

	Online Description <i>DISTO™ pro⁴ / DISTO™ pro⁴ a</i>	
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Includes description of standard-mode and extended mode.		

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1 OVERVIEW

This document describes the online set of commands for the *DISTOTM pro⁴* and *DISTOTM pro⁴ a*, and its format which is available via the serial interface.

2 INTERFACE

2.1 Validity

The following firmware versions support these documented commands.

Firmware *DISTOTM pro⁴* / *DISTOTM pro⁴ a* as of version 1.11
dated 15.06.2001

2.2 Parameters

The lay out of the interface of the *DISTOTM pro⁴* / *DISTOTM pro⁴ a* is such, that it can be connected directly to a PC. The parameters of the interface are factory- set as follows:

Pro-standard: 9600 baud, none parity, 8 databits, 1 stopbit

These settings can be changed with the online commands.

3 INTERFACE PROTOCOL

3.1 General definition

3.1.1 Characters

All characters of the ASCII- code smaller than 255 are permitted (see "Character set" in the appendix) A command is ended with ASCII-code 13 <cr> (Carriage Return), any following command like <lf> (Line Feed) is ignored. ASCII- code 10 is ignored (end code resp. terminator).

DISTO™ pro⁴ / DISTO™ pro⁴ a, also send a terminator at the end of a response. It is the <cr><lf> code.

3.1.2 Input

Every command consists of one or more characters and a terminator.

Examples:

```
a<cr><lf>
DSP 12345/F<cr><lf>
```

Numerical input (parameters of a command, %) are always entered as integers (whole numbers). The following format is permitted:

Sign (optional) and numbers without leading zero: -8007.

3.1.3 Response

There are one or more responses to every command. The following responses are possible:

?<cr><lf>	-	OK-prompt: <i>DISTO™ pro⁴ / DISTO™ pro⁴ a</i> are ready to receive new commands.
@E123<cr><lf>	-	Error message: a three character code is displayed in accordance with the table in the appendix.
12..10+12345678 <cr><lf>	-	One or more data words with terminator
Plain text	-	Plain text information

Each command puts out either an OK-prompt or an error message.

3.1.4 WI-data format

A data word as a response consists of 16 character. The following combinations are possible:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
W	W	w	w	A	U	+	1	2	3	4	5	6	7	8	

or:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
W	W	w	w	A	U	+	1	2	3	4	+	6	7	8	

or:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
W	W	.	.	.	.	+	a	b	c	d	e	f	g	h	

or:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
!	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	

Describing the data format:

Position	Description:	Remarks
1,2	Word identifier 00-99	With leading zero
3,4	No meaning	Extends word identifier. Otherwise:.
5	Attribute	0: measured value 1: manually entered value . : no attribute set
6	Units/dimensions (lengths)	0: mm for areas 1/1000m ² , for volumes 1/1000m ³ 1: ft resp. ft ² resp. ft ³ 2: 1/10 in 3: in ¹ / ₃₂ 6: 1/10 mm resp. 1/1000m ² resp. 1/1000m ³ 8: ft / in / ¹ / ₁₆ in resp. 1/100ft ² resp. 1/10ft ³ 9: ft / in / ¹ / ₃₂ in resp. 1/100ft ² resp. 1/10ft ³ . : no units
6	Units/dimensions (angle)	0: 1/10 decimals 360.0°
7-15	Decimals	With sign and leading zero
or		
7-15	Text (ASCII)	With sign and leading zero (Space)
or		
7-11	Decimal 1	With sign and leading zero
12-15	Decimal 2	With sign and leading zero
16	Space	
or:		
1-31	Text (ASCII)	Starts with (!), then the text follows

3.2 Word identifier (WI)

WI - No	Format (example)	Meaning
11	11....+xxxxxxxx	Point number with group number and measurement number
12	12....+xxxxxxxx	Device number, also module number
13	13....+xxxxyyyy	Instrument type (xxxx) and SW-version (yyyy)
14	14....+xxxxxxxx	Hardware version
15	15....+xxxxxxxx	Date of production
22	22..0u+xxxxxxxx	Angle
31	31..0u+xxxxxxxx	Slope distance
32	32..0u+xxxxxxxx	Horizontal distance

