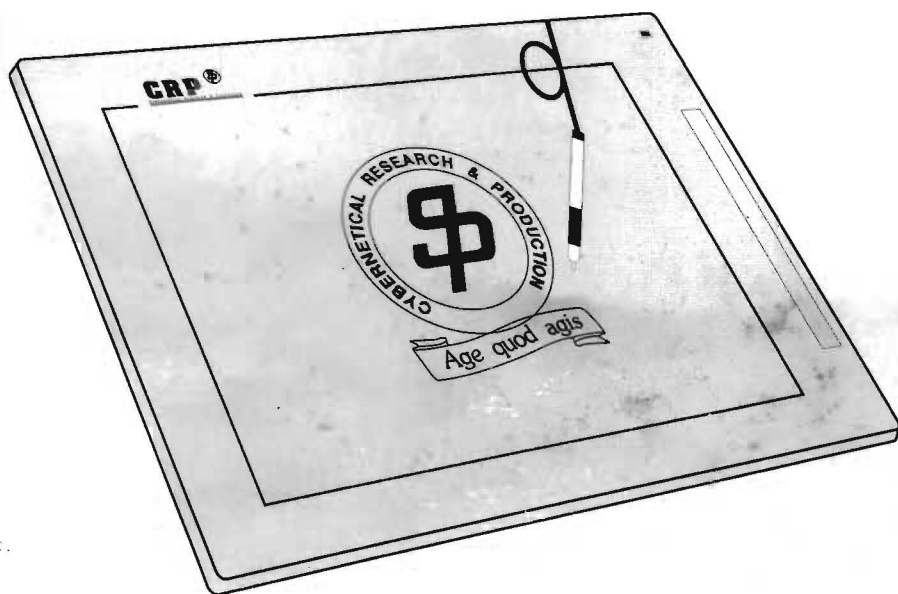


CRP

Digitizing Tablets

Operating Manual



Cybernetical Research & Production
Fritz-Arnold-Str. 23
D-W7750 Konstanz

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CHAPTER I

Chapter I

1. Introduction

A digitizing tablet (digitizer) is a device used to transform geometrical coordinates into electrical signals. With this device it is possible to enter graphic information into a computer. The CRP-Digitizers are highly accurate and reliable graphic input devices for all types of computers.

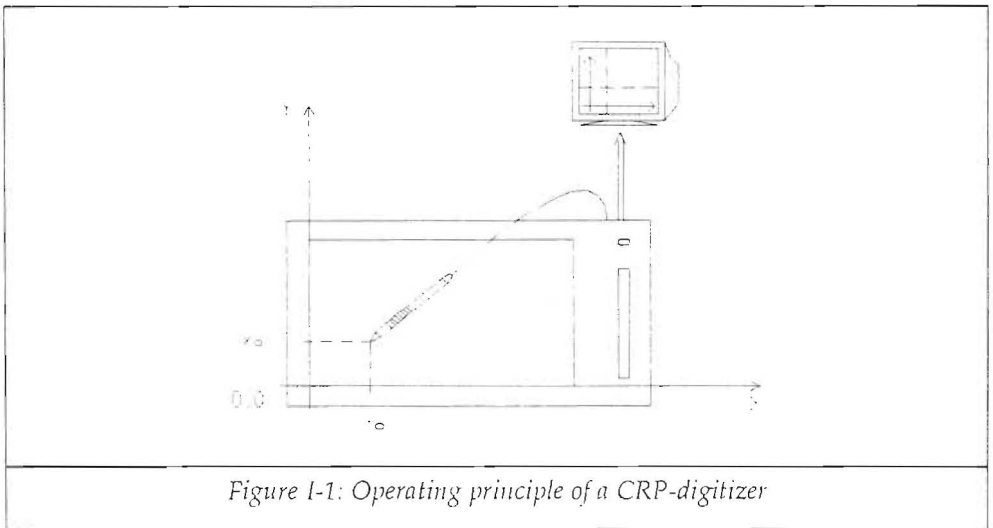


Figure I-1: Operating principle of a CRP-digitizer

1. 1. Theory of operation

A digitizing tablet consists principally of an active surface and a pointing device. The pointing device can be a stylus (see figure above) or a crosshair puck with four buttons. The pointing device is used to "point" to a certain location on the active area. The coordinates of this point (see figure: X_0 and Y_0 are the coordinate values) are transmitted to the computer.

The computer (or better: the software running on the computer) evaluates the coordinates or flow of coordinates and transforms the numerical values into graphic information.

This way it becomes possible to draw and design on a computer in a much more natural way: like using a pencil and a piece of paper.

1. 2. Applications

1. 2. 1. Graphics

In computer technology, we distinguish between the so called CAD-field (Computer Aided Design) and the creative drawing (painting) application. The CRP-digitizer is a valuable tool for these types of applications. The user communicates in a very natural way using the pointing device not only for the entry of graphic data but also to control the software itself.

1. 2. 2. Menu technique

This leads to another useful application: the control of a software without using the computer keyboard. Using the menu technique, the user points to a certain location on the digitizer's active area and generates the execution of a command. Long character strings, usually entered on a keyboard, become obsolete; the operation of a given program is easier and less time consuming.

Furthermore, the possibility of making errors is strongly reduced. The user can rely upon the fact, that exactly the same data is always entered; when using a keyboard instead, the possibility of mistyping is constantly present.

Many computer types already come with a pointing device: a so-called "mouse". This device is a relative pointing device.

The terms relative (mouse) and absolute (CRP digitizer) is the result of a certain way of operation explained as follows:

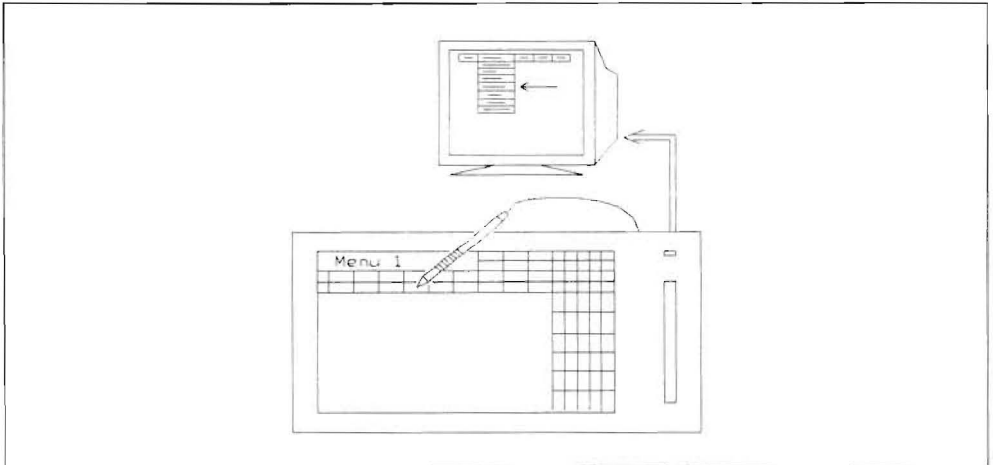


Figure 1-2: Menu technique with a CRP digitizer

- The CRP-digitizer's active surface corresponds exactly to the computer screen. Placing the pointing device on a certain point of the digitizer's surface results in an analog positioning of the graphics cursor on the corresponding screen location. There is an **absolute correspondance between digitizer and screen**.
- The mouse only moves the cursor in a certain direction. If the mouse is lifted from the table and placed on another spot, the screen cursor does not move. This type of correspondance is called **relative**.

The advantages of the CRP-digitizer versus the mouse resulting from this effect are the following:

- The digitizer's pointing device moves the screen cursor and places it exactly onto the desired position. This is **indispensable** when using a template on the digitizer's surface with a menu for a given software. Furthermore it is practically impossible to perform professional drawing with a mouse. The digitizer's stylus is a natural tool and therefore it is the ergonomic solution especially for artists and designers.

- The operating speed is drastically increased. Because of the absolute positioning, the screen cursor is placed immediately, with one movement of the hand onto the desired location. Not only CAD-software, but also graphic environments like "GEM" or "Windows" become much easier, faster and more error-free to use.

Many software packages are already designed for use with a mouse. To operate the CRP-digitizer with these programs, so-called "drivers" are requested. These drivers are small programs used to create a compatibility between a certain peripheral device and a software package. In this case, the driver simulates a mouse, that is, it "makes-believe" the applications software that a mouse rather than the CRP-digitizer is present.

In most cases such a driver is included in the delivery of the CRP-digitizer. As development is constantly expanding, new drivers might be requested. CRP constantly continues their development; registered customers are kept informed. Ask CRP or your local dealer if any incompatibility is encountered.

CHAPTER II



Chapter II

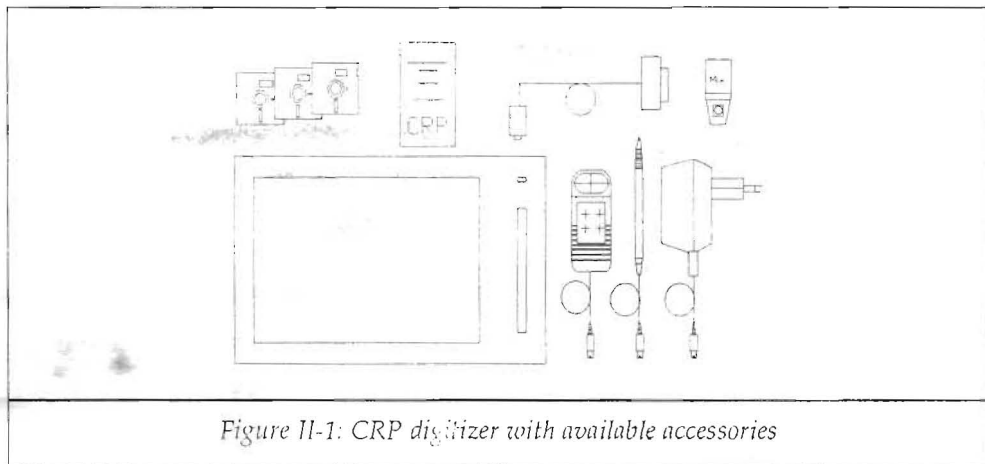
1. Installing the CRP digitizer

Before you start to install the CRP-digitizer, check your delivery. Different hard- and software components can be delivered upon request. Not all elements are always included, check your order before claiming a missing part.

1. 1. Delivery

The following is a list of the possible components being currently delivered. Not all of them are standard.

- CRP-digitizing tablet, A3 or A4 size (16" by 13" and 11" by 8" resp.)
- Stylus with steel tip and ball point pen refill.
- Puck with crosshairs and 4 buttons.



- CRP-MIX: electronic adaptor for simultaneous connection of stylus and puck.
- Power supply (input voltage according to local requirements, output 12V @500 mA)
- Computer connection cable for the serial port, with a connector matching the requirements of the particular computer type.
- **MS-DOS-version:** 3 diskettes (5.25" or 3.5", available upon request, according to the computer used; a PS/2-version is also available) with TAKAVOR-graphics software and drivers for different CAD and graphic programs. Operating manual for the TAKAVOR package.
- **ATARI-ST-version:** one double sided disk, 3.5" containing a GEM-accessory and sample programs in source code for different languages.
- **Amiga-version:** one double sided disk 3.5", containing an AmigaDOS-driver and sample programs in source code for different languages.
- Operating manual for the digitizer.
- Blank protective foil with plastic bracket or an auto-adhesive tape.

If any of the elements is missing, check your order before making a claim to your dealer, not all the components are standard.

1. 2. Setting up the CRP-digitizer

- Place the CRP-digitizer preferably in front of the monitor of your computer. If the computer you own is an IBM-PC/XT/AT, PS/2 or truly compatible, the TAKAVOR graphics software included will enable you to immediately start working with graphics. The installation procedure is described in the TAKAVOR manual.
- Place all delivered components on the table.
- Check whether the CRP-digitizer has DIP¹-switches located on the rear of the tablet. These switches have an important function as they determine certain working parameters. Each switch can be brought into the positions "ON" and

1 DIP: Dual-In-Line Package. Denominates type and size of switches used

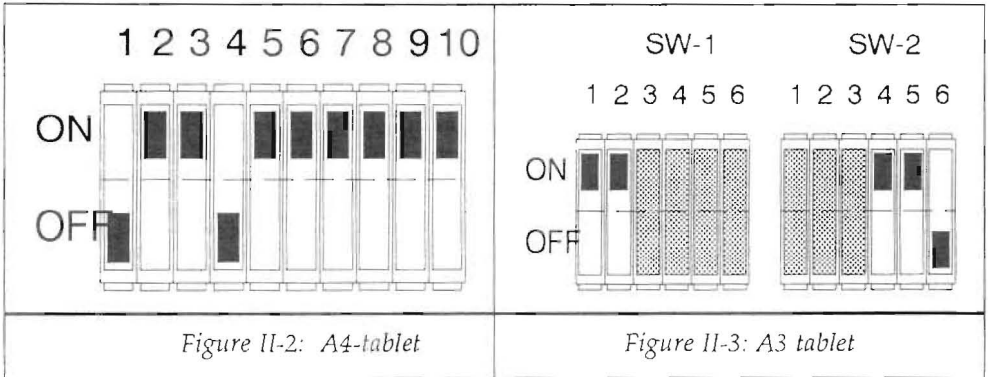


Figure II-2: A4-tablet

Figure II-3: A3 tablet

"OFF" with a pointed tool like e.g. a ball point pen, a small screwdriver or the tip of the stylus.

- Normally the switches are preconfigured and preset. However it is advisable to check the correct positions. These settings are standard for most computers and programs. Check the installation procedures in this manuals describing non-standard settings. Also see chapter VI for a detailed description.
- Connect all elements according to the following scheme:

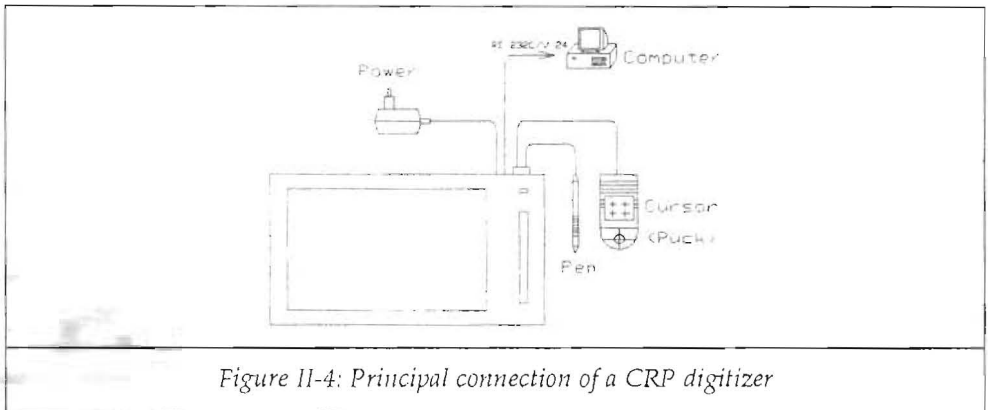


Figure II-4: Principal connection of a CRP digitizer

- Connect stylus or puck (or both if you ordered a "MIX"-adaptor). A 9-pin female connector is located on the rear of the tablet for this purpose.
- Connect the computer cable. This cable has two different connectors: a 9-pin "D"-connector (male on the A4-model, female on the A3-model) and a 25-pin "D"-connector (female). The 9-pin connector is plugged into the digitizer, the 25-pin connector into the serial port of the computer. MS-DOS-computers generally use the COM1: port, ATARI-ST/TT uses the Modem Port and the Amiga uses the serial port.

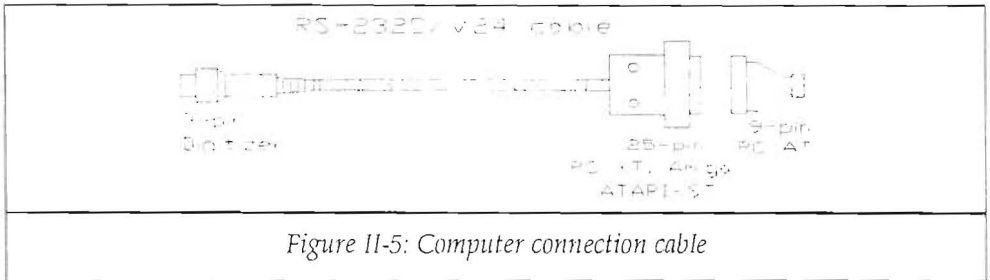


Figure 11-5: Computer connection cable

Note to IBM-PC/AT-users: a 9-pin female connector is required for the serial port. Check your dealer for support.

Note to Amiga-users: the Amiga 2000 requires a male 25-pin connector. Check your dealer for support.

In chapter VI the pinning of the serial port is fully explained. Refer to this section for further information.

- Plug the DC-adaptor into the mains outlet. This DC-adaptor is furnished with a cable and a jack plug which fits into the third connector of the digitizer. As soon as the mains is plugged in, the red LED² in the upper right corner of the digitizer should light. In case this does not happen, abort the installation and ask your dealer for help.

ATTENTION: Under all circumstances it is strictly forbidden to open the device! It could result in voiding the warranty and destruction of the active surface.

2 LED: Light Emitting Diode.

The following two sketches illustrate the position of the different plugs on the rear of the tablet. Note that the A4-digitizer (MS-DOS-version only!) has the DIP-switches located on the rear side (underneath the tablet).

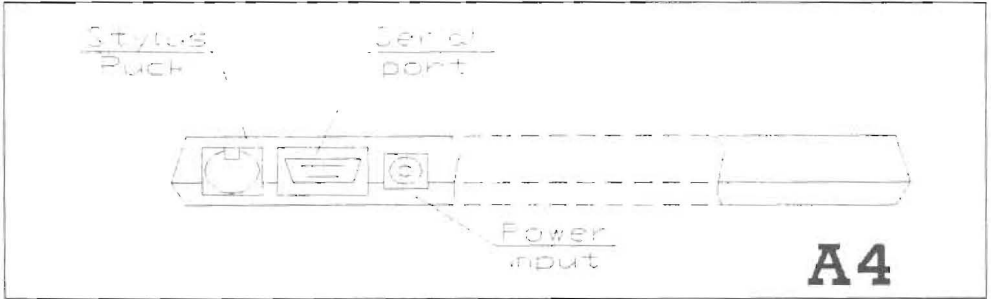


Figure II-6: Rear view of an A4 CRP digitizing tablet

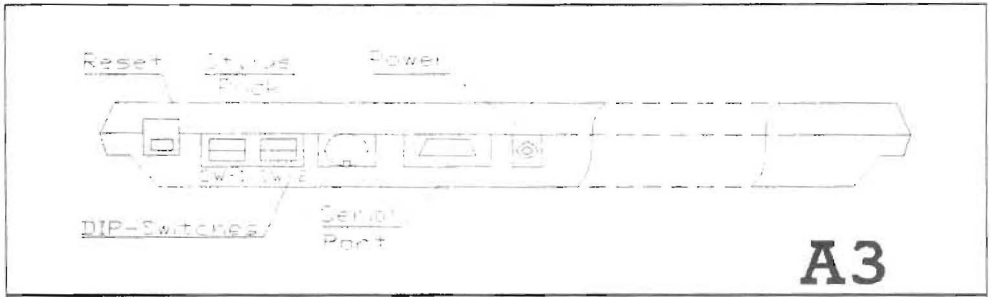


Figure II-7: Rear View of an A3 CRP digitizing tablet Rear view of an

After conclusion of the hardware installation, we shall proceed to the software installation. The following chapters deal with the description of different computer types. Skip the chapters not describing your computer type.

