WTC-1002

WACOM

Software Interface Reference Manual

UD- KT- and SD-Series Graphic Tablets

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Chapter 1

1.1 Introduction

This manual describes the programming interface to the WACOM UD- and SD-Series digitizers. It lists all the commands available to control the digitizer's operation and explains the format of the data transmitted by the tablet in various modes.

*'**Chapter 2: WACOM IVe, WACOM IV and WACOM II-S local commands**'* explains in detail the commands available within the WACOM IVe, WACOM IV and WACOM II-S command sets. The term 'local' indicates that these commands are only available when the tablet's current command set is either WACOM II-S or WACOM IV / WACOM IVe. They cannot be used when the tablet is emulating an non-WACOM command set (MM 1201, Bit Pad One).

The commands described in ***Chapter 3: UD-Series global commands'*** are available at any time, while a UD-tablet is switched on and not in a setup mode (hence the term 'global'). They can also be used when the UD-tablet emulates a non-WACOM command set.

'Chapter 4: Data formats' illustrates the format of the data sent by the tablet in different modes: binary mode, ASCII mode (WACOM II-S only), macro button transmissions. It also contains a table of the button status.

'Chapter 5: Tablet features and firmware (ROM) versions / Plug and Play (PnP)' lists the differences between the tablet firmware versions and explains the Plug and Play communication required by modern operating systems.

'Chapter 6: Tablet Settings' explains in detail the use of the commands ~*, ~W and ~R, which control the tablet state in a more overall manner than the commands listed in chapter 2.

Appendix A gives an overview of all commands of the UD-Series digitizers and lists each command set's factory defaults.

Appendix B explains the format of the Setting and Setup Strings which can be exchanged with the tablets to query or modify their current states.

Appendix C lists the factory defaults of command sets available on the tablets. It also contains a list of command sets available on various tablet models.

Sample source code in C is available on request. This kit is specific for MS-DOS but also contains information about the Wintab interface used by Windows. Programs demonstrate how to receive tablet data by polling the serial port (directly accessing the hardware and by using BIOS-routines), by using an interrupt handler and by using Wintab routines.

1.2 WACOM II and WACOM II-S compatibility

Prior to WACOM II-S all SD-Tablets used the WACOM II command set. WACOM II supported some additional commands which were removed when WACOM II-S was introduced. These commands are:

BA, LA, CA, OR, RC, RS, SB and YR.

The functionality of the TE-command has also been changed slightly. In WACOM II up to 200 bytes could be appended to the TE-command, which would be returned by the tablet after a successful self test. In WACOM II-S and WACOM IV only four characters are returned, the additional characters are ignored.

A few programs may have implemented some of these commands and may not function correctly with newer tablets which only support the WACOM II-S command set. These programs must be modified in order to function properly. These commands are not available on the UD-Series tablets.

Furthermore, the following commands were removed from the WACOM II-S command set when WACOM IV was created:

AS, DE, IC, PH, SC

The table 'WACOM II-S and WACOM IV local commands' provides a list of all commands available within WACOM II-S and WACOM IV.

1.3 The SD- and UD-Tablet Series

SD-Series Tablets support the WACOM II-S command set interface while UD-Series Tablets support the newer WACOM IV command set as the primary programming interface and WACOM II-S for compatibility with SD-Series Tablets. Programs which support WACOM II-S will work with both SD- and UD-Tablets, however using WACOM II-S emulation will limit some UD-Tablet features.

When the UD-Tablet is in WACOM II-S emulation mode, the pen’s side switch will be inactive when in pressure mode. This is because pressure and switch data are not supported simultaneously. The tablet must be switched between pressure and non-pressure mode with the PH-command. Also the tablet menu strip will not function. For these reasons it is best to use UD-Tablets in WACOM IV mode.

UD-Tablets with ROM Versions 1.4 and greater are sold under the trade names “UltraPad”, “ArtZ II” or “UD-xxxx-II” and sometimes referred to as UD-II Tablets in this manual. ArtPad (KT-0405) tablets with ROM version 1.3 are sold under the trade name ArtPad II.

Chapter 2

WACOM IVe, WACOM IV and WACOM II-S local commands

There are only minor differences between the WACOM II-S and WACOM IV operation modes. For this reason both command sets are listed together. The syntax of the following pages is as follows:

Each command description starts with a header, which indicates the command described followed by a short term notation of the command. The section **'Syntax'** shows how the command should be used. The **'Explanation'** section gives more detailed explanations on the options and effects of this command. As not all commands are available with both series, the **'Availability'** section shows the command set(s) within which it can be used. The (optional) **'Reference'** section lists related commands. Use this section to find out how other commands may be effected, side effects etc. An (also optional) **'Example'** section may give an example how this command can be used, along with a short comment.

AL **always transmit**

Syntax: AL*d*<*cr*>

Explanation: Normally the tablet does not transmit data when the pointing device is outside the effective area of the tablet (out of proximity). The AL-command can be used to modify this default behaviour. It instructs the digitizer to transmit coordinate data even though the stylus is out of proximity. This is not effective if increment mode (IN) or suppressed mode (SU) is enabled. Possible values for d are:

1 - send out of proximity data continuously
2 - send 3 coordinate pairs after the pointing device leaves proximity, then stop transmission
0 - cancel AL command

Note: d = 2 is only available in WACOM IV!
Note: The tablet will not send out-of-proximity data, if increment mode is enabled (IN).

Availability: WACOM II-S, WACOM IV

AS **select data format (ASCII or binary)**

Syntax: AS*d*<*cr*>

Explanation: d = 0 selects ASCII format for coordinate transmissions of the digitizer, d = 1 selects binary format.

Availability: WACOM II-S

DE **relative mode**

Syntax: DE*d*<cr>

Explanation: When in absolute mode, as the pointing device moves in the effective area, the digitizer sends coordinate data in terms of distance from the current origin. In relative mode it sends coordinate data in terms of distance from the previously transmitted coordinate.

d = 1 enables relative mode (DE1<cr>)
d = 0 disables relative mode (DE0<cr>)

Availability: WACOM II-S

FM **tilt mode**

Syntax: FM***d<cr>***

Explanation: This command enables or disables tilt mode.

d = 1 enables tilt mode
d = 0 disables tilt mode

In tilt mode the tablet transmits the angle between the stylus and a vertical line perbindicular to the tablet surface in addition to the coordinate and switch data of the WACOM IV binary data format. The format used in tilt mode is:

WACOM IV extended (W IVe).

Tilt values range from -64 to +63 in both x- and y-direction. The tilt resolution is in 1 unit incriments.

Note: If multi mode is enabled when this command is issued, multi mode will be disabled.

Availability: WACOM IVe, ROM Version 1.4 and above. Not available on KT-0405-R (ArtPad)

HC **reading height change**

Syntax: HC*d*<cr>

Explanation: Changes the reading height for the cursor. d = 0 sets high reading height (8 mm and more) d = 1 sets low reading height (about 2 mm) This command has no effect on the stylus.

Low reading height can not be used with a 16 button-cursor (UC-620).

Availability: WACOM IV, except KT-0405-R (ArtPad)

IC **set resolution unit**

Syntax: IC*d*<cr>

Explanation: This command selects inches or millimeters as the measurement for coordinate transmissions. Possible values for d are:

d = 0 for mm - the tablet will be set to a resolution of 50 points/mm
d = 1 for inch - the tablet will be set to 1000 points/inch.

Availability: WACOM II-S

IN **increment mode**

Syntax: IN*d1d2d3*<cr>

Explanation: Sets a coordinate increment range within which the digitizer will not transmit data. The tablet will only transmit a coordinate pair if at least one of the coordinates (x or y) differs from the last one transmitted by at least the increment value specified with d1d2d3. Values can range from 0 to 999. IN0<cr> cancels increment mode, issue IN0<cr>. In addition, the tablet will send a coordinate pair when the button status changes from zero to non-zero.

Note: The SU-command interacts with the PO-, SW- and SR-commands. The WACOM II-S default transmission mode is point mode. For this reason the tablet will behave as described above when the button state changes. However, the default transmission mode for WACOM IV is suppressed mode. In this case the tablet will transmit a point, when the button state changes from zero to non-zero.