33	33..0u+xxxxxxxx	Difference in elevation
40	40....+xxxxxxxx	Temperature 1/10°C
51	51....+XXXX+xxx	Distance accuracy in ppm (XX) / mm (xxx)
53	53....+xxxxxxxx	Measuring signal-test [mV]
71	71....+xxxxxxxx	Coding the measurement
72	72....+xxxxxxxx	Coding the measurement
73	73....+xxxxxxxx	Coding the measurement
202	202...+xxxxxxxx	Coding the end cover
314	314.0u+xxxxxxxx	Area output
315	315.0u+xxxxxxxx	Volume output
940	940...+xxxxxxxx	Print serial number
941	941...+xxxxxxxx	Print date of production
996	996...+xxxxxxxx	Battery charge
5000	5000..+xxxxxxxx	Key codes

3.3 Error codes

Error codes in the *DISTO™ pro⁴* / *DISTO™ pro⁴ a*, in the 400 to 899 range and error numbers between 200 and 299, are related to the internal distance measurement module.

No	Format	Meaning
<i>DISTO™ pro⁴</i> / <i>DISTO™ pro⁴ a</i>:		
401	@E401	Invalid parameter
402	@E402	Fatal error has occurred
404	@E404	Functions interrupted
501	@E501	Invalid EEP-range
502	@E502	Invalid data set number
503	@E503	Calibration incomplete
504	@E504	No distance available
505	@E505	Memory is full (800 data sets)
651	@E651	Module response timeout, module is not responding
702	@E702	Invalid command
703	@E703	Wrong parameter
704	@E704	Wrong dimension m, m2, m3
705	@E705	Zero division
706	@E706	Number too large for display
707	@E707	Menu entry too long
751	@E751	Invalid interface command
752	@E752	Invalid WI-conversion
753	@E753	Invalid result at conversion
754	@E754	Received question mark
755	@E755	Application not in basic mode (->press clear-key)
756	@E756	Application not in online mode
757	@E757	No end cover selected

801	@E801	Invalid EEPROM address or length
802	@E802	Checksum wrong or saving failed
803	@E803	EEP is empty
804	@E804	No valid sign received while communicating with the RS232
805	@E805	Buffer overrun while communicating with the RS232
806	@E806	Parity error while communicating with the RS232
807	@E807	General communications error communicating with the RS232
808	@E808	No valid sign received while communicating with the EDM
809	@E809	Buffer overrun while communicating with the EDM
810	@E810	Parity error while communicating with the EDM
811	@E811	General communications error with the EDM
		MODULE:
252	@E252	Temperature too high
253	@E253	Temperature too low
255	@E255	Receiver signal too low
256	@E256	Receiver signal too powerful
257	@E257	Too much ambient light
272..29	@E272 .. @E299	Internal modular error
9		

Commands

3.4 Operational modes

DISTOTM pro⁴ / *DISTOTM pro⁴ a*, have various operational modes.

- Offline mode: Default: *DISTOTM pro⁴* / *DISTOTM pro⁴ a*, are in this mode after power has been switched on (press the measurement key or any character on the interface). Principally, the instrument is operated with the keypad and the results of the measured values are transmitted to the serial interface (depending on menu setting). Measured values displayed take into account the measurement reference setting and the measurement units. Furthermore, saved data sets (text or measured values) can be displayed using the key functions. Additionally, measurement commands can be given via the interface (in place of the keypad).
- Online resp remote mode: In online mode *DISTOTM pro⁴* / *DISTOTM pro⁴ a*, are not controlled and operated via the keypad but from a PC. To switch to online-mode ('ONLINE'-is displayed) the appropriate signal has to be sent. Then functions for measurements, display settings and keypad entries are made available. A separate command switches between the modes. All measurements done in this mode use the lens surface as measurement reference.

4 SETS OF COMMANDS IN OFFLINE MODE (STANDARD-MODE)

4.1 ON-command (a)

Function: Power on or reset the *DISTO™ pro⁴* / *DISTO™ pro⁴* a. Same function as command "c"
Input: a<cr>
Output: ?<cr><lf> or @Exxx<cr><lf>

4.2 Online-command (EXT or A)

Function: Switches on the extended set of commands (online mode) and switches to online mode (all applications are off in this mode).
Input: EXT<cr> or A<cr>
Output: ?<cr><lf> or @Exxx<cr><lf>

4.3 OFF- command (b)

Function: Switches off *DISTO™ pro⁴* / *DISTO™ pro⁴* a .
Input: b<cr>
Output: ?<cr><lf> or @Exxx<cr><lf>
Remarks : Short waiting period of about 500ms after switching off before they can be switched on again.