According to the computer in use, check one of the following chapters:

MS-DOS-version	chapter III
ATARI-ST/TT-version.....	chapter IV
Amiga-version.....	chapter V

CHAPTER III

- **A3 digitizer:** Insert the "Utility Diskette #3" into the drive A: of your computer. The disk has a capacity of 360 kBytes and is compatible to any MS-DOS-computer. Type the following command on your keyboard:

```
C:\>a:digit3↵
```

- After a few seconds one of the following messages will appear:

```
Installation of an A3 (A4) model successfully completed  
to port COM1: (COM2:)
```

```
The CRP digitizer seems not connected!  
Aborting installation.
```

The first message shows that everything is working perfectly and in this case, you may proceed by typing:

```
C:\>a:dtest↵
```

This second program will display an information about the tablet attached and the maximum X and Y coordinates. Upon sweeping the pointing device (stylus or four button puck) over the tablet's active surface, the emitted coordinate values are dynamically displayed on the screen as well as the button information. Pressing "ESC" on your keyboard will terminate the test routine.

In case you did not obtain the desired result at this point, the second message appeared or strange coordinate values are displayed, the possible reasons for malfunction and their repair are described as follows:

- **Does the red LED in the upper right corner of the digitizer light?**
If it does not, the digitizer or the power supply may be defective.
Repair:
 - > Check power outlet and power supply output.
 - > Ask your dealer for support.
- **Are the DIP-switches properly set?**
Repair:
 - > Check the DIP-switches with the screen information
 - > Switch power of digitizer off and on again if any changes had to be made.

- **Did you use the serial port COM1: to connect the CRP-digitizer?**

If not, the program will not work at all, because it has been programmed for COM1: as input source.

Repair:

Use correct serial port.

- **Does the serial connector of the digitizer match the computer?**

Check the connections according to the table in chapter VI.

Repair:

> Get a special connection cable (ask your dealer for support).

- **Is there a mouse driver resident?**

Check the "AUTOEXEC.BAT" or "CONFIG.SYS" files in order to determine whether a mouse driver is loaded automatically upon booting of the computer

Repair:

> Deactivate the mouse driver.

If none of the proposed solutions resulted in a proper functioning, check with your dealer for help and repair.

ATTENTION!: Under any circumstances it is strictly forbidden to open the device! It could result in voiding of the warranty and destruction of the active surface.

1. 2. Output of text files (.DCE) to the screen

- Insert the utility disk #3 into drive A: of your personal computer.
- Type the following command on your keyboard:

```
C:\>dir a:* .dce↓
```

A list showing all available documentation files will appear on the screen. If the output of the contents of a certain file is requested, type the following command:

```
C:\>type a:sketch.dce↵
```

The output can be halted temporarily by simultaneously pressing the keys "CTRL" and "S". Check your MS-DOS manual for more information about the "TYPE" and "DIR"-commands.

1. 3. Output of text files (.DCE) to a printer

- Insert the utility disk #3 into drive A: of your personal computer.
- Connect your printer to the parallel port LPT1: of your computer. Should your printer request a serial port, use serial port COM2: (COM1: is currently used by the CRP digitizer. If you lack a second serial port, unplug the CRP digitizer and use port COM1: for your serial printer.
- Type the following command on your keyboard:

```
C:\>type sketch.dce >lpt1:↵
```

or, if using a serial printer, type:

```
C:\>type sketch.dce >com2:↵
```

The contents of the file "SKETCH.DCE" is printed.

We recommend to printout all the text files and store them together with the CRP digitizer information. This way all the information is made immediately available.

2. Installing the CRP digitizer to other software packages

This chapter describes the installation of the CRP-digitizer to currently available programs requiring a pointing device. This list is not complete of course, the most important packages however have been included.

2. 1. Important hint for the software installation

Many programs require the primary digitizer driver supplied on the utility disk #3. The A3 tablet requires the driver "DIGIT3.COM" , the A4 tablet needs the file "DIGIT4.COM". These drivers are TSR¹ like programs and need to be loaded only once. It is recommended to copy these two files to the standard DOS subdirectory. To do so, insert the Utility Disk #3 into the appropriate floppy drive and type the following command:

```
C:\>COPY A: DIGIT4.COM C:\DOS↵
```

resp.

```
C:\>COPY A: DIGIT3.COM C:\DOS↵
```

Invoke this driver whenever required or include it into your "AUTOEXEC.BAT" startup file.

2. 2. Third party software quick reference

AutoCAD

A4 model: Use the ADI-driver supplied on the utility disk #3.

A3 model: Use the ADI-driver supplied on the utility disk #3 or select the tablet »MM 1812« in the pointing device configuration menu of AutoCAD.

AUTOSKETCH

Use the ADI-driver supplied on the utility disk #3.

1 Terminate and Stay Resident

Autodesk Animator

A4 model: Use the primary digitizer driver "DIGIT4.COM" supplied on the utility disk#3.

A3 model: Use the primary digitizer driver "DIGIT3.COM" supplied on the utility disk#3.

Autodesk 3D-Studio

A4 model: Use the primary digitizer driver "DIGIT4.COM" supplied on the utility disk#3.

A3 model: Use the primary digitizer driver "DIGIT3.COM" supplied on the utility disk#3.

BASIC See programming languages.

BYLINE

This program requires an optionally available driver which simulates the Microsoft Mouse and can be ordered from CRP.

C See programming languages.

CADkey

A4 model: Install this tablet using the option BITPAD ONE.

A3 model: Install this tablet using the option "MM1812" or "MM1201".

Chart-Master

This program requires an optionally available driver which simulates the Microsoft Mouse and can be ordered from CRP.

Clickart

This program requires an optionally available driver which simulates the Microsoft Mouse and can be ordered from CRP.

Clipper See programming languages.

Concorde

Install the tablet using the option BITPAD ONE.



Deluxe Paint

A4 model: Use the primary digitizer driver "DIGIT4.COM" supplied on the utility disk#3.

A3 model: Use the primary digitizer driver "DIGIT3.COM" supplied on the utility disk#3.

Dr. Halo

A4 model: Install this tablet using the option BIT PAD ONE.

A3 model: Install this tablet using the option "MM1812" or "MM1201".

Drafix

A4 model: Install this tablet using the option BIT PAD ONE. Check an explanatory text file on the utility disk and execute the resizing program contained on the same disk.

A3 model: Install this tablet using the option "MM1812" or "MM1201".

EasyCAD

EasyCAD directly supports CRP digitizers.

Freelance

A3 model: Installation as »Summagraphics 1201 «.

GEM

Use the primary digitizer drivers for a full GEM compatibility. This feature makes the tablet compatible with all GEM based packages such as:

Artline

DynaCADD

First Publisher

First Word+

GEM Draw

GEM Paint

GEM Write

Ventura Publisher

Generic CADD

This package directly supports CRP tablets. Check the utility disk for a corresponding text file with additional explanations.

Harvard Graphics

A4 model: all Harvard Graphics versions lower than release 3 only support a relative pointing mode. Use the primary digitizer driver "DIGIT4.COM" to operate Harvard Graphics with the A4 CRP digitizing tablet.

A3 model: all Harvard Graphics versions lower than release 3 only support a relative pointing mode. Use the primary digitizer driver "DIGIT3.COM" to operate Harvard Graphics with the A3 CRP digitizing tablet.

Mirage

A4 model: Install this tablet using the option BIT PAD ONE.

A3 model: Install this tablet using the option "MM1812" or "MM1201".

Multiplan

A4 model: Use the primary digitizer driver "DIGIT4.COM" supplied on the utility disk#3.

A3 model: Use the primary digitizer driver "DIGIT3.COM" supplied on the utility disk#3.

Norton Commander

A4 model: Use the primary digitizer driver "DIGIT4.COM" supplied on the utility disk#3.

A3 model: Use the primary digitizer driver "DIGIT3.COM" supplied on the utility disk#3.

PC-Draft

This package directly supports CRP digitizers.

PC-Paintbrush

A4 model: Use the primary digitizer driver "DIGIT4.COM" supplied on the utility disk#3.

A3 model: Use the primary digitizer driver "DIGIT3.COM" supplied on the utility disk#3.

PICTURES by PC

A4 model: a special driver is supplied on the utility disk #3.

PC Tools

A4 model: Use the primary digitizer driver "DIGIT4.COM" supplied on the utility disk #3.

A3 model: Use the primary digitizer driver "DIGIT3.COM" supplied on the utility disk #3.

Programming languages

The CRP digitizer series enable you not only to use the coordinates within your programmed application but also to operate the programming environment. The utility disk #3 contains drivers for such purposes and detailed programming examples for different languages such as:

GW-Basic

Clipper

Quick Basic

Turbo Basic

Turbo C

Turbo Pascal

ROBO-CAD-PC

A4 model: Use the primary digitizer driver "DIGIT4.COM" supplied on the utility disk #3.

A3 model: Use the primary digitizer driver "DIGIT3.COM" supplied on the utility disk #3.

Windows (all versions)

A4 model: The utility disk contains special drivers for Windows. Be sure to use the correct drivers for your Windows version.

A4 model: The utility disk contains special drivers for Windows. Be sure to use the correct drivers for your Windows version.

Together with Windows, the following applications and others are supported as well:

Adobe Illustrator
Aldus Photo Styler
Arts & Letters
Ascend
Becker Tools
CorelDRAW
Excel
Halo Desktop Imager
Micrographics Designer
Norton for Windows
PageMaker
PC-Tools 7.0
Superbase
Vellum CAD
Ventura Publisher (Windows Edition)
WinWord
Wordstar for Windows
Word (DOS Version)

The text mode requires the standard primary digitizer drivers, the graphic mode is only supported with a special driver available upon request from CRP.

Works

A4 model: Use the primary digitizer driver "DIGIT4.COM" supplied on the utility disk #3.

A3 model: Use the primary digitizer driver "DIGIT3.COM" supplied on the utility disk #3.

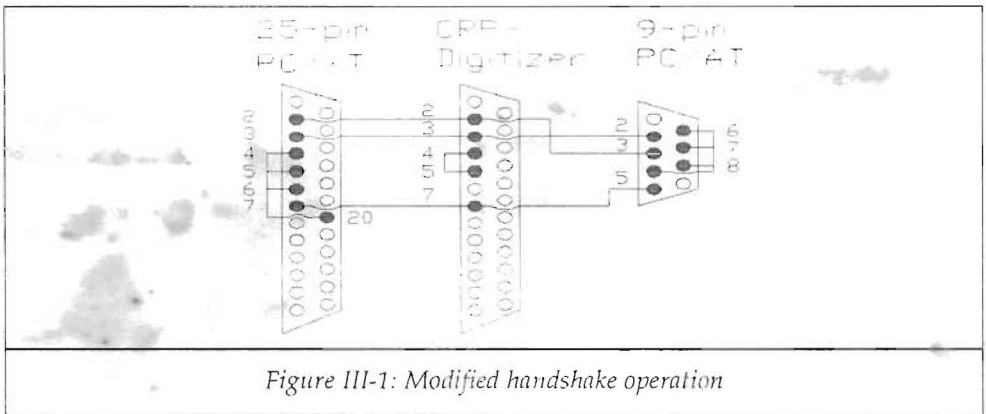
2. 3. Compatibility with other software packages

If your software package is not mentioned in this operating manual, you may check yourself for a possible compatibility with CRP tablets by:

- checking if the software requires a mouse and then exchanging the mouse driver by the appropriate primary digitizer driver DIGIT4.COM or DIGIT3.COM;
- checking if the software supports a tablet by itself.

In this case, for your information, the A4 model is compatible to "Summagraphics Bit Pad One" or "Kurta 1";

the A3 model behaves similarly to one of the following tablet types: "MM 1812", "MM 1201", "MM 961" or "Summasketch". The model "MM 1812" is the best to use since it will consider the A3 size more precisely. It may be possible to modify the connection of the handshake lines of the serial port. This may specially be the case with the A3 tablet. See the following scheme for more detailed information.



2. 4. Using the primary digitizer driver

Software packages currently just supporting a mouse may be operated with the CRP digitizing tablets using the primary digitizer drivers. These drivers behave like a mouse driver but submit absolute coordinates instead of relative ones. This incredibly useful feature enhances the performance of many applications such as e.g. painting packages.

There are programs that expect a mouse driver and check for it upon initialization. Other applications require specific installation by the user. In these cases check the performance either by selecting a Bus Mouse Driver or a Microsoft Serial Mouse Driver.

In both cases, be sure to load the primary digitizer drivers DIGIT3.COM or DIGIT4.COM before calling the application (instead of the usual MOUSE.COM driver). Proceed as follows:

```
C:>digit4
```

or

```
C:>digit3
```

depending on the used digitizer model. The driver will check automatically for the presence of the CRP tablet on either serial port (COM1: or COM2:). It will definitely locate an A3 tablet but only presume the presence of an A4 model. In case a specific port is desired, type:

```
C:>digit4 /2
```

where "2" stands for the port number (1 = COM1; 2 = COM2:)

2. 4. 1. Programs directly supported

These and other software packages may be directly operated with the primary digitizer drivers:

Autodesk Animator

3D Studio

EasyCAD

First Publisher

GEM

Harvard Graphics

Multiplan

Norton Commander (DOS-Version)

PC-Tools (DOS-Version)

RoboCAD PC

Word (DOS-Version)

Works

XTree

This list may expand in future. Check with your local customer support in case of doubt.

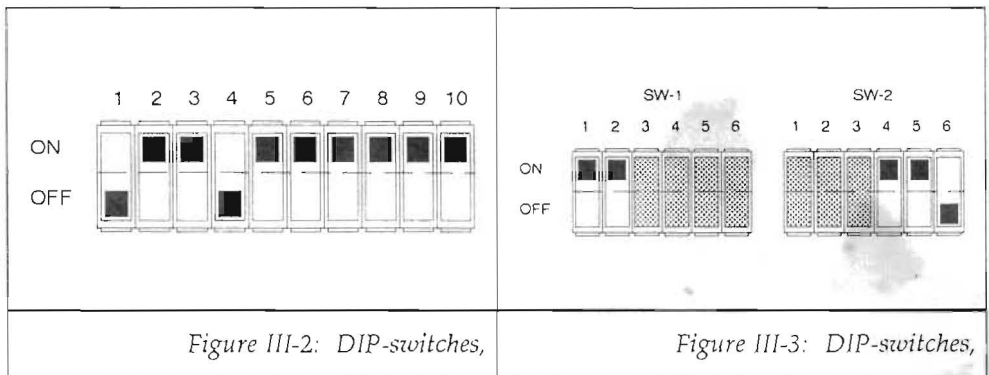
2. 5. AutoCAD

2. 5. 1. All Releases until 10.0

- Invoke AutoCAD by typing:
`C:\>acad`
- From the main menu select the command "Configure AutoCAD".
- From the configuration menu, select the command "Configure digitizer".
- **A4-model:** select from the digitizer menu the model "Summagraphics Bit Pad One" and then the type "11".
- **A3-model:** select from the digitizer menu the model series "Summagraphics MM-Series" defining the type "1812" in **absolute mode** with stylus or cursor (puck). In case you select a cursor, select the 4-button type.
- Install screen, plotter and printer if needed.
- Exit the configuration menu saving the modified values.

Note that CRP also delivers a template for AutoCAD. It is available for both digitizer sizes and supports all versions of AutoCAD. This template has been developed by experienced AutoCAD-users and is updated as soon as new versions are released.

CRP offers templates for all AutoCAD releases.



2. 5. 2. AutoCAD Release 11.0 and up

Both A4 and A3 models are to be configured as »Autodesk Device Interface« protected mode drivers (ADI P386). Prior the start of AutoCAD, copy the drivers »CRPADI4.EXP« and »CRPADI3.EXP« respectively, contained on the utility disk #3 to the standard AutoCAD directory:

```
C:>COPY A:CRPADI4.EXP C:\ACAD\ADIDIG.EXP↵
```

or, when using an A3 model:

```
C:>COPY A:CRPADI3.EXP C:\ACAD\ADIDIG.EXP↵
```

AutoCAD has to be configured only once:

```
C:>ACAD↵ (load the program)
```

```
5↵ (configure AutoCAD)
```

```
4↵ (configure the digitizer)
```

```
2↵ (select the ADI P386 digitizer)
```

When using a stylus as pointing device, now enter

```
1↵
```

For a four button puck, enter

```
4↵
```

If the CRP digitizer is connected to the serial port COM1;, enter

```
↵
```

Otherwise enter the number which corresponds to the desired serial port (COM2: to COM4:) and confirm entering

```
↵
```

All further questions are to be confirmed with

```
↵
```

(Return). This instructs AutoCAD to accept the default values.

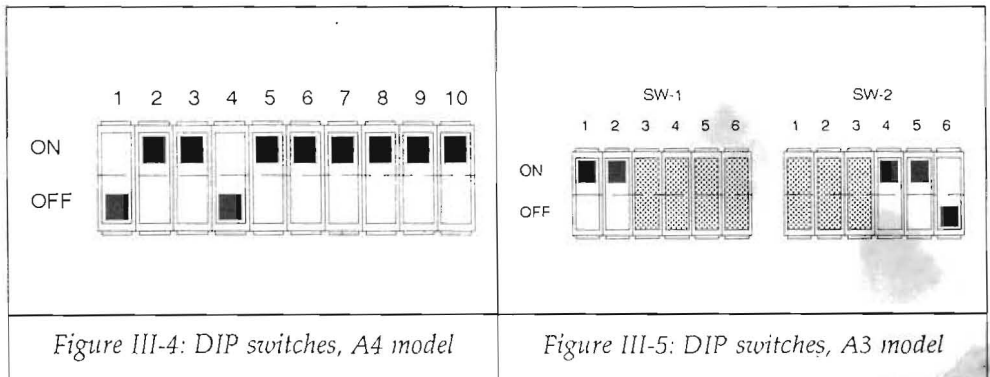
2. 6. Autosketch

The utility disk #3 contains several support files for AUTOSKETCH. The files used to properly install this software are the following:

- DIGIT4.COM – primary digitizer driver for the A4-digitizer
- DIGIT3.COM – primary digitizer driver for the A3-digitizer
- ADI.COM – driver for AUTOSKETCH
- SKETCH.DCE – documentation file

All the drivers have to be installed prior the initial installation of AUTOSKETCH itself. Proceed as follows:

- Copy the files "DIGIT4.COM" (if you own an A4-model), "DIGIT3.COM" (if you own an A3-model) and "ADI.COM" from the utility disk in drive A: to the drive and subdirectory containing the AUTOSKETCH-software (this directory is usually called "\SKETCH").
- Invoke the primary digitizer driver first. It loads itself resident into main memory and remains there until the computer is rebooted. The CRP-digitizer must be present and switched on at either COM1: or COM2: while installing "DIGIT4.COM" or "DIGIT3.COM". The driver automatically recognizes the port



used by the CRP-digitizer. However it is possible to determine which port should be used (necessary if another device is connected to a serial port); note that the CRP-digitizer must be connected in any case to the desired serial input².

```
C>digit4 /1↵ selects COM1:
```

```
C>digit4 /2↵ selects COM2:
```

In case the digitizers are changed (A4 to A3 or viceversa), or another port is desired and the driver is already loaded, invoke the primary digitizer driver again. It will display a message telling what port or type it has changed to.

- Invoke the ADI-driver by typing:

```
C>adi↵
```

A message is displayed indicating the digitizer size and serial port encountered. This information is obtained through the primary digitizer driver.

- Start the unconfigured AUTOSKETCH by typing:

```
C>sketch↵
```

AUTOSKETCH prompts the following questions:

Select pointing device:

1. Autodesk Device Interface Pointer
2. Microsoft Mouse
3. Joystick / Koala Pad
4. Keyboard Cursor Keys

Pointing device selection:

```
1↵
```

(type in the number 1)

Subsequently AUTOSKETCH asks for graphics card and plotter. Answer according to your system configuration.

² See the description about the primary digitizer drivers in this chapter.

