production control</td>
<td>V3.0 last changes V3.23</td>
</tr>
<tr>
<td>PC19</td>
<td>IF EXTRA VACUUM PUMP IS FITTED: Switches extra vacuum pump and to synchronous vacuum mode with standard fitted pump.</td>
<td>Production control</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC2</td>
<td>Switches off vacuum, waits the specified delay time and resumes job afterwards without key press etc.</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td>PC21</td>
<td>The overcut will be reduced by the given length at the begin or the end of an vector. This command is useful for wheel blades or similar tools.</td>
<td>Production control</td>
<td>V3.3</td>
</tr>
<tr>
<td>PC23</td>
<td>The machine moves to the farest end, similar to pressing the VIEW button.</td>
<td>Production control</td>
<td>V3.3</td>
</tr>
<tr>
<td>Instruction</td>
<td>Function</td>
<td>Group</td>
<td>Since</td>
</tr>
<tr>
<td>-------------</td>
<td>----------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>PC3</td>
<td>Switches vacuum pump action to &quot;blowing&quot; and waits default wait time or specified waiting time</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td>PC4</td>
<td>Switches blowing to &quot;OFF&quot; and waits the specified delay time</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td>PC5</td>
<td>Waits the specified delay time</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td>PC6</td>
<td>Automatic repetition of the plot memory with the drive switch and switching vacuum off at the end of the plot</td>
<td>Production control</td>
<td>V2.02</td>
</tr>
<tr>
<td></td>
<td>last changes</td>
<td></td>
<td>V3.23</td>
</tr>
<tr>
<td>PC9</td>
<td>Automatic repetition of the plot memory with the drive switch, switching vacuum off at the end of the plot and switching vacuum on at the start of the plot</td>
<td>Production control</td>
<td>V2.07</td>
</tr>
<tr>
<td></td>
<td>last changes</td>
<td></td>
<td>V3.23</td>
</tr>
<tr>
<td>PV</td>
<td>FOR TEXTILE: Punches a V notch at the given position with the geometry specified</td>
<td>Production control</td>
<td>V3.3</td>
</tr>
<tr>
<td>CB</td>
<td>Clears plot buffer after interpretation</td>
<td>Special</td>
<td>V3.0</td>
</tr>
<tr>
<td>MS</td>
<td>Sets ARISTOMAT to a special scan mode for special scanner hardware</td>
<td>Special</td>
<td>V3.15</td>
</tr>
<tr>
<td>WK</td>
<td>Writes &quot;Continue with Enter&quot; on the LCD and waits for pressing of &quot;ENTER&quot; key (or any other key)</td>
<td>Special</td>
<td>V3.0</td>
</tr>
</tbody>
</table>