In both cases the transmitted coordinate pair will be the same as the last one that met the increment, which may not be the exact current position of the pointer on the tablet. Increment mode modifies stream, switch stream and point mode in the way described above.

Note: The default value for the UD series is IN=0, whereas the default for the UDII series is IN=2

Example: IN90<cr>, IN0<cr>

Availability: WACOM II-S, WACOM IV

See also: SU-command

IT **specify interval of coordinate transmissions**

Syntax: IT*d1d2*<cr>

Explanation: This command sets the time interval for coordinate transmissions. It instructs the digitizer to transmit a coordinate once during the specified interval.The time interval is specified in multiples of 5 millisecond units, i.e. IT1 will set the digitizer to transmit one coordinate every 5 milliseconds, or about 200 points per second. IT99 will result in coordinate transmissions every 495 milliseconds, or about 2 points per second. IT0 sets the report rate to the maximum for the current baud rate.

Note: The maximum report rate is also affected by the baud rate setting. At 9600 Baud not more than 9600 bits can be transmitted every second, which results in a maximum report of 136 points per second independent of the tablet's Setting (105 pps for WIVe, which includes tilt data).

*(9600 / (7 bytes per coordinate * (8 bits + 1 stopbit + 1 startbit per byte))*

= 9600 / 70 = 136.

To get the maximum possible number of points per second 19200 Baud must be used.

Availabilty: WACOM II-S, WACOM IV

MU **select single or multi-mode**

Syntax: MU*d*<cr>

Explanation: In multi mode a stylus and a cursor can be used on the effective area simultaneously. The tablet transmits one stylus and one cursor coordinate alternately, while both devices are in proximity. When one device leaves proximity the tablet will transmit coordinates only for the pointer that is still on the tablet. (See 'Appendix B: Data Formats' for details how to recognize cursor and stylus data.)

d = 0 selects single mode (factory default)
d = 1 selects multi mode

If tilt mode is enabled when this command is issued, tilt mode will be disabled.

Availability: WACOM IV, except KT-0405 (ArtPad) and UD-0608-R

NR **set new x- and y-resolution**

Syntax: NR*d1d2d3d4*<cr>

Explanation: Sets the logical x- and y-resolution of the digitizer to d1d2d3d4 lpi. The command does not change the physical resolution of the tablet.

On tablets with ROM version lower than 1.2 values must reach between 1 and 1270. With ROM versions 1.2 and higher the maximum value is 2540.

Example: NR1270<cr>, NR50<cr>

Availability: WACOM IV

OC **change origin**

Syntax: OC*d*<cr>

Explanation: d = 1 sets the tablet's origin to the upper left corner of the active area.
d = 0 sets the tablet's origin to the lower left corner.

Availability: WACOM II-S, WACOM IV

PH **pressure mode**

Syntax: PH*d*<cr>

Explanation: d = 1 puts the tablet into pressure mode
d = 0 puts the tablet into non-pressure mode

The SD-Series tablets, which support only WACOM II-S, operate either in pressure or in non-pressure mode. In pressure mode the seventh byte of a binary coordinate transmission contains pressure data. In non-pressure mode it contains switch data. Also in ascii mode pressure data are sent instead of switch data.

Note: If you use a non-pressure stylus while the SD-Tablet is in pressure mode, the coordinates will be correct, but the pressure values are unpredictable. The same applies to the cursor on an SD-Tablet in pressure mode.

The UD-Tablets support WACOM IV and WACOM II-S. In WACOM IV they send switch and pressure data simultaneously in the same coordinate packet. The PH command has no effect in WACOM IV.

The range of pressure values supported by the UD-Series depends on the ROM-Version. (See the appendix for details.)

When WACOM II-S is used on a UD-Tablet, the cursor will always send switch data, even if the tablet is in (WACOM II-S-) pressure mode.

See Appendix B for details on the format of data transmissions.

Availability: WACOM II-S only

PO **point mode**

Syntax: PO<cr>

Explanation: Instructs the digitizer to transmit one coordinate when it detects a change of switch status from off to on.

Availability: WACOM II-S, WACOM IV

Reference: SR, SW, RQ, @

RE **reset**

Syntax: RE<cr>

Explanation: Resets the tablet to the factory defaults of the current command set (WACOM II-S or WACOM IV). The reset takes about 10 milliseconds. It includes a flushing of the command buffer. Thus, any byte arriving during 10 ms after this command is lost.

Availability: WACOM II-S, WACOM IV

Reference: factory defaults, $, #

RQ **enable remote request mode**

Syntax: RQ1<cr> or @

Explanation: Instructs the digitizer to transmit a coordinate regardless of the current operation mode and switch status. After receiving the first RQ1 command the tablet will enter remote request mode and only transmit data if it receives further requests. To cancel remote request mode issue the ST command.

Availability: WACOM II-S, WACOM IV

SC - scale change

Syntax: SC*xxxxx,yyyyy*<cr>

Explanation: This command sets the maximum x- and y-values that will be used by the digitizer for coordinate transmissions. Values provided for *xxxxx* and *yyyyy* must be in the range between 1 and 64000. The command does not change the physical resolution of the digitizer.

Example: On an SD-42x tablet the following command sequence will make the logical matrix of coordinates a square two-dimensional array of points that are one inch apart:

IC1<cr>
SC12,12<cr>

IC1<cr> sets the resolution measurement to inch. SC12,12<cr> sets the maximum x- and y-coordinate values to 12. These values will be proportionally spread over the digitizer's effective area.

Availability: WACOM II-S

SP stop

Syntax: WACOM II-S: SP<cr>

WACOM IV: SP<cr>, SP*d*<cr>

Explanation: Instructs the digitizer to stop transmitting coordinate data. After completing transmission of the current coordinate the tablet will cease to send data until it receives an ST or an RQ command. In the WACOM IV command set, when MultiMode is enabled (MU) you can specify which pointing device should stop transmitting data. In this case set d = 0 for the cursor or d = 1 for the stylus. If you send SP<cr> while the digitizer is in multi mode, both pointing devices will cease to transmit data.

Availability: WACOM II-S, WACOM IV

Reference: RQ, @, ST, [XOFF]

SR **stream mode**

Syntax: SR<cr>

Explanation: Puts the digitizer into stream mode. In stream mode the tablet transmits coordinates continuously when the device is within the effective range. The behavior outside the effective range can be manipulated with the AL command.

Note: Stream mode is only available if increment mode is set to 0. (The default for UDII is IN=2!)

Availability: WACOM II, WACOM IV

Reference: AL, PO, SW, SU, IN

ST **start**

Syntax: WACOM II: ST<cr>
WACOM IV: ST<cr>, ST*d*<cr>

Explanation: Instructs the digitizer to begin transmitting coordinate data. In the WACOM IV command set, when MultiMode is enabled, you can specify which pointing device should start transmitting data. In this case set d = 0 for the cursor (ST0<cr>) or d = 1 for the stylus (ST1<cr>). If you send ST<cr> while the digitizer is in multi mode, both pointing devices will transmit data.

Availability: WACOM II,WACOM IV

Reference: SP, RQ, @, [XON]

SU - suppressed mode

Syntax: SU*d1d2*<cr>

Explanation: Transmits coordinate data only if at least one of the following conditions is met:

- change of switch status from off to on
- change of switch status from on to off
- increment specified by d1d2 is exceeded

The transmitted coordinate pair will be the same as the last one that met the increment, which may not match exactly the current position of the pointer on the tablet.

Note: Suppressed mode is not canceled by the SR- and SW-commands. If the tablet is - for example - in suppressed mode with increment 3 (i.e. SU3), this increment will still be active even after issuing the SR- or SW-command.

Availability: WACOM II-S, WACOM IV

Reference: PO, SR, SW, RQ, @, IN

SW switch stream mode

Syntax: SW<cr>

Explanation: Instructs the digitizer to transmit coordinate data continuously as long as the switch status is non-zero.

Availability: WACOM II-S, WACOM IV

Reference: PO, SR, RQ, @, SU

TE - self test

Syntax: TE<cr>

Explanation: Causes the tablet to run an internal diagnostic test and then transmit a message. This message looks somehow like this:

UD-1212-R00 V1.1-0 94/01/07 by WACOM
I AM FINE.