This concludes the installation of AUTOSKETCH. The installation procedure is necessary only once or if a component is changed. To re-install AUTOSKETCH type:

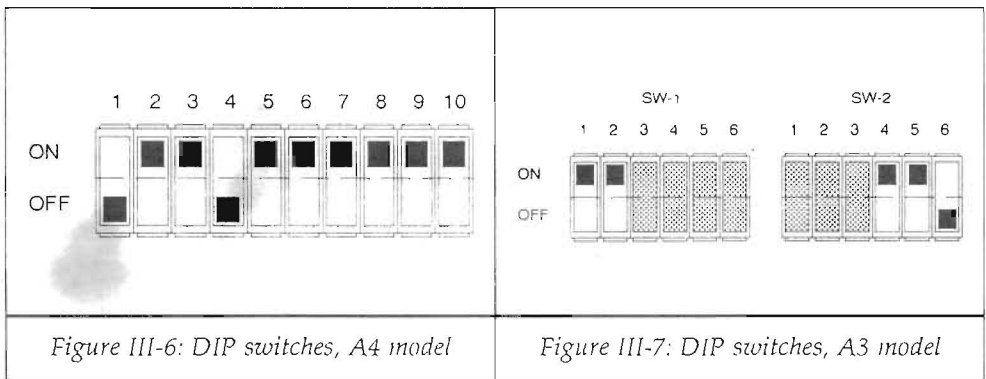
```
C>sketch/r↵
```

- Once AUTOSKETCH is exited, it is possible to deactivate the ADI-driver. Invoking the driver again switches it off and frees the allocated memory. It might not be necessary to deactivate the driver, it could however collide with other programs.

Note that CRP also delivers a template for AUTOSKETCH. It is available for both digitizer sizes and simplifies the operation of the software. It displays all available commands and executes them from the tablet.

2. 7. CADStar

- Install CADStar with the program supplied for that purpose.
- When using an A4-digitizer, select the model "Bit-Pad-One" as pointing device.
- When using an A3-digitizer, select "Summagraphics, series M.M1200, MM1800".



2. 8. Dr. HALO II, Dr. HALO III and HALO-DPE

- Copy all files supplied into a special subdirectory following the original operating manual and installation procedure.
- Invoke the "SETUP"-program by typing:
C:\DRHALO>setup↵
- Select the graphics card in use.
- Answer the questions regarding the pointing device as follows:

A4-model: select "Bit Pad One" as pointing device

A3-model: select "Summa MM1201" as pointing device.

Communication port (1 or 2): according to your configuration.

X-Resolution:

A4-model: 3000

A3-model: 5000

Y-Resolution:

A4-model: 2100

A3-model: 5000

If you chose the A4-digitizer, the install program will ask whether a "Single Button Pen" is used. Answer "Y" if you have a stylus or "N" if you have a 4-button puck or use both pointing devices with the "MIX"-adaptor.

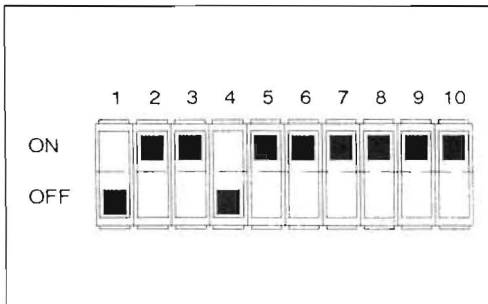


Figure III-8: DIP switches, A4 model

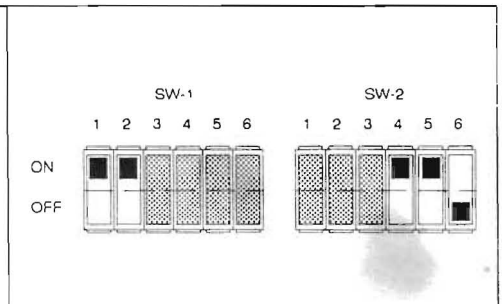


Figure III-9: DIP switches, A3 model

- Select desired printer (and scanner within HALO-DPE) and exit the "SETUP"-program.
- The "SETUP"-software creates a file named "INIT.BAT" which the user has to invoke prior starting the software itself. This file generally consists of one single line, which has to be edited with a word processor (i.e. EDLIN), **but only when an A3-digitizer is connected!** The change, which is required at this time, must be done only once (that is after each setup procedure).

When using a 4-button cursor, change the line to:

```
haloSDTI -p1 -i8 -x8250 -y6350
```

When using a stylus, enter:

```
haloSDTI -p1 -i8 -x8250 -y6350 -l127 -m128
```

(Note that only the **boldface** figures have to be changed, leave the other values unchanged, also if they do not exactly match this description).

- The software is started by typing the following commands:

```
C:\DRHALO>init␣
```

```
C:\DRHALO>drhalo␣
```

or

```
C:\DRHALO>halodpe␣
```

2. 9. DRAFIX

The interfacing to an A4-digitizer requires an additional file found on the utility disk #3. The A3-digitizer can be used by selecting "Summagraphics' MM1812" model.

- The files required to properly operate the software with an A4-digitizer are the following:

CRPDFX.COM – adjustment program for the A4-digitizer

CRPDFX.DCE – documentation file

- Copy the file "CRPDFX.COM" into the subdirectory used by DRAFIX on your hard disk drive.
- Install the graphics program using "DFXSETUP" being part of the original delivery, and select "Summagraphics Bit Pad One" as pointing device. Install all other peripheral devices.
- Invoke the CRP-software by typing:

```
C:\DRAFIX>crpdfx
```

The successful installation is displayed on the screen.

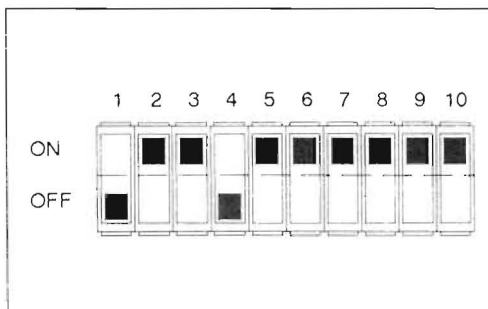


Figure III-10: DIP switches, A4 model

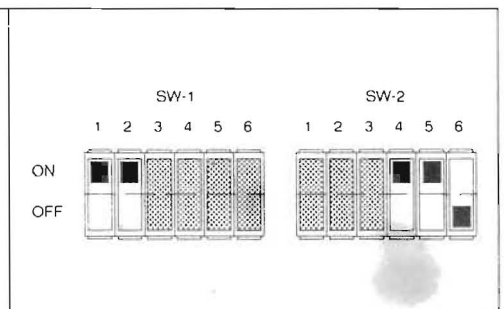


Figure III-11: DIP switches, A3 model

2. 10. DynaCADD

This is a GEM-based package and thus requires the primary digitizer drivers instead of the mouse driver. When installing DynaCADD, GEM/3 has to be installed as the first step. Select the "Bus-Mouse" as your pointing device. Prior start of DynaCADD, enter:

```
C:>digit3↵
```

or

```
C:>digit4↵
```

CRP also delivers a template for use with DynaCADD. The CAD package must be installed first, only then the template may be added. An install program delivered with the template must be started as follows:

```
A:>install↵
```

Select the size of the CRP tablet and let the software perform the installation automatically.

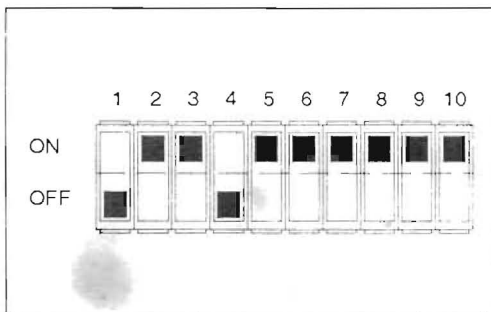


Figure III-12: DIP switches, A4 model

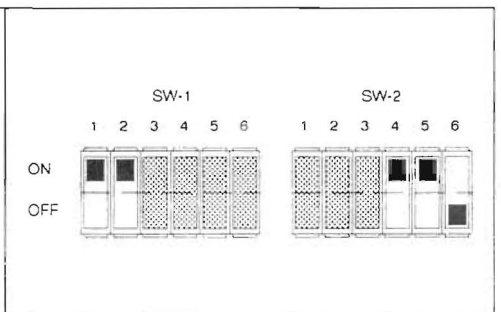


Figure III-13: DIP switches, A3 model

2. 11. Lotus Freelance plus Version 3

Currently only the A3 tablet is supported. Proceed as follows:

- Check the default DIP switch position
- Install Freelance
- Enter the disk "Font 3" into your drive and configure the tablet with the command
A:\SUMMATAB1201 1 C:\FL↵
or, when using "COM2:" as your serial port:
A:\SUMMATAB1201 2 C:\FL↵

The directory information "C:\FL" is the default directory used by Freelance. In case another directory has been selected, it is obvious to use the appropriate one.

Upon starting Freelance the installation is accomplished.

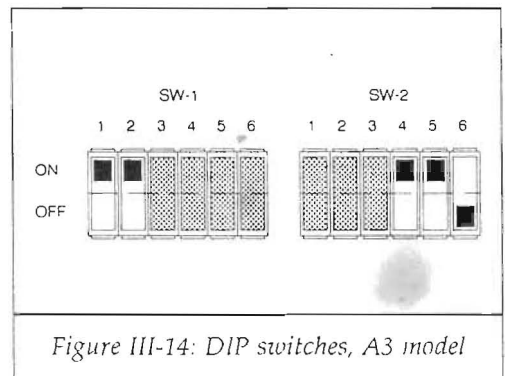


Figure III-14: DIP switches, A3 model

2. 12. GEM, GEM/3 and GEM-applications

The **A4-digitizer** requires a special driver (the primary digitizer driver) "DIGIT4.COM" contained on the utility disk #3.

The **A3-digitizer** is directly supported by GEM. When installing GEM (or a GEM-application like e.g. the VENTURA-Publisher), the pointing device "MM1812" may be chosen. However, we recommend to use the primary digitizer driver as well, since its performance has proven to be far better than the digitizer driver contained in GEM.

If the CRP-digitizers are used alternatively on the same computer or optionnally available GEM-templates are used, the primary digitizer driver "DIGIT3.COM" must be installed. Then follow the same procedure as for the A4-digitizer.

The files needed for GEM are the following:

DIGIT4.COM – primary digitizer driver for the A4-digitizer.

DIGIT3.COM – primary digitizer driver for the A3-digitizer (optional under certain circumstances)

GEM.DCE – documentation file.

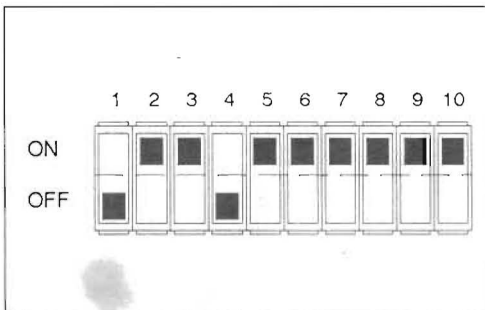


Figure III-15: DIP switches, A4 model

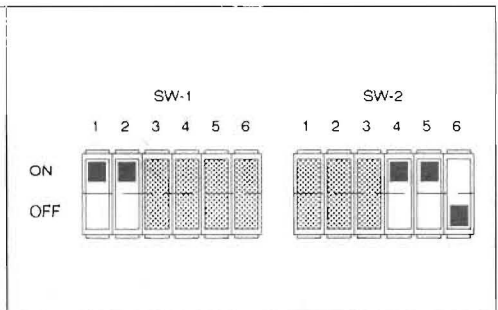


Figure III-16: DIP switches, A3 model

2. 12. 1. CRP digitizer with GEM menu

- Copy the file "DIGIT4.COM" (or "DIGIT3.COM") onto a file called "MOUSE.COM" on the utility diskette itself. Type the following command:

```
C>copy a:digit4.com a:mouse.com↓
```

or

```
C>copy a:digit3.com a:mouse.com↓
```

- Install GEM (or a GEM-application like i.e. the VENTURA-Publisher, GEM edition). Select the "Bus-Mouse" as pointing device.

ATTENTION: be sure not to select the serial mouse although the CRP-digitizer is connected to a serial port!

- Somewhen, during the installation procedure, GEM will ask for a "Microsoft-Mouse"-disk (because it needs the file "MOUSE.COM"). Insert the CRP-utility disk #3 instead into drive A: and proceed normally.
- The setup program creates a batch file named "GEM.BAT" (or "VP.BAT" when installing the VENTURA-Publisher). Edit this batch file with a word processor (e.g. EDLIN, WordStar, Word) and change the line "MOUSE" into "DIGIT4" or "DIGIT3".
- Copy the file "DIGIT4.COM" and "DIGIT3.COM" into the "GEMBOOT"-subdirectory on your hard disk.

The primary digitizer drivers "DIGIT4" and "DIGIT3" load themselves resident into main memory (they only have to be invoked once and stay until the computer is re-booted) and behave similar to the mouse driver "MOUSE.COM" included in the shipment of the Microsoft Mouse. The primary digitizer drivers expect a CRP-digitizer connected to any of the serial ports COM1: or COM2: and select the proper port automatically³. In case a specific port is desired, the user can give a parameter in the command line.

To select COM1: type:

```
C>digit4 /1↓
```

3 See the description about the primary digitizer drivers in this chapter.

To select COM2: type:

```
c>digit4 /2↓
```

A driver which has already been loaded can be changed the same way.

2. 13. Generic CADD (version 2.0 and up)

The drivers needed to operate "Generic-CADD" are delivered on the utility disk #3. The names of the files requested are:

CRP4.DIG – driver for Generic-CADD (A4-digitizer)

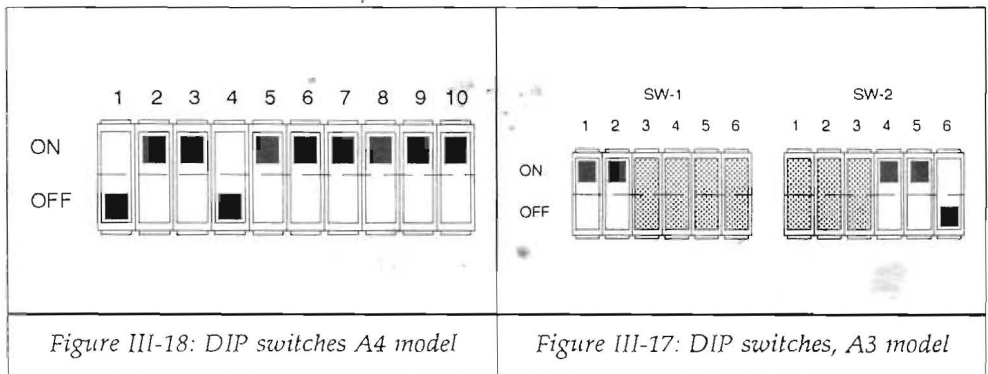
CRP3.DIG – driver for Generic-CADD (A3-digitizer)

CADD.DCE – documentation file

- Copy the files "CRP4.DIG" and "CRP3.DIG" into the subdirectory "\GENERIC" of your hard disk by typing:

```
C>copy a:*.dig c:\j
```

- Invoke the configuration program "CONFIG" and "Select a Pointing Device". A list of all supported pointing devices follows. Select the CRP-digitizer (A3 or A4-size).
- Select the serial port (COM1: or COM2:) the CRP-digitizer is connected to.
- Select the "Odd Parity"-option for the serial interface parameters.
- Select graphics card, plotter, printer and other parameters if requested.
- Exit the configuration program ("Exit to DOS") saving the changes made so far.



Upon completion of the installation procedure, start the "CADD"-software.

Note that the upper right button (#2 on the puck) selects a menu command; the upper left button (#1 on the puck or the tip of the stylus) selects a point on the drawing area.

Version 5.0 of Generic CADD uses one single configuration file that contains all the drivers. This is a large text file and it may be edited with any word processor. It is possible to include the two supplied drivers into this file but this operation requires some expertise and care.

We strongly suggest to make a backup copy of this file before modifying it.

2. 14. Paintbrush

Install Paintbrush (non-Windows version) as suggested in the original operating manual.

- Select the digitizer type "Calcomp 2300/2500".
- Complete the installation as required.
- The install program creates a batch file called "PAINt.BAT" which has to be edited with a word processor. Look for a line containing the command "SUM1201" and replace it with

DIGIT4

or

DIGIT3

This concludes the PC-Paintbrush (non-Windows) installation.

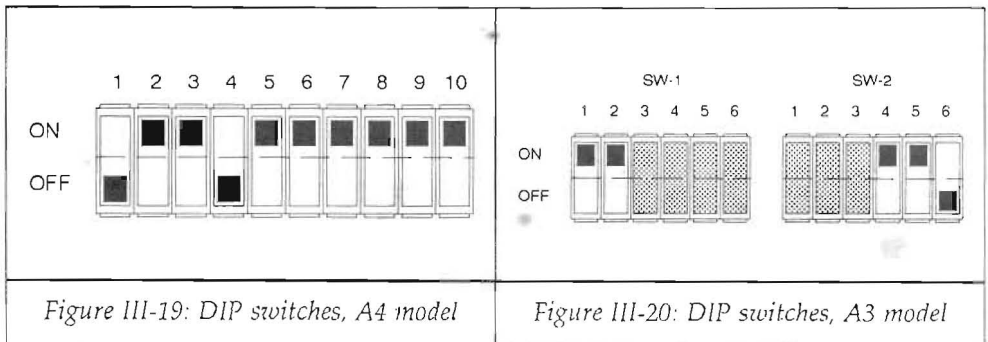


Figure III-19: DIP switches, A4 model

Figure III-20: DIP switches, A3 model

2. 15. PC-DRAFT

This CAD-program supports both CRP-digitizers. In case you own an older version not supporting the A3-model directly

The A4-digitizer is directly selectable, when installing an A3-model select the model Summasketch MM1200 (newer versions of PC-DRAFT support the model MM1812).

Notes:

- **A4-model:** observe the non standard DIP-switches position!
- **A3-model:** change the file "PCDRAFT.BAT" with a word processor (i.e. EDLIN) the line containing the following command:
`digitiz /1/4200/3300//`
(The double slash at the end of the line is absolutely necessary!)

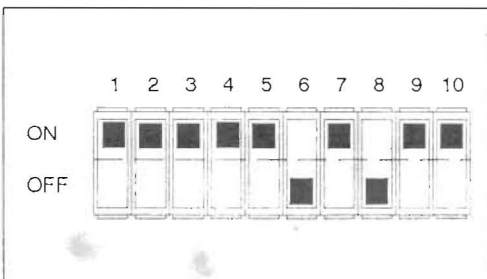


Figure III-21: DIP switches, A4 model

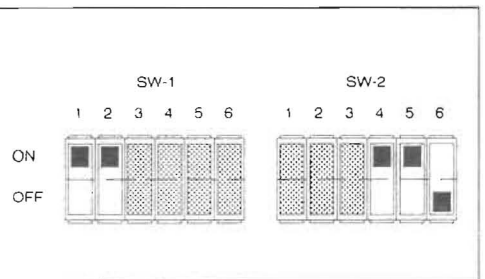


Figure III-22: DIP switches, A3 model

2. 16. PiCTURES by PC

The CAD-package PiCTURES by PC may not be currently available outside of Germany. It supports the A3-model (MM1812) without changes. The A4-digitizer can only be operated with a special driver contained on the utility disk #3 and the primary digitizer driver "DIGIT4.COM".

The files required for a proper operation of PiCTURES by PC are:

DIGIT4.COM – primary digitizer driver for the A4-digitizer

CRPIC.COM – driver for PiCTURES by PC

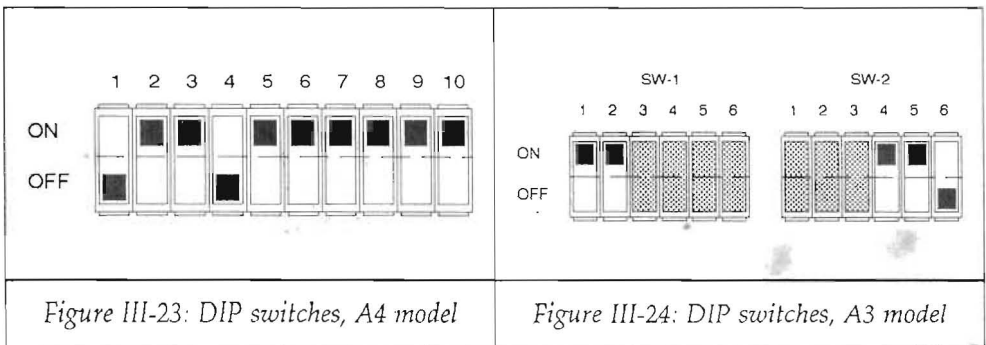
CRPIC.DOC – documentation file (available only in German language at this time)

- Install PiCTURES by PC on your hard disk. The install program creates a subdirectory named "\PICTURES". When selecting a pointing device, choose "Calcomp 2000". Do not yet start PiCTURES by PC right after completion of the installation.
- Copy all files needed for this package into the subdirectory named "\PICTURES". The commands to do this are:

```
C:\>cd \pictures
```

```
C:\PICTURES>copy a:digit4.com c:
```

```
C:\PICTURES>copy a:crpic.com c:
```



- Before starting the CAD-software, load the primary digitizer driver "DIGIT4". The CRP-digitizer must be connected to a serial port at this time⁴:

```
C:\PICTURES>digit4↵
```

- Invoke the driver for PICTURES by PC:

```
C:\PICTURES>crpic↵
```

The successful installation is displayed on the screen.