4.4 STOP/CLEAR- command (c)

Function: Stops current distance or signal measurement.
Input: c<cr>
Output: ?<cr><lf> or @Exxx<cr><lf>

4.5 Distance measurement (g)

Function: Triggers single distance measurement.
Input: g<cr>
Output: WI31 WI51<cr><lf> or @Exxx<cr><lf>

4.6 Tracking (h)

Function: Triggers continuous distance measurement. Measurement is continued until next command or until an error occurs.
Input: h<cr>
Output: WI31 WI51<cr><lf> or @Exxx<cr><lf>
Remarks: Interface must be set to 9600 baud or higher to fully exploit the measuring rate.

4.7 Signal measurements (k)

Function: Triggers continuous distance measurement. Measurement is continued until next command or until an error occurs.
Input: k<cr>
Output: WI53<cr><lf> or @Exxx<cr><lf>
Remarks: Interface must be set to 9600 baud or higher to fully exploit the measuring rate.

4.8 Laser (o, p)

Function: Switch laser on/off.

Input: o<cr> Switch laser on.
 p<cr> Switch laser off.
Output: ?<cr><lf> or @Exxx<cr><lf>

4.9 Software version (N00N)

Function: Transmit software version and instrument type to the interface.
Input: N00N<cr>
Output: WI13<cr><lf> or @Exxx<cr><lf>

4.10 Hardware version (N01N)

Function: Transmit hardware version to the interface.
Input: N01N<cr>
Output: WI14<cr><lf> or @Exxx<cr><lf>

4.11 Serial number (N02N)

Function: Transmit instrument number to the interface.
Input: N02N<cr>
Output: WI12<cr><lf> or @Exxx<cr><lf>

4.12 Date of production (N03N)

Function: Transmit date of production to the interface.
Input: N03N<cr>
Output: WI15<cr><lf> or @Exxx<cr><lf>

4.13 Check battery charge (v)

Function: Check battery charge
Input: v<cr><lf>
Output: WI996<cr><lf> or @Exxx<cr><lf>
Remarks : Output of battery charge in mV.

5 SET OF COMMANDS IN ONLINE-MODE (EXTENDED MODE)

5.1 Quit online-mode (STD or B)

Function: Switches *DISTO™ pro⁴* / *DISTO™ pro⁴* a to offline mode
 Input: STD<cr> or B<cr>
 Output: ?<cr><lf> or @Exxx<cr><lf>

5.2 Distance measurement (G)

Function: Trigger single measurement with short output, like „g“
 Input: G<cr>
 Output: WI31<cr><lf> or @Exxx<cr><lf>

5.3 Tracking (H)

Function: Triggers continuous distance measurement with short edition. Measurement is continued until next command or until an error occurs., like „h“.
 Input: H<cr>
 Output: WI31<cr><lf> or @Exxx<cr><lf>
 Remarks: Interface must be set to 9600 baud or higher to fully exploit the measuring rate.

5.4 Set baud rate (N70N)

Function: Set baud rate with fixed parity (None Parity) and fixed databits (8 databits).
 Input: N70N%1N<cr>
 %1. Parameter: Baud rate:
 1 600 baud
 2 1200 baud
 3 2400 baud
 4 4800 baud
 5 9600 baud
 6 19200 baud
 Output: ?<cr><lf> (with old baud rate) or @Exxx<cr><lf>
 Remarks: **Settings are immediately stored in the EEPROM!**

5.5 Back light on/off (LIGHT)

Function: Switches LED on /off.
 Input: LIGHT %1<cr>
 %1. parameter
 0 Back light off
 1 Back light on
 Output: ?<cr><lf> or @Exxx<cr><lf>

5.6 Delete display (CDISP)

Function: Deletes display contents
 Input: CDISP<cr>
 Output: ?<cr><lf> or @Exxx<cr><lf>

5.7 Describes display (DISPS)

Function: Uses display fonts. Small.
 Input: DISPS %1 %2 %3<cr>
 %1. Parameter x coordinate
 0..12 Pixel number
 1
 %2. Parameter y coordinate
 0..95 Pixel number
 %3. Parameter data string
 [0..9][a..z][ASCII data
 A..Z]

Output: ?<cr><lf> or @Exxx<cr><lf>
 Example: DISPS 20 50 Test<cr><lf>

5.8 Display description (DISPM)

Function: Uses display fonts. Medium.
 Input: DISPM %1 %2 %3<cr>
 %1. Parameter x coordinate
 0..12 Pixel number
 1
 %2. Parameter y coordinate
 0..95 Pixel number
 %3. Parameter data string
 [0..9][a..z][ASCII data
 A..Z]

Output: ?<cr><lf> or @Exxx<cr><lf>
 Example: DISPM 20 50 Test<cr><lf>
 Remarks: Only works in online mode !