Availability: WACOM II-S, WACOM IV

[XOFF]

Syntax: send 0x13 (hexadecimal 13)

Explanation: same as SP command

Availability: WACOM II-S, WACOM IV

Reference: SP, [XON]

[XON]

Syntax: send 0x11 (hexadecimal 11)

Explanation: same as ST command

Availability: WACOM II-S, WACOM IV

Reference: ST, [XOFF]

Chapter 3

UD-Series global commands

The commands described in this chapter are available at any time as long as the tablet is in operating mode.

The ~* and ~W commands can be used to define the entire tablet Setting with one command. They are most useful for initializing the tablet. Chapter 4 explains details of the tablet Setting.

With ~R tablet Settings can be read from the tablet. Other ~-commands can be used to obtain more detailed information from the tablet: ~C (maximum coordinates), ~# (tablet model and firmware version).

~M can be used to control the UD-Tablet's menu strip.

Of all these commands only ~# is available with the SD-Series. This command can be used to identify the tablet series and thus determine the availability of the other commands.

The $, && and %% are available on both SD- and UD-Series tablets. They instruct the tablet to run the WACOM II-S, MM 1201 and Bit Pad Two command sets, respectively, after resetting the tablet to those command set's defaults.

Note: UD-Tablets with a ROM-version lower than 1.2 are reset to Bit Pad One. The only exception is the UD-0608-R which always uses Bit Pad Two and the ArtPad (KT-0405), which only supports WACOM II-S and WACOM IV.

The # resets the UD-Tablet to the defaults of the WACOM IV command set. It is not available on the SD-Series.

In most cases (if not all) it is better to send an entire Setting to the tablet with the ~*-command. This ensures that the tablet is always in the expected state, even though the factory defaults might be changed at some point in the future.

$ **reset to WACOM II-S command set**

Syntax: $

Explanation: This command resets the digitizer. After the reset the tablet will be configured to the factory defaults of the WACOM II-S command

The reset takes about 10 ms. As part of the reset the command buffer is flushed. Thus, any byte arriving within 10 ms after this command is lost.

Compatibility: Available with the UD- and SD-Series.

**reset to WACOM IV command set**

Syntax: #

Explanation: This command resets the digitizer. After the reset the tablet will be configured to the factory defaults of the WACOM IV command set.

The reset takes about 10 ms. As part of the reset the command buffer is flushed. Thus, any byte arriving within 10 ms after this command is lost.

Compatibility: Not available with the SD-Series.

&& **reset to MM 1201 command set**

Syntax: &&

Explanation: This command resets the digitizer. After the reset the tablet will be configured to the factory defaults of the MM 1201 command set (MM 961 on theUD-0608-R).

The reset takes about 10 ms. As part of the reset the command buffer is flushed. Thus, any byte arriving within 10 ms after this command is lost.

Compatibility: Available with the UD- and SD-Series.
Not available with KT-0405-R (ArtPad).

%% **reset to Bit Pad Two command set**

Syntax: %%

Explanation: This command resets the digitizer. After the reset SD- and UD-Tablets will be configured to the factory defaults of the Bit Pad Two command set. Only the UD-Tablets with ROM version 1.0 and 1.1 will run Bit Pad One.

The reset takes about 10 ms. As part of the reset the command buffer is flushed. Thus, any byte arriving within 10 ms after this command is lost.

Compatibility: Available with the UD- and SD-
Not available with KT-0405-R (ArtPad).

~# **read tablet model and ROM-version**

Syntax: ~#<cr>

Explanation: This command returns the tablet model and the version number of the tablet's operating system. In response to this command the tablet returns a string of the form ~#*Tablet_Model ROM_Version*<cr>. The UD-1212-R's response will look somehow like this: ~#UD1212-R00 V1.1-0<cr>.

Compatibility: Available with the UD- and SD-Series.

~* **rewrite current Setting**

Syntax: ~*d1d2d3d4d5d6d7d8<cr> or ~*d1d2d3d4d5d6d7d8,iii,tt,xxxx,yyyy<cr>

Explanation: This command rewrites the current tablet Setting by writing the values d1-d8 into the tablet's RAM. The values following the Setup Body specify:

the increment value (iii) (see IN-command)
the time interval (tt) (see IT-command)
the x-resolution (xxxx) (see NR-command)
the y-resolution (yyyy) (see NR-command)

Note: The NR-commandsets the x- and y-resolution simultaneously using the same value for both. With the above method you can set x- and y-resolution to different values.

Note: As you can use this command to change the tablet's serial port parameters as well as the current command set, the communication with the tablet may be interrupted as a result of this command. Make sure that the communication parameters of the computer's and the tablet's serial port are identical and that your program is ready to process the correct data format after using this command.

Compatibility: UD-Series only.

~C **-** **read maximum coordinate**

Syntax: ~C<cr>

Explanation: This command returns the maximum coordinate at 0.02 mm resolution. In response to the ~C command the tablet returns a string of the form ~Cxxxxx,yyyyy<cr>. xxxxx gives the maximum x- and yyyyy the maximum y-coordinate value that will ever be transmitted by the tablet, i.e the highest possible value at a resolution of 0.02 mm.

(example return for a UD-1212-R.: ~C15240,15240<cr>)

Compatibility: UD-Series only.

~M **menu strip control**

Syntax: ~M*d*<cr>

Explanation: The design of the menu strip changed considerably from ROM version 1.3 onwards. For this reason the two different designs are described here separately.

Prior to ROM version 1.3
The UD-tablet's menu strip is organized into four groups.
Group 1: the 'Setup' and 'Save' buttons (1-1 and 1-2)
Group 2: the 'Standard Setting / Memory' buttons (2-1 to 2-5)
Group 3: the 'Function / Macro Buttons' (3-1 to 3-n)
Group 4: the 'Pressure' buttons (4-1 and 4-2).

Use the ~M command to disable or enable these buttons by groups:

d = 0 enables all buttons
d = 1 disables group
d = 2 disables group 2
d = 3 disables group 3
d = 4 disables group 4.

Set d = 5 to enable the group 4 buttons as macro buttons.

In operating mode, i.e. when the tablet is not in a setup mode, the group 3 buttons (Macro buttons) transmit values between 1 and the largest macro button number (= MaxButtonID) on that tablet model. The group 4 buttons normally do not transmit any button values unless the tablet receives the command ~M5<cr>. This enables the group 4 buttons as macro buttons. They will then transmit values of MaxButtonID+1 (P1) and MaxButtonID+2 (P2).

In exact numbers, P1 and P2 will transmit (if enabled):

Tablet Model	MaxButtonID	P1	P2
UD-1212-R	12	13	14
UD-1218-R	24	25	26
UD-1825-R	36	37	38

The UD-0608-R with a ROM version prior to 1.3 does not support a menu strip.

ROM version 1.3 and higher
The UD-tablet's menu strip is organized into three groups.
Group 1: the 'Setup' button (1-1)
Group 2: removed
Group 3: the 'Function' buttons (3-1 to 3-n)
Group 4: the 'Pressure' buttons (4-1 and 4-2).
Use the ~M command to disable or enable these buttons by groups:

d = 0 enables all buttons
d = 1 disables the 'Setup' button
d = 2 will be ignored by the tablet
d = 3 disables group 3
d = 4 disables group 4.

Set d = 5 to enable the group 4 buttons as macro buttons.

In operating mode, i.e. when the tablet is not in a setup mode, the group 3 buttons (Macro buttons) transmit values between 1 and the largest macro button number (= MaxButtonId) on that tablet model. The group 4 buttons normally do not transmit any button values unless the tablet receives the command ~M5<cr>. This enables the group 4 buttons as macro buttons. They will then transmit values of MaxButtonID+1 (P1) and MaxButtonID+2 (P2).

In exact numbers, P1 and P2 will transmit (if enabled):

Tablet Model	MaxButtonID	P1	P2
UD-0608-R 16	17	18	
UD-1212-R 20	21	22	
UD-1218-R 32	33	34	
UD-1825-R 44	45	46	

Note: *In addition to the ~M commands, it is possible to disable the entire menu strip and to save this setting as a startup setting in memory locations M1 or M2 by using the tablet menu template (only ROM versions 1.3 and higher).*

Compatibility: Only on UD-Series tablets with menu strip.