- Start the CAD-package PICTURES by PC.

Notes:

- The driver "DIGIT4" remains resident in main memory. It is only deactivated by re-booting the computer.
- The driver "CRPIC" can be deactivated by calling it again. This is generally necessary when a plotter is connected instead of the CRP-digitizer.
- The A3-digitizer can be connected exactly the same way. The only difference is the use of the primary digitizer driver "DIGIT3".

⁴ See the description about the primary digitizer drivers in this chapter.

2. 17. Prodesign

- Install Prodesign on your hard or floppy disk.
- Invoke the setup program either on floppy disk
`A:\>setup`↵
 or on the hard disk
`C:\>setup`↵
- Select printer and plotter.
- **A4 model:** from the pointing device menu select »SUMMA BIT PAD 1, 1103 (BINARY)« and enter width of active surface (30cm) as well as height (21cm).
- **A3-Modell:** from the pointing device menu select »SUMMA MM1812«. Older versions of Prodesign only offer »SUMMA MM1201« as valid option. Then enter width of active surface (42cm) and height (33cm).
- Select the corresponding serial port (COM1: or COM2:).
- Select the following parameters for the serial port:
 Baud Rate: 9600
 Parity (N, O, OR E): E (A4 model) resp. O (A3 model)
 Stop Bits (1 or 2): 1
 Number of data bits (7-8): 7 (A4 model) or 8 (A3 model)
- The final configuration is saved by pressing the function key »F1«.

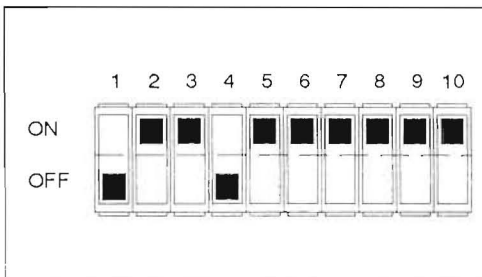


Figure III-25: DIP switches, A4 model

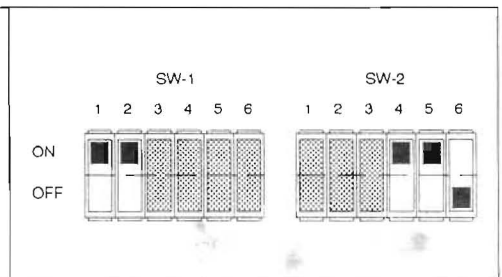
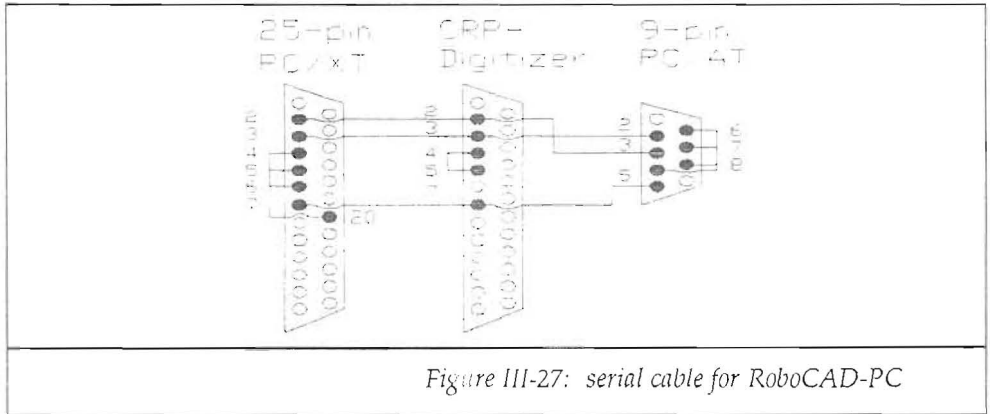


Figure III-26: DIP switches, A3 model

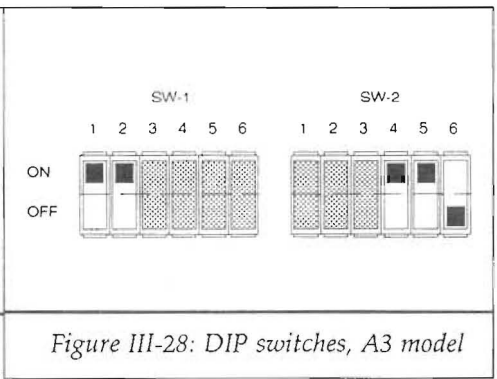
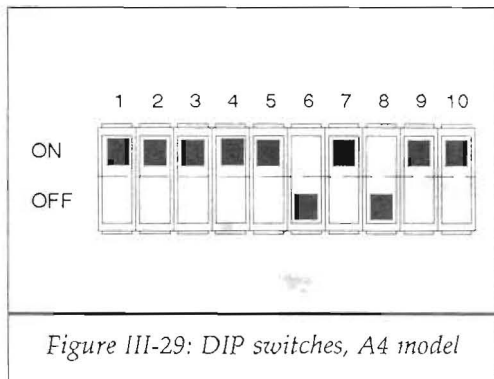
2. 18. RoboCAD-PC

2. 18. 1. RoboCAD until version 4.3

This CAD-package requires a special cable. The connection between CRP-digitizer and computer follows this scheme:



- **A4-model:** select the digitizer type Bit-Pad-One.
- **A3-model:** select the digitizer type MM1812 (older versions may require the model MM1201. In this case a re-scaling to another active area is necessary).



2. 18. 2. RoboCAD, version 4.3 and higher

- Install RoboCAD as explained in the operating manual.
- Start RoboCAD-PC by entering
C:\>RC↵
- Configure RoboCAD entering
2
- Select a pointing device by typing
2
- Enter the CRP utility disk #3 into drive A: of your computer.
- Enter the letter for selection of a new driver.
- Enter the source directory typing
A:\
when asked for it.
- Now you must enter several additional informations about this new driver.
These informations are:
Manufacturer
CRP↵
Model
DIGA4↵
or
DIGA3↵
Source file name
DIGIT4.COM↵
or
DIGIT3.COM↵
Destination file name
↵

- In order to save the data, type
1
at this point.

This concludes the installation and RoboCAD-PC is configured for the CRP digitizers.

2. 19. Windows

2. 19. 1. Versions 1.0 and 2.0

The drivers necessary to operate Microsoft Windows (or any other Windows application) with the CRP-digitizer are located on the utility disk #3:

CPR4WIN.DRV – driver for the A4-digitizer.

CPR3WIN.DRV – driver for the A3-digitizer.

WINDOWS.DCE – documentation file.

Note: this installation procedure is not only applicable to Windows 1.0 and 2.0 itself but also to applications like for instance PageMaker, In*A*Vision, Draw, etc. All Windows application programs supply a "SETUP"-disk. This disk must contain the two digitizer drivers by CRP. Then re-install the Windows software from scratch.

- Copy both drivers "CRP4WIN.DRV" and "CRP3WIN.DRV" onto your "Windows-SETUP-disk".
- Completely re-install the application, selecting the CRP-digitizers (now appearing in the pointing devices menu).

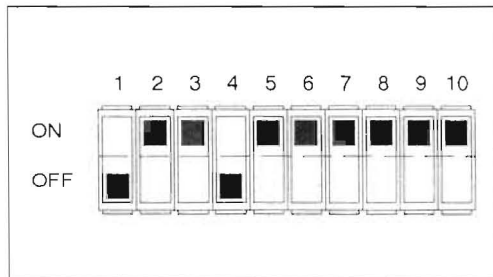


Figure III-30: DIP switches, A4 model

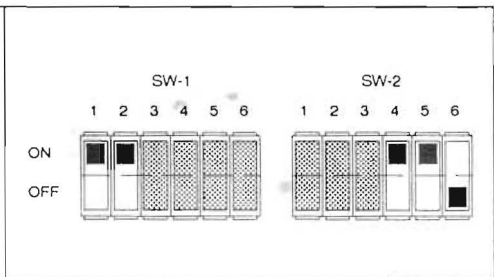


Figure III-31: DIP switches, A3 model

2. 19. 2. Version 3.0

Windows 3.0⁵ requires specially designed drivers which are contained on the CRP utility disk #3:

DIGIT4_3.DRV – Windows 3.0 driver for the CRP A4 digitizer

DIDIT3_3.DRV – Windows 3.0 driver for the CRP A3 digitizer

WIN_30.DCE – An explanatory text file

Basically it is possible to install the tablets in two different ways:

a) Windows 3.0 not yet installed

While setting up Windows 3.0 for the first time, it is possible to select a different pointing device to the ones listed by default. When doing so, insert the CRP utility disk #3 and upon being prompted, select the appropriate digitizer size. The setup program will incorporate the driver into Windows 3.0 and its applications.

b) Windows 3.0 is already installed with another pointing device

Copy the drivers DIGIT4_3.DRV or DIDIT3_3.DRV into the subdirectory \WINDOWS\SYSTEM. Use a word processor to edit the text file SYSTEM.INI located in the directory \WINDOWS and modify the line

```
mouse.drv=mouse.drv
```

by exchanging it with

```
mouse.drv=digit3_3.drv or
```

```
mouse.drv=digit4_3.drv
```

The driver name after the "=" may be a different one in the original file. Just modify this line as described making sure that no other character is inserted by accident.

This concludes the installation of Windows 3.0; check the DIP switch settings for Windows 1.0 and 2.0 for your type of tablet.

5 Windows 3.1 was not available at printing time. Check with our support for updates

3. The primary digitizer drivers

The utility disk #3 contains two files called "DIGIT4.COM" and "DIGIT3.COM" (for the A4 and A3 digitizer respectively). As already described in the previous installation procedures, these drivers play an important role in interfacing the CRP-digitizers.

This chapter will now describe the functioning of the primary digitizer drivers and their interfacing to assembler and higher level languages.

3. 1. Architecture and theory of operation

The communication between an application program and a peripheral device is usually accomplished by a small interfacing software called "driver". The drivers must exactly match the peripheral device in use, otherwise unpredictable effects may occur.

The primary digitizer drivers by CRP load themselves resident into memory and remain there until the computer is re-booted. Application programs communicate with the driver through a software interrupt: INT 34H⁶. This single software entry point furnishes information to and from the digitizer. The principal information these drivers are meant to furnish are the actual digitizer coordinates.

3. 1. 1. Applications

The primary digitizer drivers are used for the following purposes:

- Communication between applications program and CRP-digitizer.
- Creation of a compatibility between applications program and CRP-digitizer.
- Simplification and reduction of the programming task normally required in order to initialize the serial port, monitor the data emitted by the CRP-digitizer and transformation of the coded output of the digitizer into normalized, calculable coordinate data.

⁶ A certain knowledge about the MS-DOS operating system is required to fully understand this chapter.

The primary CRP digitizer drivers perform the following tasks:

- Initialization of the serial port.
- Automatic recognition and initialization of the A3-digitizer.
- Reception and monitoring of the digitizer data in the background, that is the driver is constantly receiving digitizer coordinates, also when another applications program is running (the digitizer drivers are interrupt controlled).
- Calculation of integer variables from the coded output of the CRP-digitizers⁷. These integer variables can be handled by higher level languages.
- Storage of the digitizer coordinates in a defined location for request by any applications program.

3. 2. Loading the primary digitizer drivers

The primary digitizer drivers are loaded on DOS⁸-level. Before loading a driver, a CRP-digitizer (any size) must be connected to one of the serial ports COM1: or COM2: and switched on⁹. The driver recognizes if and where the CRP-digitizer is connected to. However, it might be possible that another peripheral device behaves similarly (to especially an A4-digitizer). In this case it is possible to determine the desired port in the command line.

The driver is loaded (with automatic recognition of the serial port) by entering the command:

```
C:\>digit4↓
```

If a certain port is desired (the CRP-digitizer must be connected to the particular one), the command which has to be given is:

```
C:\>digit4 /2↓
```

7 See chapters VII and VIII for a description of the output code.

8 DOS: Disk Operating System, in this case MS- or PC-DOS

9 See chapter II for a description on how to install the CRP-digitizer.

The successful installation is displayed on the screen showing type of digitizer and serial port found. From this very moment on, the driver receives digitizer data in the background and supplies the coordinates upon request of another program.

If another digitizer type has to be connected or another port must be used, first perform the hardware change and then re-invoke any of the two drivers ("DIGIT3" for the A3-model and "DIGIT4" for the A4-model). The driver will sense its presence in main memory, re-initialize and change to the new hardware parameters.

3. 3. Deactivating the primary digitizer driver

The primary digitizer driver, a TSR¹⁰-like program, may be removed from main memory by entering the following command:

```
C:\>digit4 /d↓
```

3. 4. Communication with the primary CRP-drivers

To fully understand this chapter, it is strongly advisable to acquire a certain knowledge about the MS-(or PC-)DOS operating system as well as assembly language programming. This description is not a tutorial on these matters.

The communication between applications software and primary digitizer driver is accomplished through the software interrupt INT 34H. Upon entry into this interrupt, the CPU-register AX must contain a function code (to tell the driver what to do). Upon return from INT 34H, the registers AX, BX, CX and DX return certain values. All other registers remain unchanged.

3. 4. 1. Description of the driver functions

Function #0 (AX=0): Reset Driver.

¹⁰ Terminate and Stay Resident

This function resets the driver and initializes the (A3-)digitizer. The values returned by this function are:

AX-register: FFFFH (Driver installed ok)
BL-register: 3 or 4 (A3- or A4-tablet)
BH-register: 0H stands for Bit Pad One, 01H stands for MM1812-version
CX-register: maximum X-coordinate value (Hex)
DX-register: maximum Y-coordinate value (Hex)

Function #1 (AX=1): Get Digitizer Coordinates

This function (the most important one) returns the actual digitizer values and the status of the buttons on the pointing device. The returned values are:

AX-register: status (see explanation below)
BX-register: switch status (pointing device)
CX-register: X-coordinate
DX-register: Y-coordinate

The status information in register AX shows whether a change has occurred since the last call to this function. Bits 0 through 3 are logical "1" if any of the buttons on the puck (the stylus switch behaves like button #1) has changed in the meantime, bits 8 and 9 reflect possible changes of X- and Y-values.

Function #2 (AX=2): Set Baud Rate

This function permits the use of another baud rate¹¹ when communicating with the digitizer. Be sure to properly set the DIP-switches on the CRP-digitizer (see chapter VI for details on the switches). The baud rate is defined in the register BL.

9600 baud: BL = 0CH
4800 baud: BL = 18H
2400 baud: BL = 30H
1200 baud: BL = 60H

¹¹ Baud: bit/second, a unit to measure data transmission speed.

Function #3 (AX=3): Set Interrupt Address

This function enables the user to define an interrupt routine and an interrupt mask. Whenever the mask is satisfied (e.g. a switch position changes), the primary digitizer driver performs a "CALL FAR" to the previously defined subroutine.

AX-register: 3 (function #3)
BX-register: mask
CX-register: offset-address of the user interrupt routine
ES-register: segment-address of the user interrupt routine

The mask denotes with a logical "1" which condition should result in a call to the user subroutine (combinations are possible):

Bit 0: X- or Y-coordinate changed
Bit 1: tip of stylus (button #1 on puck) pressed
Bit 2: tip of stylus (button #1 on puck) released
Bit 3,5,7: buttons 2/3/4 pressed
Bit 4,6,8: buttons 2/3/4 released

BX=0 clears the interrupt function.

CHAPTER IV

Chapter IV

1. The CRP-digitizer for the ATARI-ST

1. 1. Important notice

The constant development of our products makes it necessary from time to time to modify and adjust certain parts of our software. Therefore it may occur that this description does only partially match the actual revision. Check for a text file on your distribution disk that will update all necessary information. According to the language it is written in, the names may be "LEAME", "README", "LIESMICH" or "LEGGI_MI".

1. 2. Hardware requirements

All CRP digitizers work together with any ATARI computer, ST, MEGA-ST, STE or TT, regardless of the operating system version or language.

1. 3. Software requirements

The delivery of a CRP-digitizer for the ATARI-ST includes a 3.5"-diskette, single sided containing all the necessary files to operate the CRP-digitizer. As already stated, all ATARI computer models are supported, as well as GDOS. No other software is required to operate the CRP digitizer.

Very few compatibility problems are known, virtually every GEM-application is supported by the CRP-digitizer. In case a particular package should not work properly, please refer to the corresponding software vendor. Newer versions might already be re-written to support the CRP-digitizer.

Notes:

- A mouse accelerator must be disabled. The mouse accelerators are generally incompatible with CRP drivers, so they must be deactivated before using the CRP software.
- The CRP digitizer may not always work with software packages that make use of the serial port by communicating through it or changing its parameters. This is especially the case with terminal programs.
- Also, software packages that directly access the mouse port to obtain the mouse data instead of calling the operating system may behave strangely or not work at all together with CRP digitizers. Game programs frequently are conceived that way. Also, the already described mouse accelerators are programmed like that and may cause the mentioned incompatibility.

2. Installation to the ATARI-ST

Installing the CRP digitizer requires some knowledge on the operation of your computer. Make sure you can look up additional information in the manual of your machine.

Place the tablet in front of your system monitor and check the DIP switches located on the rear of the A3 tablet. The A4 model for the Atari generally does not have any DIP switches at all.

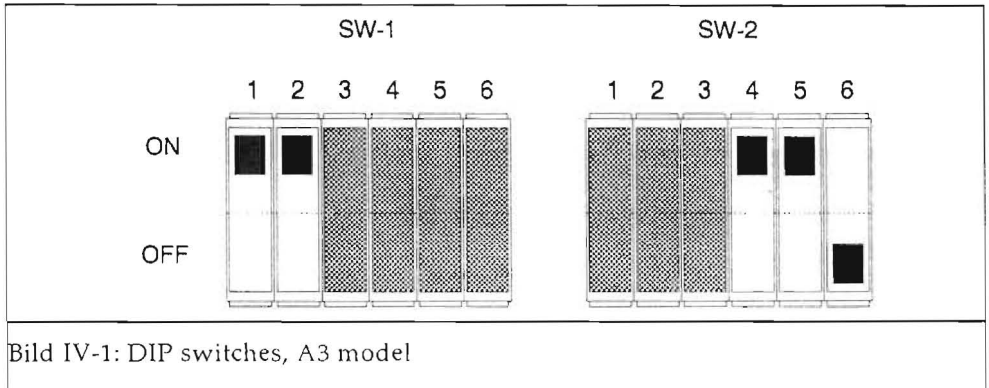
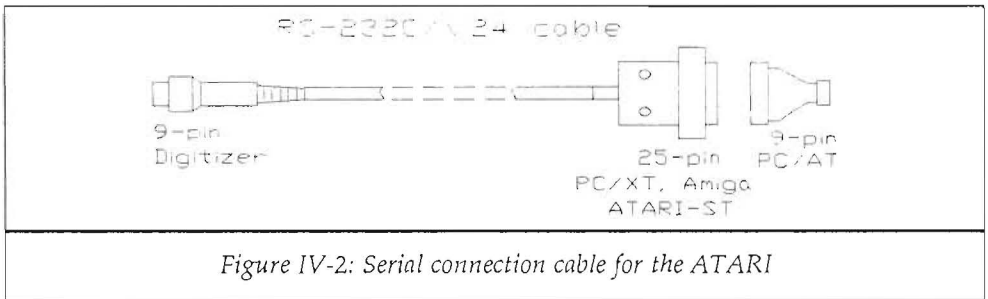


Bild IV-1: DIP switches, A3 model



The CRP-digitizer is connected to the Modem Port (a little telephone icon marks this plug on the rear of the computer). The cable supplied for the ATARI-ST has two plugs: a 9-pin (A4-model female; A3-model male) for connection to the digitizer and a 2-pin female connector for the modem port. On the STE and the TT, the interface is denominated "Modem 1".