5.9 Display (DISPL)

Function: Uses display fonts. Large.
 Input: DISPL %1 %2 %3<cr>
 %1. Parameter x coordinate
 0..12 Pixel number
 1
 %2. Parameter y coordinate
 0..95 Pixel number
 %3. Parameter data string
 [0..9][a..z][ASCII data
 A..Z]

Output: ?<cr><lf> or @Exxx<cr><lf>
 Example: DISPL 20 50 Test<cr><lf>

5.10 Test display (DISPTEST)

Function: Enables the display to be described.
 Input: DISPTEST %<cr>
 %1. Parameter x coordinate
 0 Vertical lines

```

1      Vertical lines dis-
      placed
2      Horizontal lines
3      Horizontal lines
      displaced
4      Checkerboard pattern
5      Checkerboard pattern
      Displaced
6      Writes „Online
      Disto“
Output:  ?<cr><lf> or @Exxx<cr><lf>

```

5.11 Read keypad (KEY)

```

Function:  Enables keypad to be read.
Input:    KEY %1<cr>
          %1. Parameter  x coordinate
          <=0    Waits on key
          >0    Timeout [ms] to read key
          (max.
          30000
          )
Output:   WI5000<cr><lf> or @Exxx<cr><lf>

```

5.12 End cover output (ENDCOVER)

```

Function:  Outputs end cover code
Input:    ENDCOVER<cr><lf>
Output:   WI202<cr><lf> or @Exxx<cr><lf>
Remarks:  3 = no magnet, 2 = one magnet at the left (swivel foot), 1 =
          one magnet at the right (alignment aid), 0 = two magnets

```

5.13 Output beep sound (BEEP)

```

Function:  Emits beep sound.
Input     BEEP %1<cr>
          %: Beep length 0..5000 [ms]
Output:   ?<cr><lf> or @Exxx<cr><lf>

```

5.14 Delete all data (DELALLDATA)

```

Function:  Deletes all data sets!
Input:    DELALLDATA<cr>
Output:   ?<cr><lf> or @Exxx<cr><lf>

```

5.15 Read memory (GETDATA)

```

Function:  Reads data memory.
Input:    GETDATA %1 %2<cr>
          %1. Parameter
          n    Starting range (n larger than, equal to 1)
          %2. Parameter
          n    End range (n smaller than equal to 800)

```

Output: WI11 WI31 or WI22 or WI314 or WI315 WI71 WI72 WI73<cr><lf>
?<cr><lf> or @Exxx<cr><lf>

Remarks : Every data set ends with a terminator.
From 1 to 800 data set can be transmitted.
After the last data set has been transmitted, a "?" appears
as confirmation of the end of the function.

5.16 Read entire data memory (GETALLDATA)

Function: Read data memory.
Input: GETALLDATA<cr>

Output: WI11 WI31 or WI22 or WI314 or WI315 WI71 WI72 WI73<cr><lf>
?<cr><lf> or @Exxx<cr><lf>

Remarks : Each data set ends with a terminator.
From 1 to 800 data sets can be transmitted.
After the last data set has been transmitted, a "?" appears
as confirmation of the end of the function.

6 DATA FORMATS FOR DATA TRANSFERS

Data transfer is divided into 3 categories. The division is determined by the manner in which the data to be transferred was handled. The categories are:

Data transfer to protocol

This transfer is activated via the HMI and can be switched off again. All measured and calculated values, intermediate results and results of functions as soon as they are available, are transferred via the interface. They can be used to create a protocol of the measurements.

Manual data transfer

This transfer is activated via the HMI. Values stored in memory are sent via the interface. These data can be selected.

Remote data transfer

Transfer is started via the interface. Either the entire memory contents is transferred or a measurement is made and only data from that measurement are transferred. Measurement reference in this mode is always the basic settings of the mode (tenths of millimeters, reference point: surface of front lens).

6.1 Example: data transfer to protocol

Function: Triggering a distance measurement with the keypad
Output: WI31<cr><lf> or @Exxx<cr><lf>

6.2 Example: manual data transfer

6.2.1 Text

Function: Transferring a data set only containing text
Output: !Renovation of court in sports park<cr><lf>
 ?<cr><lf> or @Exxx<cr><lf>
Remarks : Every data set ends with a terminator
 "?" as confirmation of the end of the function.