~R **read tablet Setting**

Syntax: ~R*d*<cr>

Explanation: This command reads a tablet Setting from tablet RAM, from M1 or M2. Reading from tablet RAM returns the current Setting of the tablet. Reading from M1 or M2 returns the contents of the memory location accessible through menu strip button M1 and M2.

Set d = 1 for M1 or d = 2 for M2. ~R will return the current setting (RAM).

In response to the ~R command the tablet will return a string of the form ~Rdddddddd,ddd,dd,dddd,dddd<cr>

Example: ~R1<cr> (sent to
~R1E202A000,010,02,1000,1000<cr> (tablet response)

Compatibility: UD-Series only. On KT-0405 (ArtPad) only ~R supported.

~W **write a tablet Setting**

Syntax: ~W*destination*ddddddddd,ddd,dd,dddd,dddd<cr>

Explanation: This command writes a new Setting to the specified destination in the permanent memory of the tablet (EEPROM). Possible values for *destination* are:

1 for memory location M1 or
2 for M2.

Following this command the Setting can be enabled by clicking on the M1 or M2 button of the menu strip

This command can also be used with the UD-0608-R, which does not have a menu strip. To enable a Setting stored in M1 or M2, it must be read with ~R1 or ~R2 and then written with ~*.

The ~* command modifies the current Setting of the tablet.

Compatibility: UD-Series only. Not on KT-0405-R (ArtPad).

Chapter 4

Data Formats

4.0 Overview

ROM version 1.0 and 1.1 supported 120 pressure levels and multi mode.

ROM version 1.2 supports 128 and 256 pressure levels, depending on how coordinate packets are processed.

ROM version 1.3 supports the eraser pen and the pen with 2 side switches.

ROM version 1.4 supports tilt. It is not availble on the KT-0405-R (ArtPad).

WACOM IV binary data format, ROM version 1.2 and higher

	MSB #7	#6	#5	#4	#3	#2	#1	LSB #0
1	1	Proximity	Pointer		Button Flag		X15	X14
2	0	X13	X12	X11	X10	X9	X8	X7
3	0	X6	X5	X4	X3	X2	X1	X0
4	0	B3	B2	B1	B0	**P0**	Y15	Y14
5	0	Y13	Y12	Y11	Y10	Y9	Y8	Y7
6	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0
7	0	Sp	**P6**	**P5**	**P4**	**P3**	**P2**	**P1**

WACOM IV binary data format, prior to version 1.2

	MSB #7	#6	#5	#4	#3	#2	#1	LSB #0
1	1	Proximity	Pointer		Button Flag		X15	X14
2	0	X13	X12	X11	X10	X9	X8	X7
3	0	X6	X5	X4	X3	X2	X1	X0
4	0	B3	B2	B1	B0		Y15	Y14
5	0	Y13	Y12	Y11	Y10	Y9	Y8	Y7
6	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0
7	0	Sp	**P5**	**P4**	**P3**	**P2**	**P1**	**P0**

WACOM IVe binary data format with tilt data, version 1.4 and higher

	MSB #7	#6	#5	#4	#3	#2	#1	LSB #0
1	1	Proximity	Pointer		Button Flag		X15	X14
2	0	X13	X12	X11	X10	X9	X8	X7
3	0	X6	X5	X4	X3	X2	X1	X0
4	0	B3	B2	B1	B0	P0	Y15	Y14
5	0	Y13	Y12	Y11	Y10	Y9	Y8	Y7
6	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0
7	0	Sp	P6	P5	P4	P3	P2	P1
8	0	**SXt**	**Xt5**	**Xt4**	**Xt3**	**Xt2**	**Xt1**	**Xt0**
9	0	**SYt**	**Yt5**	**Yt4**	**Yt3**	**Yt2**	**Yt1**	**Yt0**

Function button output format

	MSB #7	#6	#5	#4	#3	#2	#1	LSB #0
1	1	0	Pointer	0	Button Flag	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	B3	B2	B1	B0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	F5	F4	F3	F2	F1	F0

Function button output format, tilt mode

	MSB #7	#6	#5	#4	#3	#2	#1	LSB #0
1	1	0	Pointer	0	Button Flag	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	B3	B2	B1	B0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	F5	F4	F3	F2	F1	F0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0

WACOM II-S binary data format

MSB **LSB**

	#7	#6	#5	#4	#3	#2	#1	#0
1	1	Proximity	Pointer	Pressure		Sx	X15	X14
2	0	X13	X12	X11	X10	X9	X8	X7
3	0	X6	X5	X4	X3	X2	X1	X0
4	0					Sy	Y15	Y14
5	0	Y13	Y12	Y11	Y10	Y9	Y8	Y7
6	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0
7	0	0	Button Flag	B4	B3	B2	B1	B0

↑ non-pressure mode

↓ pressure mode

7	0	Sp	P5	P4	P3	P2	P1	P0

4.1 WACOM IV binary data format, ROM version 1.2 and higher

ROM version 1.2 and above support pressure levels between -128 and +127, i.e. a total pressure range of 256 levels. Due to internal calibration offsets, however, you should assume the 'no-pressure-value' to be about -120, even though the tablet sends pressure data below that value. The least significant bit of the pressure value is located at position 4,2 (see below, **P0**).
For this reason, programs written for tablets supporting only 120 pressure levels, will function as usual, if they cut off values outside [-60, +60], i.e. if they do something like this:

```
if  (pressure < -60)    pressure = -60;
if  (pressure > 60)     pressure = 60;
```

Otherwise you will get pressure levels as low as -64 and as high as +63 in P1 - P5, which may lead to unpredictable results.

MSB **LSB**

	#7	**#6**	**#5**	**#4**	**#3**	**#2**	**#1**	**#0**
1	1	Proximity	Pointer		Button Flag		X15	X14
2	0	X13	X12	X11	X10	X9	X8	X7
3	0	X6	X5	X4	X3	X2	X1	X0
4	0	B3	B2	B1	B0	**P0**	Y15	Y14
5	0	Y13	Y12	Y11	Y10	Y9	Y8	Y7
6	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0
7	0	Sp	**P6**	**P5**	**P4**	**P3**	**P2**	**P1**

Explanation:

Proximity	1 if the pointing device is detected, 0 otherwise
Pointer	1 if the pointing device is a stylus 0 if it is a cursor
Button flag	1 if a button on the pointing device has been pressed, 0 otherwise
X0 - X15	x-coordinate
Y0 - Y15	y-coordinate
B0 - B3	button data
P0 - P6	**pressure data (-120 to +120)**
P1 - P6	**pressure data (-64 to + 63)**
Sp	0 if the pressure value is positive. 1 if it is negative. In this case the value is in two's complement format.

Button switch data and sync bits are as specified for ROM versions prior to 1.3.
For ROM versions 1.3 and higher, the switch status with a stylus is in the range of 0 - 5 (ref. Chapter 5).

4.2 Table of button states (applies to all WACOM IV binary data)

switch number	button flag	B3	B2	B1	B0
OFF	0	0	0	0	0
1	1	0	0	0	1
2	1	0	0	1	0
3	1	0	0	1	1
4	1	0	1	0	0
5	1	0	1	0	1
6	1	0	1	1	0
7	1	0	1	1	1
8	1	1	0	0	0
9	1	1	0	0	1
10	1	1	0	1	0
11	1	1	0	1	1
12	1	1	1	0	0
13	1	1	1	0	1
14	1	1	1	1	0
15	1	1	1	1	1
16	1	0	0	0	0

This table is valid for all WACOM IV binary transmission formats, i.e. all those described in sections 4.1, 4.3, 4.4 and 4.5 of this chapter.