Connect the tablet to the power supply making sure that the mains adaptor supplied with your tablet matches local power requirements

When switching on your computer, *make absolutely certain that no mouse accelerator is active*. Failing to observe this will result in inexplicable malfunction of the driver and the cursor movements. Be sure to definitively deactivate such accelerators for as long as you intend to use the CRP digitizer.

There are just three files required from your distribution disk. Copy the files named "CRP31.ACC", "CRP3H.RSC" and "CRP3L.RSC" onto your boot drive or the startup disk if there is no hard disk present.

Reboot your computer after copying the driver files. Use the key combination "Ctrl-Alt-Del" or the "Reset"-key with TOS versions lower than 1.4. The CRP driver will automatically load if present on the boot drive of the hard disk. If no hard disk is available, the startup disk must be inserted at booting time.

Please observe that accessory programs (with the extension ".ACC") might use more than one of the six available entries in the "Desk" menu (the leftmost menu item on the top menu bar of the screen). So, make sure there is one entry for the CRP accessory available. Otherwise, the operating system will not load the CRP driver and the following steps will become meaningless. Note that the CRP accessory only requires one entry into the desk menu.

This concludes the basic installation and the software is ready to be activated by the user.

3. Activation of the driver

The "Desk" menu in the leftmost part of the upper menu bar displays all successfully loaded accessories.

Look for an accessory named "CRP Digitizer 3.1E". The number is the version number (3.1 in this case, it may vary with future releases) the letter "E" stands for English language. When clicking this entry, a dialog box will appear as shown on this page. Click the button "ON" with the mouse to activate the CRP digitizer.

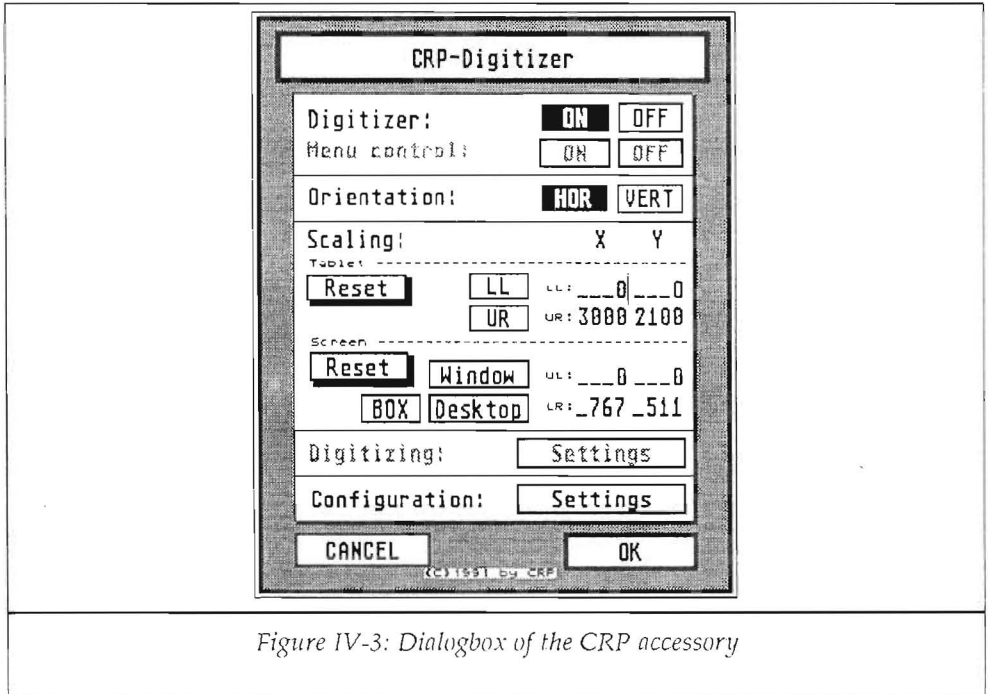


Figure IV-3: Dialogbox of the CRP accessory

Already at this time you may use the CRP digitizer's pointing device to move the screen cursor. Note that if you position the pointing device on any spot on the tablet's active area, the screen cursor will follow and place itself accordingly.

If the cursor does not react in the described way, there are several possibilities to check with:

- If the cursor does not move at all, recheck the installation procedure completely. Especially double check the connections between the peripherals and the power supply.
- If the cursor jumps incoherently over the screen, there might be a mouse accelerator yet active. Or, the A3 tablet is not configured properly, have another look at the DIP switch settings.

Should none of these remedies result in a perfect functioning, contact your local dealer for support. Be sure to have all information concerning your particular configuration at hand when reporting the problem.

4. Operation

4. 1. Scaling of screen and tablet

Clicking on the "ON" button to activate the driver also results in selecting predefined scaling values for both screen and tablet. Either it is the default values or previously saved ones. By default, the entire tablet area is active and fits the full screen area. This means that e.g. the lower left screen corner matches the lower left tablet corner. Of course all four corners of each elements will perfectly match.

4. 1. 1. Scaling of the tablet

If this default scaling is not desired, the user may select any values for tablet and screen independantly.

Exiting the dialog box by pressing the "OK" button will use the selected values until reset.

The standard values can be reselected any time by pressing the "RESET" button. This may be useful when the entered values are to be rejected.

It is also possible to select the scaling values using the digitizer's pointing device. The user may define a lower left corner ("LL") and an upper right ("UR") one. Make sure that the upper right corner is indeed "upper" and more to the right than the defined lower left corner. In case of error, press the left mouse button to abort the process and restart. Thus the previously defined scaling is restored. Using the keyboard to enter the data makes it possible to define precise coordinate values.

The tablet can be operated in two positions: horizontal (default) and vertical. This means that upon selection of the button "VER" the tablet must be rotated *clockwise* by 90 degrees. Thus, the tablet is portrait oriented, which corresponds to what we call "Vertical".

A previously defined scaling is preserved, it may become necessary again after the rotation.

4. 1. 2. Scaling of the screen

It is possible to independently scale the screen. This process is very much like the tablet scaling already described. There are several buttons located in the area "Screen scaling" in the main dialog box. Also here you must enter the two diametrically opposed screen corners.

Another button called "BOX" is available here. Clicking this button shows a crosshair cursor and by pressing the left mouse button (and keeping it pressed) it is possible to determine a portion of the screen the tablet values are scaled to. The resulting values of the screen size (in pixels) are displayed in the corresponding fields. These values may also be edited with the keyboard.

There is another button marked "DESKTOP" with a useful function. This function selects the size of the Atari desktop. This means, that the CRP accessory defines the screen area (without the menu bar) as active screen portion the tablet values are scaled to.

4. 1. 3. Window scaling

Use the button "WINDOW" to select an active, moveable window to scale the tablet's coordinates on. The scaling is automatically adapted to the position and size of this window. If no windows is active, the scaling corresponds to the option "DESKTOP".

5. Configuration of the driver software

Within the main dialog box there is a button to access a panel in order to load and save a specific configuration and modify configuration parameters. The available functions are:

5. 1. Save

It is possible to save all defined settings permanently to disk. To do so, select the button "SETTINGS" and from the now opened dialog box select "Save". A sub-

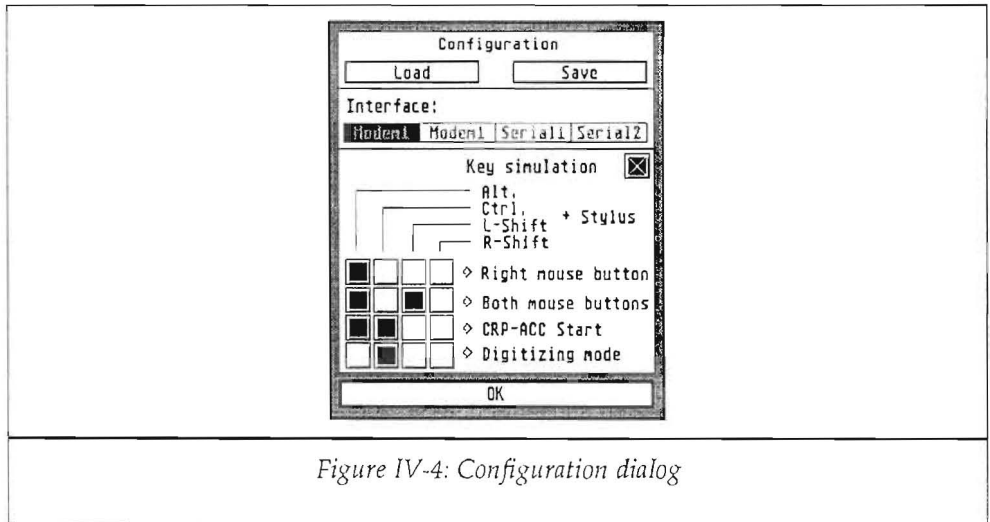


Figure IV-4: Configuration dialog

sequent file selector box enables the user to select a file name for the desired configuration. Clicking "OK" in the file selector box accepts the file name.

5. 2. Load

Clicking the button "Load" again opens a file selector box. The user may enter a file name, e.g.

A:\TEST.DAT

or

X:\SUB1\SUB2\XXYYZZ.DAT

or just point to one of the proposed names for already saved configurations. This way, it is possible to refer to numerous parameter settings and to restore any saved configuration.

5. 3. Key simulation

The CRP digitizing tablet may be operated with either a stylus or a four button puck. The stylus has one button, it corresponds to button #1 on the puck and the mouse's left button. The puck's button #2 has the same function as the right mouse button. Button #3 of the puck enables or disables (acting as a toggle switch) the digitizing function (only contained in a special version of this accessory used in CAD, when the CRP digitizer is used for true scale digitizing). Pressing button #4 equals pressing both mouse buttons simultaneously. Since the stylus has one button only, the other functions are simulated with the keyboard.

To make this possible, the box "Key simulation" must be active (crossed). By the way, the only reason to switch this function off is when an incompatibility to an application software is encountered.

In order to simulate the other buttons with the stylus tip switch, it is necessary to press one of the corresponding keys *together* with the stylus tip. It is the user's choice to select which keyboard key performs what function. The possible keys are both "Shift" keys, "Ctrl" and "Alt".

The sample dialog box shows the following choice: pressing the "Alt"-key together with the stylus switch results in simulation of the right mouse button, pressing "Alt", "Ctrl" and the stylus results in popping up the accessory's dialog box.

The user's selection may be at random, however take care in not programming redundant cases where different combination may execute the same function.

As you see, it is also possible to start the accessory from the tablet instead of having to use the menu bar for this purpose.

CHAPTER V

Chapter V

1. The CRP-digitizer for the Amiga

1. 1. Important notice

The constant development of our products makes it necessary from time to time to modify and adjust certain parts of our software. Therefore it may occur that this description does only partially match the actual revision. Check for a text file on your distribution disk that will update all necessary information. According to the language it is written in, the names may be "LEAME", "README", "LIESMICH" or "LEGGI_MI".

1. 2. Hardware requirements

All CRP digitizers work together with any Amiga computer, regardless of the operating system version or language.

1. 3. Software requirements

The delivery of a CRP-digitizer for the Amiga includes a 3.5"-diskette, double sided containing all the necessary files to operate the CRP-digitizer.

There are very few known compatibility problems. However CRP constantly develops and updates the driver software to keep up with the ongoing development. Check with your local dealer or with our hotline for possible changes, updates and additional information. Also, the vendor of a specific software package might be of assistance if you encounter problems with a particular package.

Notes:

- A mouse accelerator must be disabled. The mouse accelerators are generally incompatible with CRP drivers, so they must be deactivated before using the CRP software. The Workbench 2.0 already contains a mouse accelerator which must be disabled (see chapter "Preferences" in your Amiga manual). In case of doubt set the speed factor to the value "1".
- The CRP digitizer may not always work with software packages that make use of the serial port by communicating through it or changing its parameters. This is especially the case with terminal programs.
- Also, software packages that directly access the mouse port to obtain the mouse data instead of calling the operating system may behave strangely or not work at all together with CRP digitizers. Game programs frequently are conceived that way. Also, the already described mouse accelerators are programmed like that and may cause the mentioned incompatibility.

2. Installation to the Amiga

Installing the CRP digitizer requires some knowledge on the operation of your computer. Make sure you can look up additional information in the manual of your machine.

Place the tablet in front of your system monitor and check the DIP switches located on the rear of the A3 tablet. The A4 model for the Amiga generally does not have any DIP switches at all.

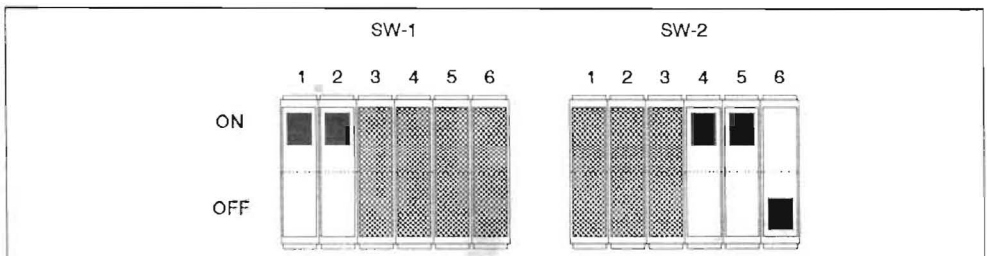
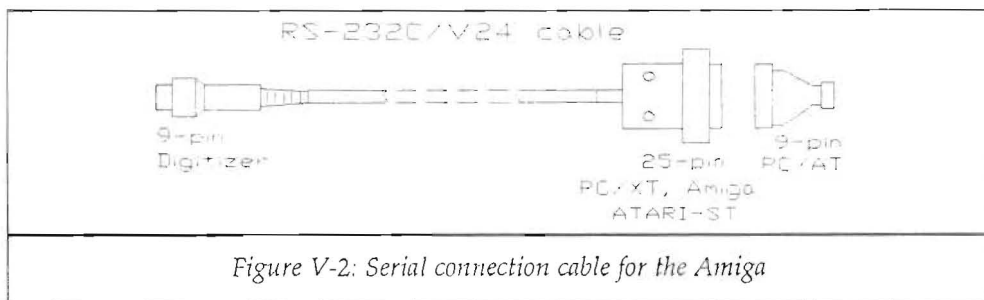


Figure V-1: DIP switches, A3 model



The CRP-digitizer is connected to the serial port located on the rear of the computer. The cable supplied for the Amiga has two plugs: a 9-pin (A4-model female; A3-model male) for connection to the digitizer and a 2-pin female connector for the serial port.

Connect the tablet to the power supply making sure that the mains adaptor supplied with your tablet matches local power requirements

When switching on your computer, *make absolutely certain that no mouse accelerator is active*. Failing to observe this will result in inexplicable malfunction of the driver and the cursor movements. Be sure to definitively deactivate such accelerators for as long as you intend to use the CRP digitizer.

Make a backup copy of your distribution disk.

The driver set supplied is operatable from floppy or hard disk. In any case you must install the supplied font set. This is accomplished by clicking the icon "Install_Font" on the distribution disk.

To install the entire driver set on the hard disk, we suggest to create a new directory and give it any name. Then copy all files from the CRP disk into this directory. Do not forget to run the "Install_Font" program as well. To finalize the operation, edit the "Startup-Sequence" and add the following line *before* the command "LoadWB":

```
ASSIGN CRP: <Drive:Path>
```

Reboot your computer now. Use the key combination "Ctrl-LeftAmiga-RightAmiga" This concludes the basic installation and the software is ready to be activated by the user.

3. Activation of the driver

Click the icon corresponding to the program "CRP_Control_II". A dialog box opens (as shown below) and the first step is to click on the button "ON" in order to activate the digitizer driver.

Already at this time you may use the CRP digitizer's pointing device to move the screen cursor. Note that if you position the pointing device on any spot on the tablet's active area, the screen cursor will follow and place itself accordingly.

If the cursor does not react in the described way, there are several possibilities to check with:

- If the cursor does not move at all, recheck the installation procedure completely. Especially double check the connections between the peripherals and the power supply.

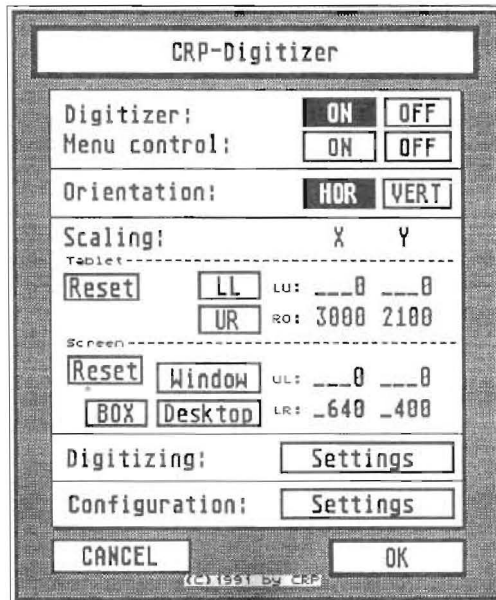


Figure V-3: CRP digitizer dialogbox

- If the cursor jumps incoherently over the screen, there might be a mouse accelerator yet active. Or, the A3 tablet is not configured properly, have another look at the DIP switch settings.

Should none of these remedies result in a perfect functioning, contact your local dealer for support. Be sure to have all information concerning your particular configuration at hand when reporting the problem.

4. Operation

4. 1. Scaling of screen and tablet

Clicking on the "ON" button to activate the driver also results in selecting predefined scaling values for both screen and tablet. Either it is the default values or previously saved ones. By default, the entire tablet area is active and fits the full screen area. This means that e.g. the lower left screen corner matches the lower left tablet corner. Of course all four corners of each elements will perfectly match.

4. 1. 1. Scaling of the tablet

If this default scaling is not desired, the user may select any values for tablet and screen independantly.

Exiting the dialog box by pressing the "OK" button will use the selcted values until reset.

The standard values can be reselected any time by pressing the "RESET" button. This may be useful when the entered values are to be rejected.

It is also possible to select the scaling values using the digitizer's pointing device. The user may define a lower left corner ("LL") and an upper right ("UR") one. Make sure that the upper right corner is indeed "upper" aond more to the right that the defined lower left corner. In case of error, press the left mouse button to abort the process and restart. Thus the previously defined scaling is restored. Using the keyboard to enter the data makes it possible to define precise coordinate values.

The tablet can be operated in two positions: horizontal (default) and vertical. This means that upon selection of the button "VER" the tablet must be rotated *clockwise* by 90 degrees. Thus, the tablet is portrait oriented, which corresponds to what we call "Vertical". A previously defined scaling is preserved, it may become necessary again after the rotation.

4. 1. 2. Scaling of the screen

It is possible to independantly scale the screen. This process is very much like the tablet scaling already described. There are several buttons located in the area "Screen scaling" in the main dialog box. Also here you must enter the two diametrically opposed screen corners.

The button marked "BOX" is not used on the Amiga version of this driver.

Selecting the button "DESKTOP" scales the tablet coordinates automatically to the "Front Screen". Also a possibly activated "Overscan"-mode is automatically recognized and scaled upon.¹

The CRP digitizer generates absolute coordinate values, the mouse provides relative ones. This explains the basic difference between the two pointing devices. The tablet has a constant resolution over the entire active area. The Amiga hardware is capable of generating different screen resolutions at the same time in different screens ("screens" as understood by the operating system). Thus, it is not possible to change from one screen to the other as with the mouse because the tablet coordinates are scaled to the particular front screen, regardless of the fact that it fills the monitor entirely or just partially. This explains why it is not possible to move a screen with the tablet. The system mouse must be used for this purpose. Since the mouse remains active at all times, this is not a drawback at all.

4. 1. 3. Window scaling

Use the button "WINDOW" to select an active, moveable window to scale the tablet's coordinates on. The scaling is automatically adapted to the position and size of this window.

1 For more information consult the Amiga manual

5. Configuration of the driver software

Within the main dialog box there is a button to access a panel in order to load and save a specific configuration and modify configuration parameters. The available functions are:

5. 1. Save

It is possible to save all defined settings permanently to disk. To do so, select the button "SETTINGS" and from the now opened dialog box select "Save". A subsequent file selector box enables the user to select a file name for the desired configuration. Clicking "OK" in the file selector box accepts the file name.

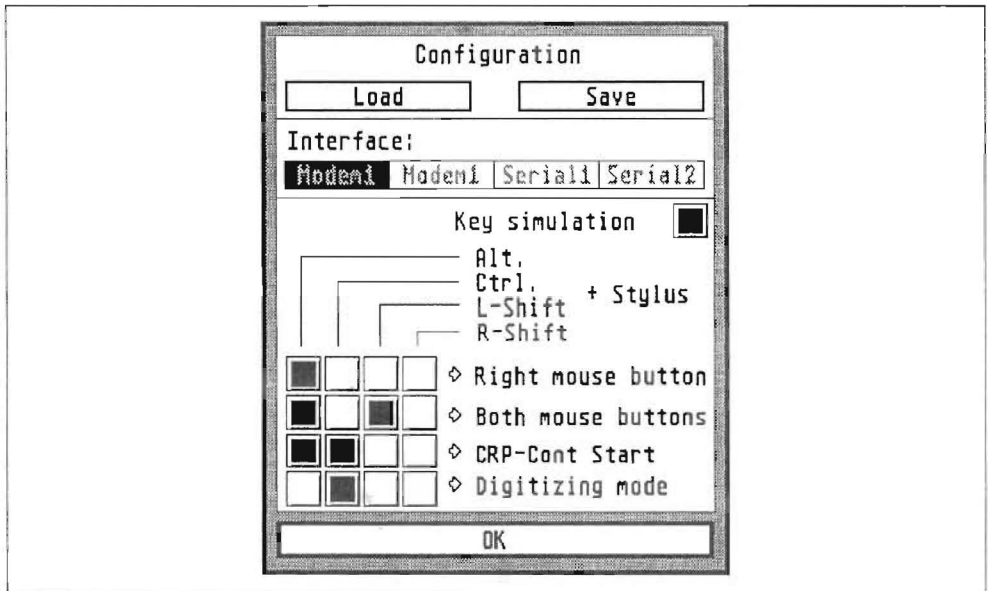


Bild V-4: Configuration dialog

5. 2. Load

Clicking the button "Load" again opens a file selector box. The user may enter a file name, e.g.

```
DF0:TEST.DAT
```

or

```
CRP:SUB1/SUB2/XXYYZZ.DAT
```

or just point to one of the proposed names for already saved configurations. This way, it is possible to refer to numerous parameter settings and to restore any saved configuration.

5. 3. Key simulation

The CRP digitizing tablet may be operated with either a stylus or a four button puck. The stylus has one button, it corresponds to button #1 on the puck and the mouse's left button. The puck's button #2 has the same function as the right mouse button. Button #3 of the puck enables or disables (acting as a toggle switch) the digitizing function (only contained in a special version of this accessory used in CAD, when the CRP digitizer is used for true scale digitizing). Pressing button #4 equals pressing both mouse buttons simultaneously. Since the stylus has one button only, the other functions are simulated with the keyboard.

To make this possible, the box "Key simulation" must be active (crossed). By the way, the only reason to switch this function off is when an incompatibility to an application software is encountered.

In order to simulate the other buttons with the stylus tip switch, it is necessary to press one of the corresponding keys *together* with the stylus tip. It is the user's choice to select which keyboard key performs what function. The possible keys are both "Shift" keys, "Ctrl" and "Alt".

The sample dialog box shows the following choice: pressing the "Alt"-key together with the stylus switch results in simulation of the right mouse button, pressing "Alt", "Ctrl" and the stylus results in popping up the accessory's dialog box.

The user's selection may be at random, however take care in not programming redundant cases where different combination may execute the same function.

As you see, it is also possible to start the driver program from the tablet instead of having to click on the corresponding icon.



CHAPTER VI



Chapter VI

1. Servicing and operating elements

1. 1. Service

Generally speaking, the CRP-digitizers are non serviceable. It may happen that the active surface becomes stained or dirty. To clean the CRP-digitizers use a soft cleansing tissue impregnated in isoprpyl alcohol (without additives) or a soft cleansing liquid.

The plastic foils or optionnally available templates included in some of the packages are treated exactly the same way.

Notes:

- Do not submerge the CRP-digitizer into fluids.
- Protect the device against shock, excessive temperature changes, sun radiation, dust or any other extreme external influence. The CRP-digitizer is a high precision measuring device.

ATTENTION: Never use solvents or thinners to clean the CRP-digitizers. Also the use of gasoline is strictly forbidden: their usage will result in irreparable damage!

1. 2. Operating elements

The CRP-digitizer series requires a pointing device such as stylus or 4-button puck, a power supply and a computer connection cable and protective foils or templates. In this section all available components are discussed.

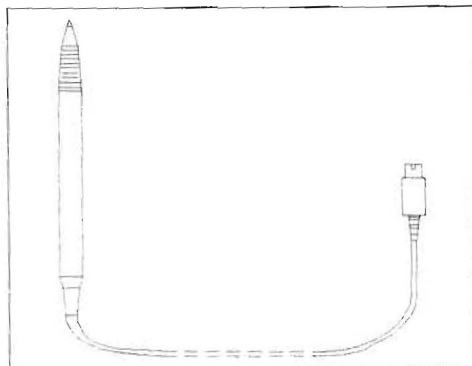


Figure VI-1: The stylus

1. 2. 1. The stylus

The stylus can be used either with the steel tip or a ball point pen. Its ergonomic design makes it a very handy working tool conceived for efficient drawing or pointing.

The stylus is connected to the digitizer via the 5-pin connector on the rear side and is provided with a cable long enough to permit free, undisturbed working.

The stylus carries a switch in its interior. This switch is activated by pressing down the tip on the active surface of the digitizer. The software driving the digitizer acts according to the function to be executed by the switch. For example, the program "TAKAVOR" (the graphics package included in all MS-DOS-versions) executes a command pointed to on the menu on the left hand side of the screen.

To exchange the steel tip, proceed as described now:

- grab the inserted tip (or ball point pen refill) with the tips of your fingers and pull it out.
- insert the new tip (or ball point pen refill) instead; the tip has to point outwards. Push the tip into the stylus until you notice a click inside the pen.
- Note that only original CRP replacements are to be used, otherwise any type of warranty becomes null and void.

1. 2. 2. The 4-button puck with crosshairs

This pointing device is used for the purpose of "digitizing" an existing image; that is, the user may very accurately point to a certain dot on an image or drawing placed on top of the CRP-digitizer. The image to be translated into a computer-like information can be a picture, slide, X-ray photo, drawing, etc.

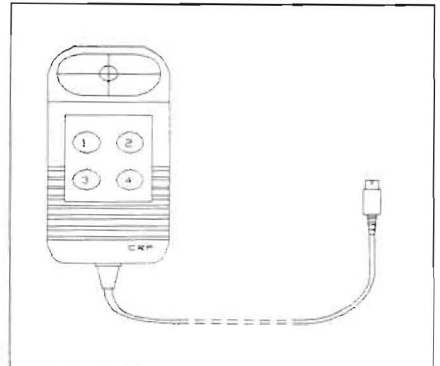


Figure VI-2: The 4-button puck

The cursor is provided with 4 coloured buttons marked from "1" to "4". The key number "1" acts like the switch inside the stylus. The function of the other keys again depends on the software package used.

1. 2. 3. The "MIX"-adaptor

In order to connect both stylus and puck simultaneously, a special electronic adaptor has been created. It is available for both sizes (A3 and A4; notice however that their size is different, so make sure to order the correct one) and fits into the 8-pin plug on the rear of the digitizer.

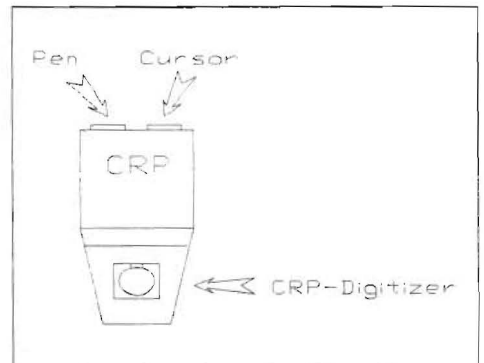


Figure VI-3: CRP-Mix

Whenever a software package requires a stylus to operate (drawing programs or other creative software) and several buttons to execute commands, the "MIX" adaptor is the ideal solution. With one hand the stylus is operated, with the other hand commands are given to the software.

This is especially required for Amiga-computers where the 2nd mouse button plays an important role.

1. 2. 4. The power supply

This adaptor fits into a standard mains outlet (other types with different plugs or input voltages are available upon request). The cable of this power supply is connected via a jack plug to the CRP-digitizer. All digitizer models use the same type of power supply.

Be sure to check if your power supply is suitable for the main outlet standard in your country.

Input voltage: 220V / 50Hz (standard)

Output voltage: +12V @500mA

1. 2. 5. The DIP-switches

On the rear side of your CRP-digitizer a set of DIP-switches is located. The A4-model (MS-DOS-version only) carries a set of 10 switches on the back (turn the tablet face down to see them). The A3-digitizer has 2 sets of 6 switches each on the rear side (next to the "RESET"-button). These switches determine certain working parameters like transmission speed, data formats, etc.

The switches are changed by means of a pointed tool (like the digitizer's stylus or a small screw driver). They are set to one of two possible positions "ON" or "OFF".

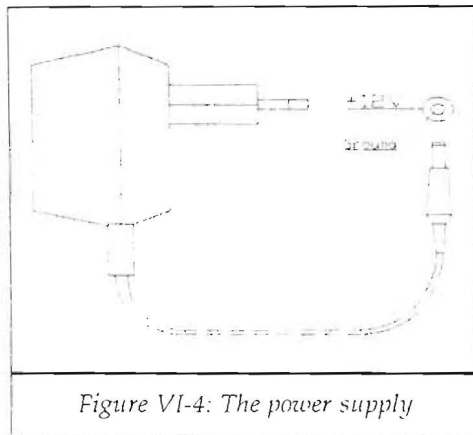


Figure VI-4: The power supply

ATTENTION: in case the switches have to be changed, be sure to switch the CRP-digitizer off and on again (or press the "RESET"-button on the A3-model) in order to make the changes effective!

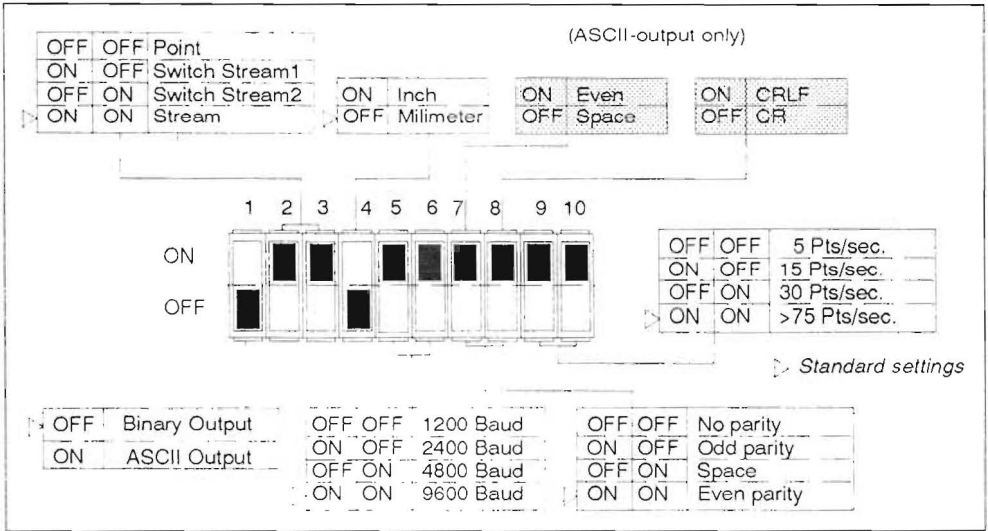


Figure VI-6: DIP switches (A4 DOS version)

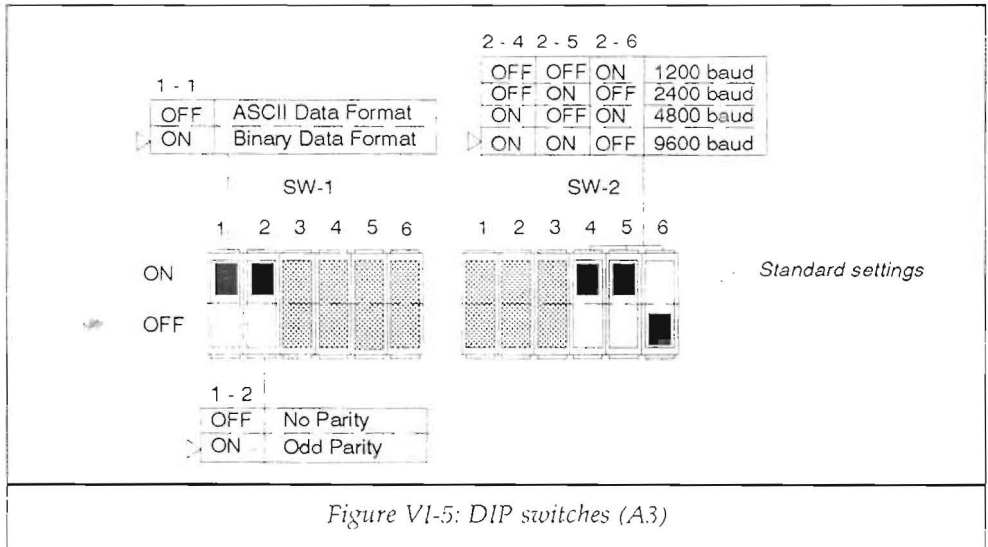


Figure VI-5: DIP switches (A3)

The sketches following on the next page shows the meaning of the DIP-switches. Be sure to select the correct position before operating the CRP-digitizer.

2. The serial interface (RS 232C)

XT (AT)	Tabl.	Name	Description	Direction
1	1	---		
2 (3)	3	RD	Receive Data	→ digitizer
3 (2)	2	SD	Send Data	→ computer
4 (7)	5	CS	Clear to Send	→ digitizer
5 (8)	4	RS	Request to Send	→ computer
6 (6)	8	ER	Data Terminal Ready	→ computer
7 (5)	7	SG	Signal Ground	---
8 - 19		---		
20 (4)	6	DR	Data Set Ready	→ digitizer
21 - 25		---		

Table VI-1: Signals on the serial connector

2. 1. Description of the 25-pin serial connector

All CRP-digitizers communicate with the computer via a standard serial interface according to the standard RS 232C (V24 in Europe). The signals are the following:

Notice: this table shows the pins of the 25-pin serial connector used on PC-XT-ATARI-ST and Amiga computers. The numbers in brackets describe the 9-pin connector used on PC-AT computers.

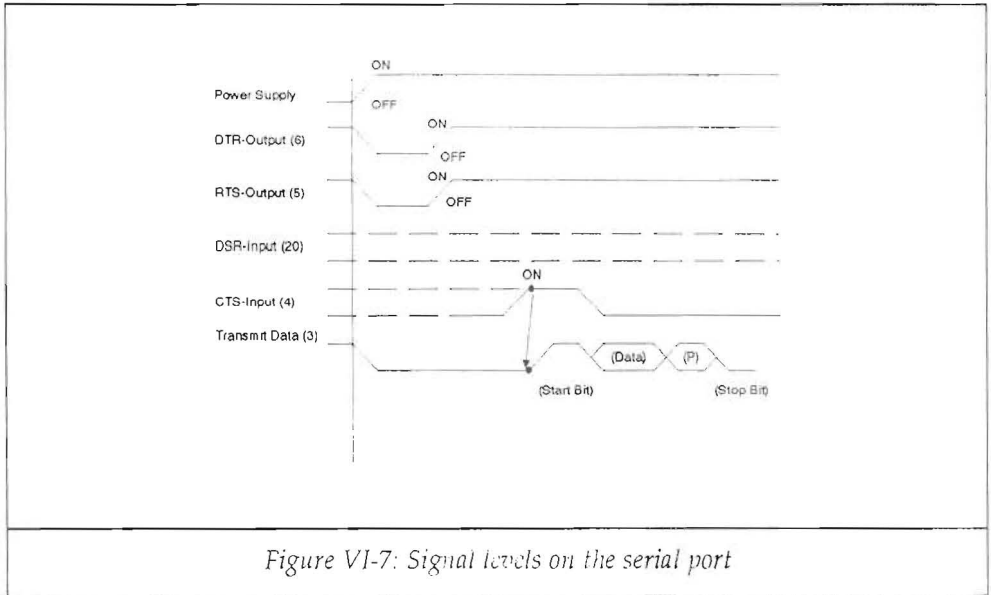


Figure VI-7: Signal levels on the serial port

2. 2. Signal levels

The signal levels of the serial port are the following:

+5V to +12V (corresponds to logical "0" or "OFF")

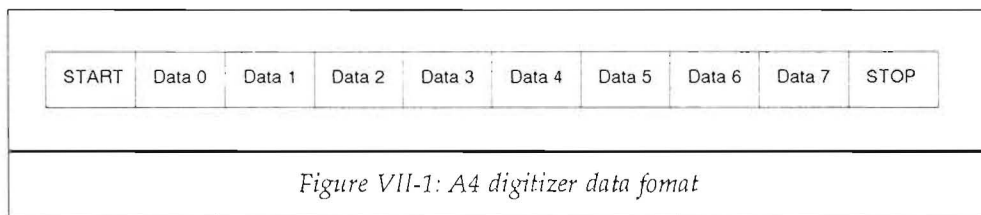
-5V to -12V (corresponds to logical "1" or "ON")

CHAPTER VII

Chapter VII

1. Data format (A4-tablet)

A byte is transmitted as follows:



The definition is: "Low" = Mark = 1
 "High" = Space = 0

1. 1. The binary format

The binary format is selected by switching the DIP-switch #1 into the "OFF"-position. A pair of coordinates results in 5 bytes also containing the button information:

Bit	7	6	5	4	3	2	1	0
Byte 1	0	1	F3	F2	F1	F0	0	0
Byte 2	0	0	X5	X4	X3	X2	X1	X0
Byte 3	0	0	X11	X10	X9	X8	X7	X6
Byte 4	0	0	Y5	Y4	Y3	Y2	Y1	Y0
Byte 5	0	0	Y11	Y10	Y9	Y8	Y7	Y6

Table VII-1: Coding of the binary data

Description:

Byte 1: the bit 6 marks this word. The CRP-digitizer is constantly sending data (as long as the pointing device is within 3mm of the active surface and the stream mode is selected). For synchronisation purposes this bit 6 denotes the start of a sequence of values.

The bits F0 and F3 represent the status of the switches on the pointing device. F0 stands for the switch in the stylus (or button #1 on the puck), F1 to F3 represent buttons #2 to #4 on the puck. They are at "0"-level when the switch is not pressed, otherwise they take the value "1" (only one at a time).

Bytes 2 and 3: the value of the X-coordinate is made up from these two bytes.

Bytes 4 and 5: the value of the Y-coordinate is made up from these two bytes.

1. 1. 1. Value range (binary format)

The maximum and minimum values for the A4-tablet are the following:

X-coordinate: 0000 to 3000 (0H to 0BB8H)

Y-coordinate: 0000 to 2100 (0H to 834H)

One count (or one step) corresponds to $\frac{1}{10}$ mm; 3000 represents for example 300 mm or 30 cm.