4.3 WACOM IVe binary format with tilt, version 1.4 and higher

MSB LSB

	#7	**#6**	**#5**	**#4**	**#3**	**#2**	**#1**	**#0**
1	1	Proximity	Pointer		Button Flag		X15	X14
2	0	X13	X12	X11	X10	X9	X8	X7
3	0	X6	X5	X4	X3	X2	X1	X0
4	0	B3	B2	B1	B0	P0	Y15	Y14
5	0	Y13	Y12	Y11	Y10	Y9	Y8	Y7
6	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0
7	0	Sp	P6	P5	P4	P3	P2	P1
8	0	**SXt**	**Xt5**	**Xt4**	**Xt3**	**Xt2**	**Xt1**	**Xt0**
9	0	**SYt**	**Yt5**	**Yt4**	**Yt3**	**Yt2**	**Yt1**	**Yt0**

Explanation:

SXt 0 if the tilt value for the x-direction is positive
1 if it is negative. In thiscase the value is in two's complement notation

SYt same as above for the tilt in y-direction

Xt0 - Xt5 tilt value in x-direction

Yt0 - Yt5 tilt value in y-direction

Bytes 1 - 7 are according to the WACOM IV binary data specification.

4.4 WACOM IV, prior to ROM version 1.2

The tablet sends coordinate and status information in blocks of seven bytes. The first bit of every byte is called a sync bit. In the first byte of a block, the sync bit is 1, the other bytes have sync bits of 0.

Each coordinate block contains also switch and pressure data.. Bits #3 - #6 of byte 4 and bit #3 of byte 1 (i.e. bits 4,3 - 4,6 and 1,3) hold the switch status. A switch status is in the range of 0 - 3 with the stylus (0 = no switch, 1 = tip switch, 2 = side switch, 3 = tip and side switch pressed together), 0 - 4 with the 4-Button-cursor and 0 - 16 with the 16-Button-cursor. In the case of the 16-button-cursor, if button 16 is pressed the Button flag is 1 and B0 - B3 are 0, i.e. a switch data of 0 with the button flag on indicates that button #16 is pressed.

	MSB							**LSB**
	#7	**#6**	**#5**	**#4**	**#3**	**#2**	**#1**	**#0**
1	1	Proximity	Pointer		Button Flag		X15	X14
2	0	X13	X12	X11	X10	X9	X8	X7
3	0	X6	X5	X4	X3	X2	X1	X0
4	0	B3	B2	B1	B0		Y15	Y14
5	0	Y13	Y12	Y11	Y10	Y9	Y8	Y7
6	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0
7	0	Sp	**P5**	**P4**	**P3**	**P2**	**P1**	**P0**

Explanation:

Proximity	1 if the pointing device is detected, 0 otherwise
Pointer	1 if the pointing device is a stylus, 0 if it is a cursor
Button flag	1 if a button on the pointing device has been pressed, 0 otherwise
X0 - X15	x-coordinate
Y0 - Y15	y-coordinate
B0 - B3	button data
P0 - P5	pressure data (-60 to + 60)
Sp	0 if the pressure value is positive. 1 if it is negative. In this case the value is in two's complement format.

4.5 WACOM IV, multi mode

If the tablet is in multi mode, it transmits alternately one coordinate for the pen and one for the cursor. There is no difference in the layout of the binary format. The coordinate packet for the pen has the pointer bit (1,5) set to 1, the pointer bit of the cursor packet is 0.

4.6 WACOM IV, macro button transmission

When a function button is clicked in normal mode, the tablet transmits a button number in the following format:

	MSB							LSB
	#7	**#6**	**#5**	**#4**	**#3**	**#2**	**#1**	**#0**
1	1	0	Pointer	0	Button Flag	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	B3	B2	B1	B0		0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	F5	F4	F3	F2	F1	F0

If the proximity flag (1,6) is 0 and the button flag (1,3) is 1 the packet contains macro button information - not coordinates.
In this case, bits #3 - #6 of byte #4 (4,3 - 4,6) give the number of the pointer button which was pressed to generate this macro transmission. Bits #0 to #5 of the last byte (7,0 - 7,5) indicate which function button on the menu strip was clicked.

Note: ROM version 1.0 of the UD-1212-R does not transmit the pointer button number together with the macro button value, i.e. bits 4,3 - 4,6 are always 0.

4.7 WACOM II-S binary

The tablet sends coordinate and status information in blocks of seven bytes. The first bit of every byte is called the sync bit. The sync bit of the first byte of each block is always 1, those of the other 6 bytes always 0. The sync bit is used to detect the start of a coordinate block.
In the WACOM II-S command set the tablet can be either in pressure or non-pressure mode. The layout and meaning of the last byte of a coordinate transmission depends on the selected operating mode.

	MSB							LSB
	#7	**#6**	**#5**	**#4**	**#3**	**#2**	**#1**	**#0**
1	1	Proximity	Pointer	Pressure		Sx	X15	X14
2	0	X13	X12	X11	X10	X9	X8	X7
3	0	X6	X5	X4	X3	X2	X1	X0
4	0					Sy	Y15	Y14
5	0	Y13	Y12	Y11	Y10	Y9	Y8	Y7
6	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0
7	0	0	Button Flag	B4	B3	B2	B1	B0

↑ non-pressure mode

↓ pressure mode

7	0	Sp	P5	P4	P3	P2	P1	P0

Explanation:

Proximity	1 if a pointing device is in proximity, 0 otherwise
Pointer	1 if the pointing device is a stylus, 0 if it is a cursor
Pressure	1 if the tablet sends pressure data, 0 otherwise
Sx	0 if the x-coordinate is positive 1 if it is negative. In this case the value is in two's complement format.
Sy	0 if the y-coordinate is positive 1 if it is negative. In this case the value is in two's complement format.
X0 - X15	x-coordinate
Y0 -Y15	y-coordinate
B0 - B4	button data
Button flag	1 if a button is pressed, 0 otherwise
P0 - P5	pressure data (-32 to + 32)
Sp	0 if the pressure valueis positive. 1 if it is negative. In this case the value is in two's complement format.

4.8 WACOM II-S ASCII, absolute and relative mode

In ASCII mode the tablet sends coordinate data in the following format:

Device,XXXXX,YYYYY,B1B1<cr><lf>

Device can be:

'*' for the cursor,
'#' for the stylus, if the tablet is in non-pressure mode
'!' for the stylus, if the tablet is in pressure mode.

<cr> stands for carriage return, ASCII 13 (0Dh), <lf> for line feed, ASCII 10 (0Ah).
XXXXX is the x-coordinate, and YYYYY the y-coordinate, always 5 digits.

Here are a few examples, how the output might look like:

*,12345,12345,01<cr><lf>	cursor, pressure or non-pressure mode
#,12345,12345,01<cr><lf>	pen, non-pressure mode
!,12345,12345,-022<cr><lf>	pen, pressure mode
!,12345,12345,022<cr><lf>	pen, pressure mode

WACOM II-S ASCII data format for relative mode

In relative the tablet transmits coordinates, which express the pointing device location relative to the previously detected point on the active surface. In this case the coordinate values have a leading '-' sign in case of negative and no sign for positive values.

*,-00010,00010,01<cr><lf>	cursor, pressure or non-pressure mode
!,00004,00012 ,022<cr><lf>	pen, pressure mode

Chapter 5

Features and ROM versions

ROM version	120 pressure levels	128 pressure levels	256 pressure levels	multi mode	tilt	eraser	2-side-switch pen	Plug and Play (PnP)
1.0	•			•				
1.1	•			•				
1.2		•	•	•				
1.3		•	•	•		•	•	•
1.4		•	•	•	•	•	•	•

Pressure

UD-Tablets with ROM versions prior to 1.2 provided 120 levels of pressure, with the data ranging from -60 to +60.

From ROM version 1.2 up the tablets support 256 levels of pressure, i.e. pressure information is contained in 8 bits. Due to the distribution of the pressure inf. in the data packet there are 2 ways to extract the pressure value from a packet:

1. Only bits 0-6 of byte 7 are considered and bit 2 in byte 4 (P0) disregarded. Pressure values will then range between -64 and +63.

2. Bits 0-6 of byte 7 are shifted by one bit to the left and P0 added on the right end. Pressure values will then range between -128 and +127.

Multi Mode

UD-1212, UD-1218 and UD-1825 tablets support Multiple Device Mode. In this mode it is possible to work with a cursor and a pen simultaneously. The tablet then transmits alternating one coordinate packet for the pen and one for the cursor.

ROM versions 1.3 and higher support an eraser pen (UP-701E), and a pen with two side switches (UP-801). In the spring of 1996, these two pens were combined into a single pen with two side switches and an eraser:

Eraser

When the eraser is in proximity of the tablet, or the second side switch is pressed while the pen is in proximity, then the tablet will transmit a switch number of 4. When the eraser tip is pressed against the tablet, or the second side switch is pressed while the pen tip is pressed against the tablet, then the tablet will transmit a switch state of 5.

Note that the tablet cannot detect the difference between an eraser in proximity and a pen tip with the 2nd side switch pressed in proximity (switch state 4), and it cannot detect the difference between an eraser pressed against the tablet and a tip pressed against the tablet while the 2nd side switch is pressed (switch state 5).

Note: The WACOM drivers differentiate between the eraser function and the second side switch function by analyzing the first switch state transmitted after the pen enters proximity: if the initial switch state is 4, the driver assumes that an eraser is now in proximity, and if the initial switch state is 0 and changes later to 4 or 5, then the driver assumes that the pen tip is in proximity and that the 2nd side switch was pressed at the later moment.

Tilt

Tablets with ROM versions 1.4 or higher provide tilt data, which indicate the angle between the stylus and a vertical line on the tablet surface. Tilt mode has to be enabled with the FM-command. After the tablet receives the command FM1-command, it will begin to transmit coordinate packets in the WACOM IVe format (WACOM IV extended). This format contains the same information as WACOM IV. The design of bytes 1 -7 is identical to WACOM IV. Two additional bytes are appended - one for the tilt value in x-direction, one for tilt in y-direction.

Plug and Play (PnP)

The KT-0405 (ArtPad) with ROM version 1.2 and all tablets with ROM version 1.3 or higher support Plug and Play. Plug and Play is a standard developed by Microsoft to facilitate installation of new hardware on the computer. For details how to use this feature please refer to the document *'Plug and Play - External Com Device Specification'* from Microsoft. You can get it from the Plug-and-Play-Forum of CompuServe. If you don't have access to CompuServe contact WACOM Computer Systems for a copy.

This chapter only lists the UD-Tablets' response to the Plug and Play command sequence. The following table lists the response of a UD-1212-R tablet:

OtherID	"\96,N,8,1"	;0x5C,0x39,0x36,0x2C,0x4E,0x2C,0x38,0x2C,0x31,0x28
Begin PnP	"("	;0x28
PnP Rev.	version 1.0 (2 bytes binary)	;0x01,0x24
EISA ID	"WAC"	;0x57,0x41,0x43 (received EISA approval)
Product ID	"1212"	;0x31,0x32,0x31,0x32
device serial	"\"	;0x5C
Class Name	"\"	;0x5C
compatible ID	"\WAC0000"	;0x5C,0x57,0x41,0x43,0x30,0x30,0x30,0x30
end user legible description	"\WACOM UD<cr><lf>	;0x5C,0x57,0x41,0x43,0x4F,0x4D,0x20,0x55,0x44,0x0D,0x0A
	UD-1212-R,V1.4-0<cr><lf>"	;0x55,0x44,0x2D,0x31,0x32,0x31,0x32,0x2D,0x52,
		0x2C,0x56,0x31,0x2E,0x34,0x2D,0x30,0x0D,0x0A
checksum	2 bytes in ASCII, representing the checksum	
	all characters from "(" to ")", exclusive of the	
	checksum bytes themselves	;0x46,0x44
End PnP	")"	;0x29

The response of other models only differs with regard to 'end user legible description' and 'Product ID':

Model	Product ID	end user legible description
UD-0608-R	0608	\Wacom UD <cr><lf>UD-0608-R,V1.4-0<cr><lf>
UD-1218-R	1218	\Wacom UD <cr><lf>UD-1218-R,V1.4-0<cr><lf>
UD-1825-R	1825	\Wacom UD <cr><lf>UD-1825-R,V1.4-0<cr><lf>
KT-0405-R	0405	\Wacom UD <cr><lf>KT-0405-R,V1.3-0<cr><lf>

The information in 'Other ID' is optional. The WACOM tablet uses this field to transmit its current communication setting:

Other ID \<**baud rate**>,<**parity**>,<**data bits**>,<**stop bits**>

Values are separated by colons. The number of characters per value is fixed:

baud rate	2 characters
parity	1 character
data bits	1 character
stop bits	1 character

The options for each value are as follows (according to the PnP specification):

baud rate	19	for 19200 Baud
	96	for 9600 Baud
	48	for 4800 Baud
	24	for 2400 Baud
	12	for 1200 Baud
	06	for 600 Baud
	03	for 300 Baud
parity	N	for 'no parity'
	E	for 'even parity'
	O	for 'odd parity'
data bits	7	for 7 data bits
	8	for 8 data bits
stop bits	1	for 1 stop bit
	2	for 2 stop bits

Chapter 6

Tablet Settings

At any time the tablet is in a certain state which is the result of all commands received since the last reset or power on. Most of the variables which define this state can be expressed in one bit (yes/no), some need two bits. Four of them - increment, interval, x- and y-resolution - need an entire byte or word.

It is possible to query the tablet to transmit information about it's current state. As a response the tablet will send a Setting string. This string consists of two parts:

<Setting body><Setting extension>

The Setting body is an ascii string of 8 hexadecimal digits. It contains information of all those variables which can be expressed in one or two bits.
The Setting extension is an ascii string made up of four groups of decimal digits, separated by colons. It contains the values of those variables that need more than two bits:

iii,tt,xxxx,yyyy

iii	specifies the increment setting (see IN-command)
tt	specifies the interval setting (see IT-command)
xxxx	specifies the x-resolution (see NR-command)
yyyy	specifies the y-resolution (see NR-command)

The commands to request Setting information are:

~R	to get information about the current state (tablet RAM)
~R1	to read the Setting stored in the tablet EEPROM location #1
~R2	to read the Setting stored in the tablet EEPROM location #2

The total response of the tablet will be:

<header><Setting body>,<Setting extension><cr>

<header> repeats the command sent to the tablet to request the information (~R, ~R1 or ~R2).

Example: ~RE202A000,000,03,1270,1270<cr> describes the currently active Setting (in tablet RAM) as a response to ~R<cr> sent to the tablet..

To understand the contents of the Setting body, first convert it to binary notation. Then use the table in Appendix B to obtain the meaning of each bit.