1. 2. The ASCII¹-format

The ASCII-format is selected by setting DIP-switch #1 into the "ON"-position. A pair of coordinates and the button information consist of 13 bytes. The sequence is the following:

1 ASCII: American Standard Code for Information Interchange

MSB LSB MSB LSB
 $X^4 X^3 X^2 X^1, Y^4 Y^3 Y^2 Y^1, F <CR LF>$

X^4 to X^1 correspond to the X-coordinates of a point on the active surface

Y^4 to Y^1 correspond to the Y-coordinates of a point on the active surface

F is the code for the button pressed on the pointing device

MSB = Most Significant Byte

LSB = Least Significant Byte

1. 2. 1. Value range (ASCII-format)

The value ranges in this format are the following:

XXXX: 0000 to 3000 (one digit equals $\frac{1}{10}$ mm)

YYYY: 0000 to 2100

F: 0 = no button pressed on the pointing device

1 = tip of stylus pressed (or button #1 on the puck)

2 = button #2 on the puck

4 = button #3 on the puck

8 = button #4 on the puck

<CRLF>: Carriage Return (0DH) - Line Feed (0AH)

The ASCII-code for the digits 0 to 9 and the different control codes appearing are listed in the following table:

Digit	Decimal	Hex	Digit	Decimal	Hex
0	48D	30H	5	53D	35H
1	49D	31H	6	54D	36H
2	50D	32H	7	55D	37H
3	51D	33H	8	56D	38H
4	52D	34H	9	57D	39H
CR	13D	0DH	LF	10D	0AH
,	44D	2CH			

Table VII-2: Extract of ASCII-table

2. Transmission modes (A4-digitizer)

There are four DIP-switch selectable report² transmission modes on the A4-digitizer to define the conditions under which the digitizers transmits data. The DIP-switches 2 and 3 control the transmission modes³. Note that after a change of the DIP-switches, the power of the digitizer must be turned off an on again.

2. 1. Stream mode

Whenever the pointing device is on the active surface, the digitizer will continuously send data. For synchronisation purposes, the first byte of each sequence is marked (see the section dealing with the binary data format).

In order to select the stream mode, set DIP-switches #2 and #3 to the "ON"-position (default settings when the digitizer is shipped). The ATARI-ST and Amiga versions are hardwired to this mode.

² For a definition of the term "report", see chapter VIII for details.

³ See chapter VI for a complete explanation on the DIP-switches.

2. 2. Switch stream mode 1

The data flow will only occur if the tip of the stylus or any button on the puck is pressed down. The pointing device has to be within the active area of the digitizer. Set DIP switch #2 to the "ON"-position and #3 to the "OFF"-position to obtain this transmission mode.

2. 3. Switch stream mode 2

The data flow will only occur if NO button on a pointing device is pressed down. The pointing device has to be within the active area of the digitizer. Set DIP switch #2 to the "OFF"-position and #3 to the "ON"-position to obtain this transmission mode.

2. 4. Point mode

In this mode the digitizer sends one (and only one) report each time a button on the pointing device is pressed down and it is within the active area of the digitizer. Set both DIP-switches #2 and #3 to the "OFF"-position to obtain this mode.

CHAPTER VIII

Chapter VIII

1. Operation of the A3-CRP-Digitizer

Before starting the description of the operating of the A3-digitizer by CRP, certain terms have to be defined and explained.

1. 1. Definitions

1. 1. 1. Programmability

The A3-digitizer by CRP is programmable. This means, that the computer can send commands to the tablet which act upon the behaviour of the device or re-calculate the coordinate values according to given parameters.

1. 1. 2. The report

The CRP-digitizer is a measuring instrument. It calculates coordinates from a geometrical position (pointed to by the stylus or puck) and transmits them to the computer. A set of X-/Y-coordinates and the button information is called a report.

1. 1. 3. The proximity distance

The pointing device must be within a certain distance (measured vertically) from the active surface in order to provoke the generation of reports. If the pointing device is within this distance, we say it is within proximity.

The distance itself depends on the internal construction of the digitizer and can be considered a constant value.

1. 1. 4. Absolute and relative coordinates

In chapter I (Introduction) the terms "relative" and "absolute" have been explained comparing the CRP-digitizer with a mouse. The CRP-digitizer (A3-model) however is capable of issuing relative coordinates, useful in some applications. Whenever a point has unique coordinate values, we talk about absolute values. If the coordinates of a point depend on the values of a previous point, we define the term relative coordinates.

The difference is explained in the subsequent sketch.

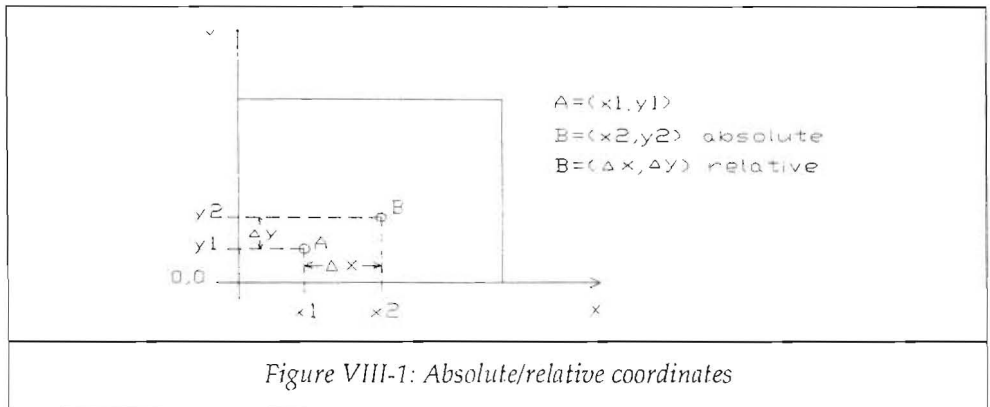


Figure VIII-1: Absolute/relative coordinates

Points A and B have unique and fixed values in absolute mode. When referring to relative coordinates, the values for point B will depend on the relative distance to point A (determined previously).

Absolute coordinates are always measured from the tablet origin, relative coordinates refer to the previously measured point.

1. 1. 5. The resolution

The term resolution describes the shortest possible distance that can be recognized between two adjacent points. The CRP-digitizer series have a hardware resolution of 0,1mm; they do however simulate a resolution of 0,025 mm. The resolution can be

expressed either in lines per inch (lpi) or lines per mmm (lpmm). The term "lines" actually refers to points.

1. 1. 6. The count (or step)

The position of a point on the active surface can also be expressed in counts. The effective geometrical distance calculates itself from the resolution.

Examples:

- * Assuming the resolution is 10 lpmm, a distance of 3 mm equals 30 counts (or steps).
- * Assuming the resolution is 20 lpmm, a distance of 3 mm equals 60 counts (or steps).

1. 2. Command format

As already explained, the CRP-digitizer can receive commands from a computer and act upon them. A command consists of at least one character. Some commands require more than just one. The digitizer has a buffer of 16 characters length. This way it is possible to enter 16 characters into the digitizer, in a sequence faster than the execution would require. Note that the execution time of the commands is sensibly different and must be taken into consideration.

1. 3. Report format

The CRP-digitizer A3-size knows two basic formats: ASCII and binary. The formats are only DIP-switch selectable (not programmable).

1. 3. 1. The ASCII¹ data format

This format issues the reports in the so-called ASCII-code, as true digits to the computer. The number of digits depends on the selected resolution:

1 ASCII: American Standard Code for Information Interchange.

Resolution	data format
1 to 508 lines per inch	XXXX,YYYY,F<CRLF>
1000 and 1016 lpi	XXXXX,YYYYY,F<CRLF>

Explanation:

- X: one digit of the X-value (between 0 and 9)
 Y: one digit of the Y-value (between 0 and 9)
 ,: the comma (2CH)
 F: value denoting the button status on the pointing device. The values for "F" are fully explained in the section regarding the binary data format.
 <CR>: "Carriage Return"-code (0DH) (the "<>" are not transmitted)
 <LF>: "Line Feed"-code (0AH)

1. 3. 2. The binary data format

The binary data format is a coded format. The data is compressed into fewer bytes², resulting in a faster transmission of reports. This format requires prior decoding by a software. Nevertheless it is more commonly used than the ASCII data format because it is faster (fewer bytes have to be transmitted).

All CRP-drivers supplied with the different tablet versions work with the binary data format. These drivers generally re-calculate the binary information into integer variables which can be processed by higher level languages.

The binary format is different for absolute and relative coordinates. In absolute mode a report consists of 5 bytes, in relative mode only 3 bytes are required.

The following tables illustrate the binary data format of the A3-digitizer by CRP:

Bit	7	6	5	4	3	2	1	0
Byte 1	PH	PR	T	Sx	Sy	Fc	Fb	Fa
Byte 2	0	X6	X5	X4	X3	X2	X1	X0
Byte 3	0	X13	X12	X11	X10	X9	X8	X7
Byte 4	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0
Byte 5	0	Y13	Y12	Y11	Y10	Y9	Y8	Y7

Table VIII-1: Binary data format (absolute mode)

2 Byte: an information unit. One byte consists of 8 bits. One ASCII character is one byte.

Bit	7	6	5	4	3	2	1	0
Byte 1	PH	PR	T	Sx	Sy	Fc	Fb	Fa
Byte 2	0	X6	X5	X4	X3	X2	X1	X0
Byte 3	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0

Table VIII-2: Binary data format (relative mode)

Byte 1: the bit 7 (PH = Phasing Bit) marks this byte. As it is possible for the digitizer to constantly send reports, this bit is used by the computer software to check the beginning of a sequence. The phasing bit is always at logical "1"-level.

The other bits have the following meaning:

PR= "PRoximity "0": pointing device within proximity, otherwise PR is set to "1".

T= Tablet identification: takes values "0" or "1", see commands of group III.

Sx= Sign bit of the X-coordinate ("0": negative X-value; "1": positive X-value)

Sy= Sign bit of the Y-coordinate ("0": negative Y-value; "1": positive Y-value)

F= Flag bits, denote status of buttons on pointing device.

Bytes 2 and 3: the value of the X-coordinate is made up from these two bytes. Notice the significance of the two bytes.

Bytes 4 und 5: the value of the Y-coordinate is made up from these two bytes. Notice the significance of the two bytes.

In relative mode, the X- and Y-coordinates consist on only one byte each.

The following table shows the codes of the buttons pressed on the pointing device. These codes are valid for ASCII and binary data format³:

³ In ASCII data format the values issued for "F" are the same digits in hex (e.g. "1" is transmitted as 31H).

Switch (Pointing Device)	Fa	Fb	Fc	Combinations	Fa	Fb	Fc
No button	0	0	0	1 + 2	0	1	1
Stylus tip	0	0	1	1 + 3	0	1	1
Puck buttons:				1 + 4	1	0	1
# 1	0	0	1	2 + 3	0	1	1
# 2	0	1	0	2 + 4	1	1	0
# 3	0	1	1	1 + 2 + 3	0	1	1
# 4	1	0	0	1 + 2 + 4	1	1	1
				2 + 3 + 4	1	1	1
				1 + 2 + 3 + 4	1	1	1

Table VIII-3: Flag bit values

2. Description of the A3-digitizer commands

The digitizer commands (which are sent to the CRP-digitizer in order to define a certain behaviour) are subdivided into three groups:

- Group I: these commands define under what circumstances reports are issued by the CRP-digitizer. There are four transmission modes: stream, remote, switch stream and point. These modes are fully explained in the corresponding section.
- Group II: the commands of this set are also called modify commands. The reason lies in the fact that they "modify" the report according to certain rules. There are three types of modes: increment and axis update mode and the report rate definition.
- Group III: the third group deals with miscellaneous commands defining certain working parameters such as origin location, transmission control, device identification, etc.

2. 1. Command overview

Command	ASCII	HEX	Group	Command	ASCII	HEX	Group
Absolute coordinates ...	F	46	III	Start transmission.....	DC1	11	III
Axis update mode	G	47	II	Stop transmission	DC3	13	III
Axis value.....		20 to 7F		Tablet identification			
Resolution				zero	0	30	III
1 line per inch	l	6C	III	one	I	31	III
2 lines per inch	n	6E	III	Origin			
4 lines per inch	p	70	III	lower left	c	63	III
100 lines per inch	d	64	III	upper left	b	62	III
200 lines per inch	e	65	III	Report rate			
400 lines per inch	g	67	III	2 reports/sec.....	T	54	II
500 lines per inch	h	68	III	10 reports/sec.....	S	53	II
1000 lines per inch	j	6A	III	50 reports/sec.....	R	52	II
10 lines per mm.....	f	66	III	Maximum rate	Q	51	II
20 lines per mm.....	i	69	III	Report transmission modes			
40 lines per mm.....	q	71	III	Remote	D	44	I
Diagnosis				(Trigger command) ...	P	50	I
Selftest.....	t	74	III	Stream	@	40	I
Send test results	w	77	III	Point	B	42	I
Echo.....	k	6B	III	Switch stream	A	41	I
Increment mode.....	I	49	II	Version check.....	^E	05	III
Increment value		20 to 7F		X/Y-scale	r	72	III
Configuration check.....	a	61	III	X-value LSB00 to FF	
Checksum	x	78	III	X-value MSB00 to FF	
Relative coordinates.....	E	45	III	Y-value LSB00 to FF	
Reset.....	NUL00		III	Y-value MSB00 to FF	

Table VIII-4: Command overview (default in boldface)

2. 2. Group I commands

This set of commands describes those which act upon the condition under which a report is issued by the CRP-digitizer. There are 4 possible modes.

2. 2. 1. Remote mode

Code: D (44H)

Trigger command: P (50H)

When the CRP-digitizer is set to this mode, no reports are issued until a special request from the computer is received. This "request" is called trigger command. Whenever the CRP-digitizer receives the letter "P" (50H), it will always answer with a report, in either ASCII or binary data format (as set with the DIP-switch).

Notes:

- The CRP-digitizer always responds with a report, also if it is set to point or switch stream mode. The code "P" (50H) can also be used in stream mode (to get reports while the pointing device is out of proximity).
- If the pointing device is out of proximity, the CRP-digitizer sends the last valid report (that is, the one which was sensed before the pointing device was moved out of proximity). If the binary data format is selected (with a DIP-switch), the proximity bit (PR) is set to "1".
- It may take up to 20 ms⁴ to issue a report.

⁴ ms: milisecond; 1/1000th of a second.

2. 2. 2. Stream Mode

Code: @ (40H)

Whenever the CRP-digitizer is set to this mode, reports are constantly issued with the previously set report rate. This mode is selected by all CRP-drivers; they usually monitor the tablet's data in the background (interrupt driven drivers). Every change of the position of the pointing device is immediately sensed and transmitted to the computer.

Notes:

- As soon as the pointing device is moved out of proximity, and no button is pressed, the CRP-digitizer sends the last detected report three times. If a button is pressed while the pointing device is outside of proximity, the last detected report is continuously sent (the binary data format carries the proximity information – PR-bit set to logical "1").
- Redundant⁵ reports are suppressed if the increment mode or the axis update mode is combined with the stream mode.

2. 2. 3. Point Mode

Code: B (42H)

In this mode the CRP-digitizer only emits a report (and only one at a time) whenever a button on the pointing device is pressed. If a button is pressed while the pointing device is outside of proximity, the last detected report is issued (the binary data format carries the proximity information – PR-bit set to logical "1").

2. 2. 4. Switch stream mode

Code: A (41)

⁵ Redundant reports are uselessly repeating values.

The CRP-digitizer continuously (with the preset report rate) sends reports as long as a button on the pointing device is kept pressed down.

Notes:

- The switch stream mode is default after issuing a "RESET"-command or pressing the "RESET"-key on the rear of the tablet.
- If a button is pressed while the pointing device is outside of proximity, the last detected report is issued continuously (the binary data format carries the proximity information – PR-bit set to logical "1").
- Redundant reports are suppressed if the increment mode or the axis update mode is combined with the switch stream mode.

2. 3. Group II commands

As already explained previously, the group II commands deal with the set of so-called modifying commands. They are called this way because the report is truly modified before being issued.

2. 3. 1. Increment mode

Code: I (49H)
Increment value: SP to DEL (20H to 7FH)

The increment value is the distance in X- and Y-direction which the pointing device must travel before a report is issued by the CRP-digitizer. The unit is counts. That means that the actual geometrical distance the pointing device must travel depends on the preset resolution.

Notes:

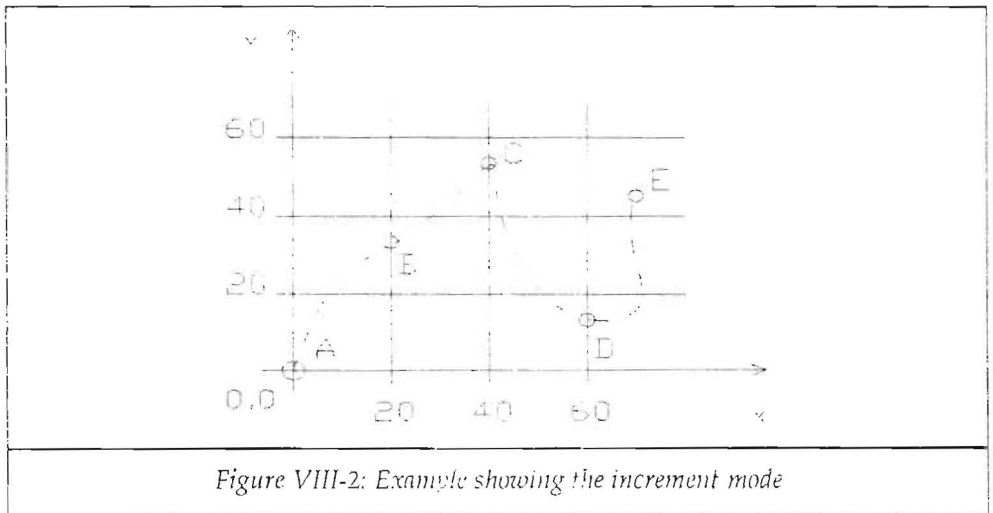
- While being programmed to increment mode, the digitizer does not send redundant reports. This way the number of issued reports can be reduced (especially helpful in stream and switch stream mode).

- During stream mode, when the pointing device moves the required increment distance and a button is pressed, the same report is sent twice: once when the button is pressed and once when it is released. The first time the flag bits are set, the second time the flag bits are set to logical "0".

2. 3. 1. 1. How the increment mode works

In increment mode the last issued report becomes the center of a square whose sides are twice the increment value. As long as the pointing device moves within the limits of this square, no reports are issued. When the pointing device touches or passes the side of this imaginary square, the report is issued and this point becomes the center of a new square with the same dimensions.

The following sketch demonstrates an example with an increment of 20 (counts). The dotted line shows the travel of the pointing device, the coordinates of the points A through E are explained



Point	Coordinates	Description
A	0,0	first report after selecting the increment mode.
B	20,10	the increment is met on the X-axis; the actual value for Y is issued.

Between points B and C no report is issued because the increment value has not been met or exceeded anywhere.

Point	Coordinates	Description
C	40,15	the increment value is met on the X-axis; the actual value for Y is issued.
D	60,15	the increment value is again met on the X-axis; the actual value for Y is issued.
E	65,43	the increment value is met on the Y-axis; the actual value for X is issued.

2. 3. 1. 2. Notes on the use of the increment mode

- First of all the command to initiate the increment mode has to be sent to the digitizer: "I" (49H).
- Then, the number of counts (which, multiplied with the preset resolution, result in the geometrical distance) is transmitted to the digitizer.
- The increment value transmitted to the computer is calculated from the number of counts desired (0 to 95D⁶) plus a fixed offset of 20H (32D). The previous example could be achieved with the following set of commands:

Desired increment value: 20 counts (or steps).

Increment value: 20D+32D=52D (equals 35H).

Total string sent to the digitizer: I5 (49H and 35H).

The increment mode is cleared by sending the hex-value 20H (32D) which would correspond to an increment value of "0".

A last note on the calculation of the true physical distance the pointing device has to travel. Let's assume, the preset resolution is 10 lpmm (0,1 mm). The pointing device

⁶ 95D represents the number 95 in decimal notation.

must travel 20 counts which equals to 2 mm to meet the increment value and provoke the issue of a report.