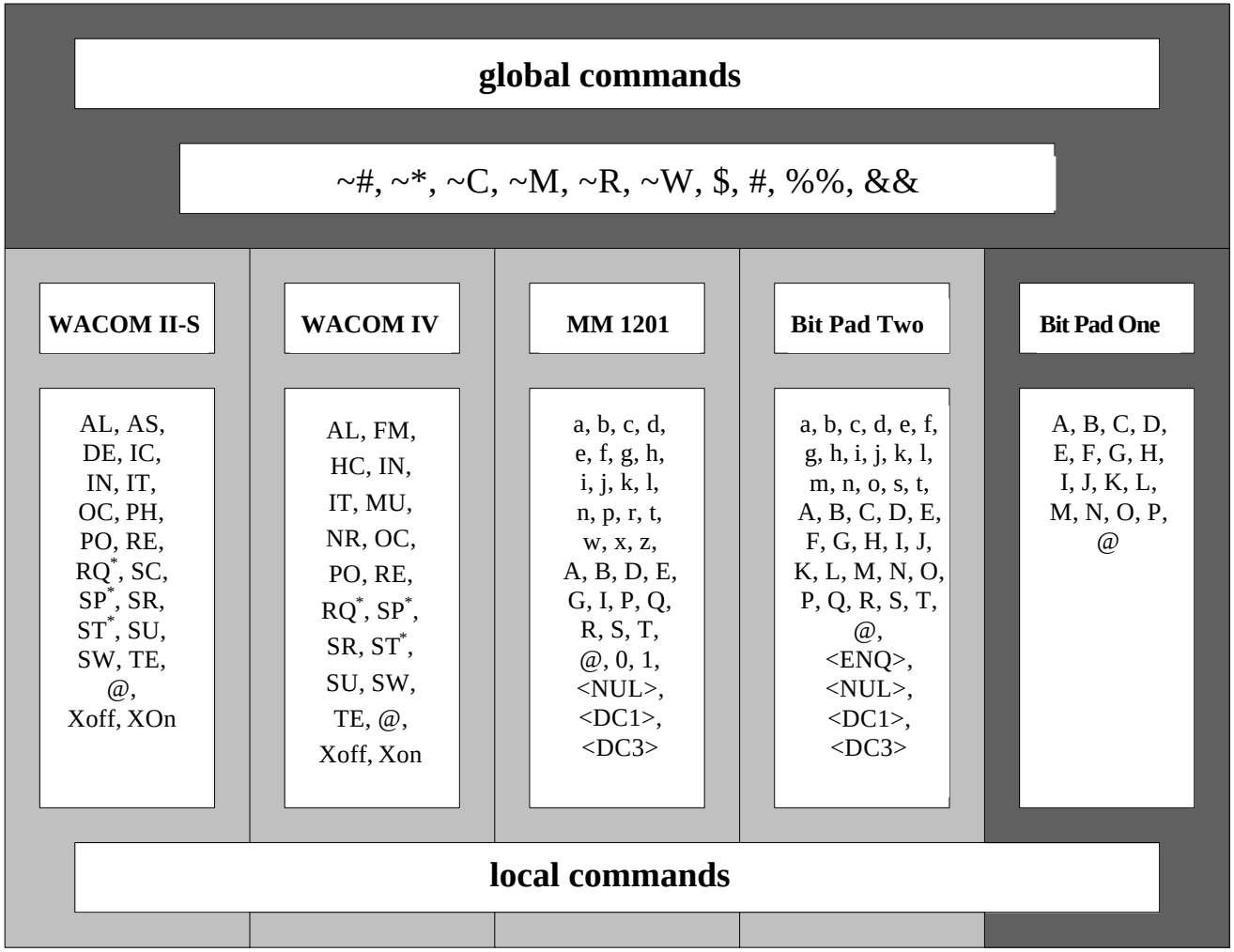
The tablet can be configured by sending strings of the above format to the tablet. In this case the string is called Setup string, which consists of Setup body and Setup extension:

<header><Setup body><Setup extension><cr>

In this case <header> can be ~*, ~W1 or ~W2 depending on the location, where the Setting should be stored within the tablet: RAM, Memory1 or Memory2.

If a string is sent to the tablet's RAM (~*), its values take effect immediately. Depending on the value of the Setup body, the communication parameters or the command set may be changed. The programmer must make sure, that the computer's serial port is set to the same values as the one of the tablet after receiving this command and that the program is ready to process the correct data format.

Appendix A: UD- and UDII-Series local and global commands (Overview)



*minor differences in implementation

Global commands can be accessed at any time, regardless which command set is currently active.
Local commands are only available if the command set they belong to is the active one.

WACOM II-S and WACOM IV local commands

	Command Name	Command Syntax	Description	W II	W IV
1	Always Transmit	AL*d*<cr>	control behavior when pointing device is out of proximity	●	●
2	Data Format	AS *d*<cr>	select binary or ASCII data format	●	
3	Relative Mode	DE *d*<cr>	enable / disable relative mode	●	
4	Tilt Mode	FM *d*<cr>	enable / disable tilt mode		●
5	Height Change	HC *d*<cr>	change reading height		●
6	Resolution Unit	IC *d*<cr>	set resolution unit to inch or millimeter	●	
7	Increment Mode	IN*d1d2d3*<cr>	enable increment mode and set the increment value	●	●
8	Interval	IT*d1d2*<cr>	set the interval between coordinate transmissions	●	●
9	Multi Mode	MU*d*<cr>	enable / disable multi mode		●
10	Resolution	NR*d1d2d3d4*<cr>	set x- and y-resolution		●
11	Origin Change	OC*d*<cr>	specify location of the tablet's origin (upper left or lower left)	●	●
12	Pressure Mode	PH*d*<cr>	enable / disable pressure mode	●	
13	Point Mode	PO<cr>	enable point mode	●	●
14	Reset	RE<cr>	reset to defaults	●	●
15	Remote Request	RQ1<cr>	enable remote request mode and request a coordinate pair	●*	●*
16	Scale Change	SCxxxxx,yyyyy<cr>	change the scale of the x- and y-direction	●	
17	Stop	SP<cr>	stop coordinate transmissions	●*	●*
18	Stream Mode	SR<cr>	enable stream mode	●	●
19	Start	ST<cr>	resume coordinate transmissions	●*	●*
20	Suppressed Mode	SU*d1d2*<cr>	enable suppressed mode and specify increment, SU0<cr> disables suppressed mode	●	●
21	Switch Stream Mode	SW<cr>	enable switch stream mode	●	●
22	Test	TE... <cr>	run internal test and issue report	●	●
23	Request One	@	enable remote request mode and request one coordinate pair (same as RQ1<cr>)	●	●
24	XOff	send 13hex	stop coordinate transmissions	●	●
25	XOn	send 11hex	resume coordinate transmissions	●	●

*minor differences in implementation

UD- and UDII-Series global commands

	Command Name	Command Syntax	Description	other UD	ArtPad
1	Tablet ID	~#	get tablet model and operating system (firmware) version number	●	●
2	RAM Rewrite	~*<setup string><cr>	rewrite the currently active setting	●	●
3	Tablet Size	~C<cr>	get the maximum x- and y-coordinate at 0.02mm resolution	●	●
4	Menu Strip Control	~M*d*<cr>	disable / enable Menu Strip by groups	●	
5	Read Setting	~R*d*<cr>	read a setting from tablet RAM or from non-volatile tablet memory (M1 or M2)	●	●*
6	Write Setting	~W*d*<setup string><cr>	rewrite a setting in non-volatile tablet memory (M1 or M2)	●	
7	Global WACOM II Reset	$	reset tablet and load WACOM II defaults	●	
8	Global WACOM IV Reset	#	reset tablet and load WACOM IV defaults	●	●
9	Global BitPad One Reset	%%	reset tablet and load Bit Pad One defaults	●	
10	Global MM 1201 Reset	&&	reset tablet and load MM 1201 defaults	●	

*only ~R

Short explanation on the Setting / Setup string

The tablet's current status is called a **Setting**. If you request status information from the tablet with the ~R command, it sends a **Setting string**, which always has the same syntax:

XXXXXXXX,ddd,dd,dddd,dddd<cr>

An 'X' stands for a hexadecimal digit. This part of the string is called the **Setting body**. The 'd's stand for a decimals digit. They make up the **Setting extension** or **Setting tail**.

Example: **Setting string**

E2028800,000,00,1000,1000<cr>

Setting body **Setting tail**

A string, which can be sent to the tablet for configuration, is called a **Setup string**. It consists of a **Setup body** and a **Setup extension** or **Setup tail**.

Setting strings and Setup strings are structured identically for firmware versions 1.1 and above. Prior versions of the operating system used a differently structured Setup tail in certain situations.

Examples:

~*E202A000,010,02,0700,0700<cr> WACOM IV, RAM

~W16A230800,010,00,0500,0500<cr> MM 1201, Mem1

The Setup body is mandatory, the tail is optional.

Appendix B: Setting and Setup Strings

Note: In this table the most significant bit is referred to as bit #0. The least significant bit is bit #31.

Bit #	Meaning	
0+1	command set	11 - WACOM IV, 10 - WACOM II-S, 01 - MM 1201, 00 Bit Pad
2+3	baud rate	11 - 19200, 10 - 9600, 01 - 4800, 00 - 2400
4 + 5	parity	11 - even, 10 - odd, 01, 00 - none
6	data length	1 - 8 bits, 0 - 7 bits
7	stop bits	1 - 2 stop bits, 0 - 1 stop bit
8 + 9	CTS/DSR	11 - both checked, 10 - only CTS, 01 - only DSR, 00 - none
10 + 11	data transfer mode[1]	11 - stream, 10 - switch stream, 01 - point, 00 - suppressed
12	output format	1 - ASCII, 0 - binary
13	coordinate system[2]	1 - relative, 0 - absolute
14 + 15	transfer rate[3]	11 - maximum, 10 - 100 pps, 01 - 67 pps, 00 - 50 pps
16 + 17	resolution[4]	11 - 1270 lpi, 10 - 1000 lpi, 01 - 508 lpi, 00 - 500 lpi
18	origin location	1 - lower left, 0 - upper left
19	out-of-range data	1 - yes, 0 - no
20 + 21	terminator	11, 10 - carriage return + line feed, 01 - line feed, 00 - carriage return
22	not used	
23	PnP[5]	0 - off, 1 - on
24	pressure sensitivity	1 - soft, 0 - firm
25	reading height[6]	1 - low (2 mm), 0 - high (8 mm or more)
26	multi device mode[7]	1 - enabled, 0 - disabled
27	tilt mode[5]	0 - off, 1 - on
28	MM command set	1 - MM961, 0 - MM1201
29	MM961 orientation	1 - portrait, 0 - landscape
30	BitPad II cursor data	1 - 1248, 0 - 1234
31	remote mode	1 - on, 0 - off

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[1] for details read the description of SR (stream), SW (switch stream), PO (point), SU (suppressed)

[2] for details see the DE-command

[3] for details see the IT-command

[4] for details see the NR-command

[5] ROM version 1.3 or higher

[6] for details see the HC-command

[7] for details see the MU-command

If you request status information from the tablet with the ~R-commands, the tablet responds with a Setting string. The Setting string is made up of 8 hexadecimal digits, the Setting body, followed by a Setting extension. The extension gives information on the increment setting, the interval between data transmissions (report rate) and the x- and y-resolution. The tablet can be configured by sending a string to the tablet using ~* or the ~W-commands.

To understand the contents of the Setting body, first convert it to binary notation. Then use the table on the previous page to get the meaning of each bit (or group of bits).

As described with the MU and FM commands multi mode and tilt mode cannot be used simultaneously. The MU1-command switches off tilt mode, the FM1 command switches off multi mode. If in the Setup String both the bit for Multiple Mode (#26) and for Tilt Mode (#27) are set, the Multi Mode bit takes precedence over the Tilt Mode bit, i.e. after receiving the Setup String the tablet will switch to multi mode. The tilt bit will be disregarded.

Appendix C: Factory (Power Up[8]) default settings

This appendix contains the factory defaults of the command sets available on WACOM UD-Tablets. The factory default settings of M1 and M2 are undefined.

C.1 WACOM IV (UD-II-Tablets)

factory defaults:	Baud Rate:	9600 Baud
	Parity:	none
	Data bits:	8
	Stop bits:	1
	handshaking:	none
	operation mode:	suppressed, increment 2 (equivalent to SU2)
	output format:	binary[9]
	coordinate system:	absolute[9]
	transfer rate:	102
	resolution:	1270 lpi
	origin location:	upper left
	out of range data:	no
	data terminator:	<cr><lf>
	reading height:	8+ mm
	pressure sensitivity:	firm
	multi device mode:	no
	Plug and Play[10]:	on
	tilt:	off
global command:	#	
response to ~R:	E202C100,000,02,1270,1270	
available on:	UD-Series	

[8]The defaults after receiving a global command may vary slightly from the power up defaults. If this is the case you will find a remark on the relevant page in this appendix.
[9]cannot be modified
[10]ROM version 1.3 or higher

C.2 WACOM IV (UD-Tablets)

factory defaults:	Baud Rate:	9600 Baud
	Parity:	none
	Data bits:	8
	Stop bits:	1
	handshaking:	none
	operation mode:	suppressed, increment 0 (equivalent to SU0)
	output format:	binary[11]
	coordinate system:	absolute[11]
	transfer rate:	max
	resolution:	1270 lpi
	origin location:	upper left
	out of range data:	no
	data terminator:	<cr><lf>
	reading height:	8+ mm
	pressure sensitivity:	firm
	multi device mode:	no
	Plug and Play[12]:	on
	tilt:	off

global command: #
response to ~R: E203C000,000,02,1270,1270
available on: UD-Series

[11]cannot be modified
[12]ROM version 1.3 or higher

C.3 WACOM IV (ArtPad, ArtPad II)

factory defaults:	Baud Rate:	9600 Baud
	Parity:	none
	Data bits:	8
	Stop bits:	1
	handshaking:	none
	operation mode:	suppressed, increment 3 (equivalent to SU3)
	output format:	binary[13]
	coordinate system:	absolute[13]
	transfer rate:	102
	resolution:	1000 lpi
	origin location:	upper left
	out of range data:	no
	data terminator:	<cr><lf>
	reading height:	8+ mm
	pressure sensitivity:	firm[14]
	multi device mode:	no
	Plug and Play[15]:	on
	tilt:	off (i.e. n/a)

global command:	#
response to ~R:	E2018000,000,02,1270,1270 (on power up)
	E203C000,000,00,1270,1270 (after #)
available on:	UD-Series

Note: Upon receiving the #-command the ArtPad-II (ROM Version 1.3 and above) will reset to the WACOM IV defaults for UD-II-Tablets (C.1), whereas the ArtPad (prior to ROM Version 1.3) will reset to those of the UD-Tablets (C.2).

[13] cannot be modified
[14] soft pressure is not supported by the ArtPad II
[15] ROM version 1.3 or higher

C.4 WACOM II-S

factory defaults:	Baud Rate:	9600 Baud
	Parity:	none
	Data bits:	8
	Stop bits:	1
	handshaking:	none
	operation mode:	point
	output format:	ascii
	coordinate system:	absolute
	transfer rate:	maximum
	resolution:	1270 lpi
	origin location:	upper left
	out of range data:	no
	data terminator:	<cr><lf>
	reading height:	8+ mm[16]
	pressure sensitivity:	firm[16]
	multi device mode:	no[16]
	Plug and Play[17]:	on

global command: $
response to ~R: A21BC800,000,00,1270,1270
available on: UD-Series, SD-Series

[16]cannot be modified
[17]UD-Tablets with ROM version 1.3 or higher

C.5 Bit Pad One

factory defaults:	Baud Rate:	9600 Baud
	Parity:	even
	Data bits:	7
	Stop bits:	2
	handshaking:	none
	operation mode:	stream
	output format:	ascii
	coordinate system:	absolute
	transfer rate:	maximum
	resolution:	200 lpi
	origin location:	lower left
	out of range data:	no
	data terminator:	<cr><lf>
	reading height:	8+ mm[18]

global command: %
response to ~R: 2D3B2800,000,00,0200,0200
available on: UD-Series (except UD-0608-R)

[18]cannot be modified

C.6 Bit Pad Two

factory defaults:	Baud Rate:	9600 Baud
	Parity:	even
	Data bits:	7
	Stop bits:	2
	handshaking:	none
	operation mode:	stream
	output format:	ascii
	coordinate system:	absolute
	transfer rate:	maximum
	resolution:	200 lpi
	origin location:	lower left
	out of range data:	no
	data terminator:	<cr><lf>
	reading height:	8+ mm[19]
	remote mode:	off
	cursor switch data:	1234
	Plug and Play[20]:	on

global command: %
response to ~R: 2D3B2800,000,00,0200,0200
available on: SD-Series, UD-0608-R

[19]cannot be modified
[20]UD-Tablets with ROM version 1.3 or higher

C.7 MM 1201, MM 961

factory defaults:	Baud Rate:	9600 Baud
	Parity:	odd
	Data bits:	8
	Stop bits:	1
	handshaking:	none
	operation mode:	switch stream
	output format:	binary
	coordinate system:	absolute
	transfer rate:	100 pps
	resolution:	500 lpi
	origin location:	lower left
	out of range data:	yes
	data terminator:	<cr><lf>
	reading height:	8+ mm[21]
	orientation:	landscape
	Plug and Play[22]:	on

global command: &
response to ~R: 6A223800,000,02,0500,0500
6A223808,000,02,0500,0500
available on: MM 1201: SD-Series, UD-Series (except UD-0608-R)
MM 961: UD-0608-R

[21]cannot be modified
[22]UD-Tablets with ROM version 1.3 or higher