Examples:

Resolution	Increment value	Length of a count	Actual physical distance
10 lines per mm	10	0,1 mm	1 mm
20 lines per mm	10	0,05mm	0,5 mm
40 lines per mm	10	0,025 mm	0,25 mm

2. 3. 2. Axis update mode

Code: G (47H)
Update value: SP to DEL (20H to 7FH)

The axis update mode is somehow similar to the increment mode. The difference lies in the fact that when the update (increment) is met, the coordinates of the intersection points, rather than the actual value of the other axis, are issued. Like the increment mode, the update value refers to both X- and Y-axis.

Imagine a grid has been laid on the active surface of the digitizer and the only values requested are the intersection points of this grid.

Notes:

- Before the command for the axis update mode is issued, the pointing device should point to a grid intersection point.
- During stream mode, when the pointing device moves the required update distance and a button is pressed, the same report is sent twice: once when the button is pressed and once when it is released. The first time the flag bits are set, the second time the flag bits are set to logical "0".

2. 3. 2. 1. How the axis update mode works

- As soon as the pointing device enters proximity, the first detected point becomes the reference point. An imaginary grid is placed on the digitizer's active surface, the distance between the axis being the update value (in number of counts).
- Every time the pointing device moves into a new square, reports are issued to the computer.

Next an example with an update of 20 (counts) is illustrated. The actual physical distance depends on the preset resolution. The origin in this example is assumed to be (0,0), however it does not necessarily have to match the digitizer's origin.

The dotted line shows the travel of the pointing device across the active surface. The points A through F explain the different reports being issued.

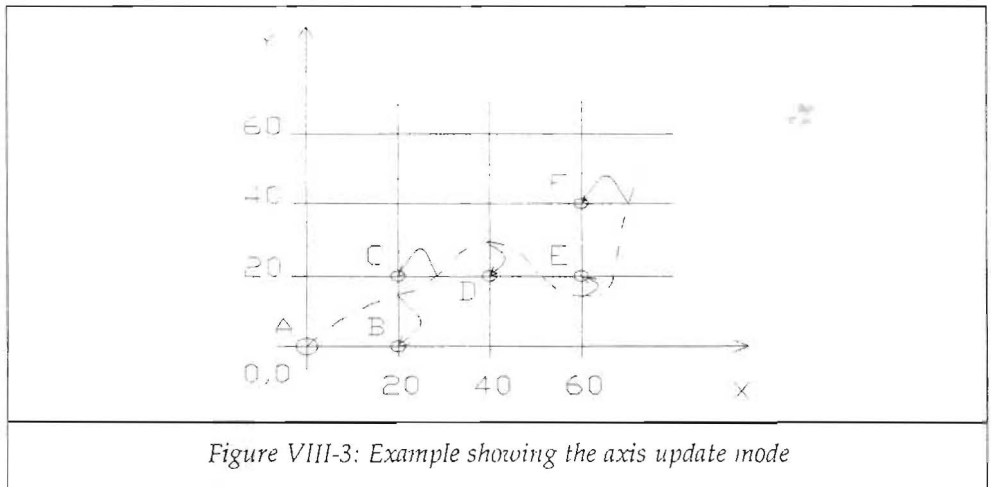


Figure VIII-3: Example showing the axis update mode

Point	Coordinates	Description
A	0,0	reference after selecting axis update mode.
B	20,0	the update is met on the X-axis, the previous Y-value is issued.
C	20,20	the update is met on the Y-axis, the previous X-value is issued.
D	40,20	the update is met on the X-axis, the previous Y-value is issued.
E	60,20	the update is met on the X-axis, the previous Y-value is issued.
F	60,40	the update is met on the Y-axis, the previous X-value is issued.

2. 3. 2. 2. Notes on the use of the axis update mode

- First of all the command to initiate the increment mode has to be sent to the digitizer: "G" (47H).
- Then, the number of counts (which, multiplied with the preset resolution, result in the geometrical distance) is transmitted to the digitizer.
- The update value transmitted to the computer is calculated from the number of counts desired (0 to 95D) plus a fixed offset of 20H (32D). The previous example could be achieved with the following set of commands:

Desired update value: 20 counts (or steps).

Update value: $20D + 32D = 52D$ (equals 35H).

Total string sent to the digitizer: G5 (47H and 35H).

The axis update mode is cleared by sending the hex-value 20H (32D) which would correspond to an update value of "0".

2. 3. 3. Report rate

The CRP-digitizer recognizes four report rates. A report rate is the number of reports issued per unit of time, in this case per second. The corresponding codes are:

2 reports per second: T (54H)
10 reports per second: S (53H)
50 reports per second: R (52H)
Maximum rate: Q (51H)
(90 reports per second approx.)

Notes:

- After a "RESET"-command or pressing the "RESET"-key, the digitizer defaults to the maximum report rate.
- The report rate is also influenced by the baud rate (DIP-switch selectable). Whenever a low baud rate is selected, the flow of reports is slower. Also the speed is reduced when the ASCII data format is selected because more bytes per report have to be transmitted than in binary data format.
- If a low report rate is selected, the pointing device must remain on the same spot for a longer period of time. If i.e. a report rate of 2 points/second is selected, the button press must last for at least half a second before the output occurs.

2. 3. 4. Combining commands of groups I and II

It is possible to combine the commands from group I and II. However not all combinations are possible or sensible.

Next a diagram follows indicating the valid and non-valid combinations between the commands discussed so far. Note that the digitizer does not check for valid or non-valid combinations.

Modify commands (Group II)	Report transmission modes (Group I)			
	Stream mode	Switch stream	Point mode	Remote
Increment mode	valid	valid	valid	not valid
Report rate	valid	valid	not valid	not valid

Table VIII-5: Combinations between groups I and II

Notes:

- The report rate has an influence on the group I commands because it determines the time base of the report flow. This time base can be explained as if inside the digitizer a clock would trigger the output of a report.
- If an increment is met and a trigger from the internal time base occurs, the CRP-digitizer issues a report.
- If no increment is met and a trigger from the internal time base occurs, no report is issued as long as the increment is not met.
- If an increment is exceeded and a trigger from the internal time base occurs, a report is issued.
- The above mentioned combinations are also applicable to the switch stream and point modes; here the event of pressing a button on the pointing device has also to be taken into consideration.
- During stream mode, when the pointing device moves the required increment/update distance and a button is pressed, the same report is sent twice: once when the button is pressed and once when it is released. The first time the flag bits are set, the second time the flag bits are set to logical "0".
- Increment and axis update modes cannot be combined.

2. 4. Group III commands

This group of commands deals with miscellaneous commands which define the communication parameters, origin location, device identification, relative/absolute coordinates, etc.

2. 4. 1. Absolute/relative coordinates

Absolute coordinates: F (46H)

Relative coordinates: E (45H)

2. 4. 1. 1. Absolute coordinates

- Absolute coordinates always refer to the origin (0,0) of the digitizer. Each point on the digitizer's surface has one unique coordinate value.
- A negative coordinate value is only possible when the origin is located in the upper left corner of the active area.
- In binary data format the maximum reportable value is 16,383⁷. Higher values are outputted as 16,383. This restriction only applies to the maximum resolution of 1000 and 1016 lpi. This restriction does not apply to the ASCII data format.

2. 4. 1. 2. Relative coordinates

- Relative coordinates always refer to the previous issued report. The coordinates of a point depend on the previous one which is taken as a new coordinate origin of a new coordinate system.
- Relative coordinates may be positive or negative at any time.
- Relative coordinates are "0,0" if the pointing device is out of proximity. The binary data format carries the proximity information – PR-bit set to logical "1" when this fact occurs.

⁷ See a more detailed description where the resolution commands are explained.

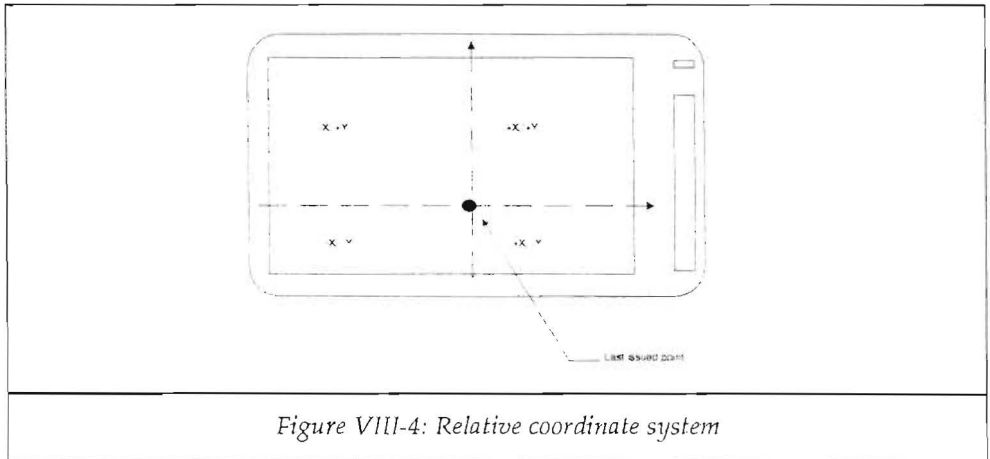


Figure VIII-4: Relative coordinate system

2. 4. 2. The RESET-command

Code: NUL (0H)

The "RESET"-command can be a hardware and a software command. Nearly (but not exactly) the same happens when the RESET-button is pressed on the rear of the CRP-digitizer.

The RESET-command presets the following modes and values (default values also valid after power-on):

Axis update mode:	off (update value = 0)
Resolution:	500 lines per inch
Increment mode:	off (increment = 0)
Coordinate type:	absolute coordinates
Origin of coordinates:	lower left corner
Tablet identification:	"0"
Report transmission:	switch stream
Report rate:	maximum rate

Notes:

- After issuing a RESET-command wait for at least 25 ms before sending a new command to the digitizer.
- A RESET-command should be issued always within the initialization sequence of a program in order to start from the same basis (see function #0 of the primary digitizer drivers).
- The RESET-command does not clear the "Stop transmission"-command (XOFF). Only by issuing a "Start transmission" or pressing the RESET-switch XOFF is deactivated.

2. 4. 3. Definition of the coordinate origin

Origin lower left corner: c (63H)

Origin upper left corner: b (62H)

These commands define where the origin of the digitizer's active surface is to be assumed. After a RESET-command the origin is in the lower left corner. The origin of a coordinate system has the coordinate values (0,0).

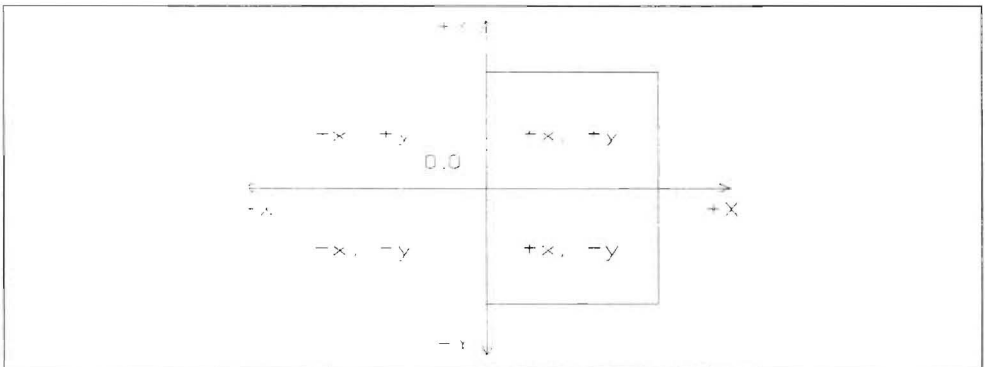


Figure VIII-5: Active area within coordinate system

Notes:

- When the digitizer defaults to a lower left coordinate origin, all values issued in absolute mode are positive.
- If the coordinate origin is in the upper left corner, the Y-coordinate values have a negative sign.

2. 4. 4. Resolution commands

This set of commands enables the software selection of eleven different resolutions (in inches or millimeters).

1 line per inch:	l (6CH)
2 lines per inch:	n (6EH)
4 lines per inch:	p (70H)
100 lines per inch:	d (64H)
200 lines per inch:	e (65H)
400 lines per inch:	g (67H)
500 lines per inch:	h (68H); default after "RESET"
1000 lines per inch:	j (6AH)
10 lines per mm (254 lpi):	f (66H)
20 lines per mm (508 lpi):	i (69H)
40 lines per mm (1016 lpi):	q (71H)

Notes:

- The CRP-digitizer has a hardware resolution of 0,1mm (254 lpi). Higher resolutions are simulated, that is the digitizer reports every second or fourth value.
- The resolution applies to both X and Y axis simultaneously.
- When selecting the binary data format, the maximum reportable value is 16,383. The reason lies in the fact that 14 bits are reserved for the coordinate information. So, a maximum value of 2^{14} can be represented. Therefore, when working with the two highest resolutions (1000 and 1016 lpi or 40 lines per mm), and a coordinate value takes a higher value than that (when the pointing device is in the very right hand side of the active area), only the constant 16,383 is reported. This

limitation does not apply to the ASCII data format because with 5 digits the maximum reportable value is 99,999.

- The maximum measurable X-size in binary data format and in the highest resolution is 16,383 counts (4096 mm or 16.125"). If this limitation is critical, select the next lower resolution.

2. 4. 5. Tablet identification

Tablet identification "0": 0 (30H)

Tablet identification "1": 1 (31H)

Principally it is possible to connect two digitizers to the same computer. In order to distinguish the origin of a set of coordinates, an identification (previously set) accompanies the report.

Notes:

- The tablet (or device) identification is only detectable in the binary data format. The ASCII data format does not furnish this information.
- The RESET-commands defaults to a tablet identification of "0".

2. 4. 6. Scaling of the X/Y-relationship

Code: r (72H) (followed by four bytes of scaling information)

The independant scaling of X and Y axis is one of the most valuable features of the CRP-digitizer.

Several screen oriented software packages use this feature saving a considerable amount in programming code.

Also, when digitizing pictures in a certain scale, this feature becomes most important to the user.

With this feature it is possible to scale (or project) another two-dimensional object (like a computer graphics screen for example) to the digitizer's active surface. The resolution of each axis can be set independantly within the range of 1 to 1016 points.

Notes:

- The command "r" is followed by four more bytes:
 - 1) low order byte of the X-resolution
 - 2) high order byte of the X-resolution
 - 3) low order byte of the Y-resolution
 - 4) high order byte of the Y-resolution
- This sequence must be strictly observed, otherwise unpredictable scaling values may occur.
- Before transmitting the values to the digitizer be sure to correctly calculate and code the resolution values.

Example:

In this example we will assume that a computer screen has a resolution of 640x30 pixels⁸ and the digitizer surface should exactly match this screen. The calculation is executed in the following order:

- Width of the screen: 640 points
Height of the screen: 350 points
- 640D equals 280H (X-axis resolution)
350D equals 15EH (Y-axis resolution)
- Pad the two hex-numbers with as many zeroes as required to obtain a four digit number:
0280 = X-value
015E = Y-value
- Subdivide the four-digit number into two two-digit numbers and align them as shown next (note that the pointed brackets are not part of the data flow, they just perform an optical division between the numbers):
<80><02><5E><01>

8 Pixel stands for "picture element" and determines a point on the screen.

- Transmit the following data sequence to the CRP-digitizer (again, be sure NOT to include the pointed brackets in the data flow):

<72><80><02><5E><01>

The first byte is the ASCII code of the character "r".

- Check the correct resolution with the "send configuration" command described later in this chapter.

Notes:

If the active area of the CRP-digitizer must match the scale of a map or a photograph, the resolution of the object is calculated as follows:

- Resolution of the object: 5 lines per mm
- Number of points in X-direction: 5 lpmm x 420 mm = 2100 lines
Number of points in Y-direction: 5 lpmm x 330 mm = 1650 lines

2. 4. 7. Transmission control

Start transmission (XON): DC1 (11H)

Stop transmission (XOFF): DC3 (13H)

These two commands enable to control the data flow from the computer. They work independantly from the selected transmission mode (point, stream, switch stream or remote).

These commands are derived from standard transmission protocols between computers. Many programs are already set up for this kind of "software handshake".

Notes:

- After issuing an "XOFF"-command the CRP-digitizer waits for an "XON"-command to resume the transmission previously halted.
- A software RESET does not clear this wait state, only a hardware RESET acts upon this command.

- If an "XOFF" is received while a report is transmitted, the data does not get lost. When resuming, the digitizer continues the data flow.
- While waiting for a command to resume, the command buffer accepts commands without executing them. They are processed when the transmission is resumed. If more than 16 bytes are sent to the digitizer, they get lost.
- Do not send XON/XOFF commands within the command sequence to scale the tablet. They would be interpreted as scaling parameters.

2. 4. 8. Send configuration

Code: a (61H)

This code tells the digitizer to answer with the preset (or default) X and Y maximum values. The following information is transmitted (in either ASCII or binary data format, according to the corresponding DIP-switch position):

- Button status of the pointing device
- Maximum X- and Y-values (this feature is very important to check the correct data transmission after a X/Y-scale data sequence). The returned value is the number of possible counts.

Notes:

- The values are always positive.
- Multiplying these values with the preset resolution, the user can obtain the actual physical distance that can be measured at this time.

2. 4. 9. Send software identifier

Code: ENQ (05H)

This command returns a character string informing the user of the firmware⁹ version contained in the internal ROM¹⁰.

Notes:

- The character string returned does not depend on any preset data format. The format of this string is:

DST-3A Digitizer from CRP. Software Version x.x

The character sequence x.x is replaced by the actual version number (1.1 at the time of printing of this manual)

2. 4. 10. Checksum control

Code: x (78H)

Approximately one second after issuing this command the CRP-digitizer returns a checksum performed on the internal ROM. This number is used to check the proper contents of this circuit (containing the firmware).

Notes:

- Upon receipt of this command the CRP-digitizer returns a character string independently from any preset data format. The string has the following form:

.#XXXX

⁹ Firmware is the software contained in a device and makes it work (the term "firm" derives from company)

¹⁰ ROM: Read-Only-Memory. Integrated circuit containing the "firmware".

The sequence XXXX is a four digit hex number calculated by adding the contents of all the ROM-addresses.

Example: #E348

- The digitizer may take up to one second to return the calculated checksum value. Be sure to provide a time-out in case the digitizer should "hang".

2. 4. 11. Echo

Code: k (6BH)

The echo command is used to quickly check the transmission between digitizer and computer. If the tablet is hooked up to a terminal and the echo code is sent, the digitizer will respond with all subsequently sent characters (echo) without acting upon them as commands.

Notes:

- While being in echo mode, the digitizer does not execute commands.
- The RESET-command is not sent back, but acted upon. It terminates the echo mode (as well as a hardware RESET would do).
- The RESET-command is the only possibility to end the echo mode.

2. 4. 12. Selftest

Perform selftest: t (74H)

Send test results: w (77H)

The CRP-digitizer is capable to perform a self test (do not misinterpret this test with the checksum feature. This latter one only checks the ROM, not the rest of the circuitry). After receiving a "t", the digitizer checks several internal parts.

Notes:

- The code to perform a self test does not result in an answer from the digitizer. The test results must be obtained issuing a "w".
- The self test requires that a pointing device is placed on the digitizer's active surface. Otherwise incorrect results may be obtained.
- When asking for the test results, the CRP-digitizer responds with a single byte (regardless of a preset data format). The meaning of the word is:

Bit	7	6	5	4	3	2	1	0
Meaning:	T	0	0	0	PR	D	C	A

T = result of the test from D, C and A ("1": OK; "0": error)

PR = proximity bit ("1": pointing device within proximity)

D = digital circuitry status ("1": OK; "0": error)

C = status of the pointing device ("1": OK; "0": error)

A = analog circuitry status ("1": OK; "0": error)

- Bits 4, 5 and 6 are always logical "0".
- The ASCII character "O" (4FH) is returned when the digitizer is OK.

Check with your local dealer for any malfunction of the digitizer.



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