6.2.2 Single data set

6.2.3 Function: Transferring a data set with all information

Output: WI11 WI31 WI71 WI72 WI73<cr><lf>
 ?<cr><lf> or @Exxx<cr><lf>

Remarks : Every data set ends with a terminator
 "?" as confirmation of the end of the function.

6.2.4 All data sets

6.2.5 Function: Transferring a data set with all information

Output: WI11 WI31 WI71 WI72 WI73<cr><lf>
 WI11 WI31 WI71 WI72 WI73<cr><lf>
 WI11 WI31 WI71 WI72 WI73<cr><lf>

.....
 ?<cr><lf> or @Ex<cr><lf>
 Remarks : Every data set ends with a terminator.
 0 to n data sets can be transferred.
 After the last data set has been transmitted, a "?" appears
 as confirmation of the end of the function.

6.3 Example: remote data transfer

6.3.1 Text

Function: Transferring a data set only containing text
 Output: !Renovation of court in sports park<cr><lf>
 ?<cr><lf> or @Exxx<cr><lf>
 Remarks : Every data set ends with a terminator
 "?" as confirmation of the end of the function

6.3.2 Single data sets

Function: Measuring a distance via the interface
 Output: WI31<cr><lf> or @Exxx<cr><lf>

6.3.3 All data sets

Function: reading all data sets via the interface with all information
 with descriptions.
 Output: !Renovation of court in sports park<cr><lf>
 WI11 WI31 WI71 WI72 WI73<cr><lf>
 WI11 WI31 WI71 WI72 WI73<cr><lf>
 WI11 WI31 WI71 WI72 WI73<cr><lf>

 ?<cr><lf> or @Exxx<cr><lf>
 Remarks : Each data set ends with a terminator.
 0 to n data sets can be transferred.
 After the last data set has been transmitted, a "?" appears
 as confirmation of the end of the function.

Appendix

6.4 Keypad codes *DISTO™ pro⁴* / *DISTO™ pro⁴ a*

Key code	Key description
0	No key
1	Measurement trigger key / on
2	Menu key
3	Multiplication key
4	Addition / menu up key
5	Subtraction / menu down key
6	Execute key
7	Delete / Undo key
48	Zero key
49	One key
50	Two key
51	Three key
52	Four key
53	Five key
54	Six key
55	Seven key
56	Eight key
57	Nine key
20	Undefined key
21	Off key

6.5 Character set

32 (bl)	64 @	96 `	160 (bl)	192 À	224 à
33 !	65 A	97 a	161 ì	193 Á	225 á
34 "	66 B	98 b	162 ç	194 Â	226 â
35 #	67 C	99 c	163 £	195 Ã	227 ã
36 \$	68 D	100 d	164 ¨	196 Ä	228 ä
37 %	69 E	101 e	165 ¥	197 Å	229 å
38 &	70 F	102 f	166 |	198 Æ	230 æ
39 '	71 G	103 g	167 §	199 Ç	231 ç
40 (	72 H	104 h	168 ¨	200 È	232 è
41)	73 I	105 i	169 ©	201 É	233 é
42 *	74 J	106 j	170 ª	202 Ê	234 ê
43 +	75 K	107 k	171 «	203 Ë	235 ë
44 ,	76 L	108 l	172 ¬	204 Ì	236 ì
45 -	77 M	109 m	173 -	205 Í	237 í
46 .	78 N	110 n	174 ®	206 Î	238 î
47 /	79 O	111 o	175 ¯	207 Ï	239 ï
48 0	80 P	112 p	176 °	208 Ð	240 ð
49 1	81 Q	113 q	177 ±	209 Ñ	241 ñ
50 2	82 R	114 r	178 ²	210 Ò	242 ò
51 3	83 S	115 s	179 ³	211 Ó	243 ó
52 4	84 T	116 t	180 ´	212 Ô	244 ô

53	5	85	U	117	u	181	μ	213	Õ	245	õ
54	6	86	V	118	v	182	¶	214	Ö	246	ö
55	7	87	W	119	w	183	·	215	×	247	÷
56	8	88	X	120	x	184	,	216	Ø	248	ø
57	9	89	Y	121	y	185	¡	217	Ù	249	ù
58	:	90	Z	122	z	186	º	218	Ú	250	ú
59	;	91	[	123	{	187	»	219	Û	251	û
60	<	92	\	124	|	188	¼	220	Ü	252	ü
61	=	93	]	125	}	189	³	221	Ý	253	ý
62	>	94	^	126	~	190	¾	222	Þ	254	þ
63	?	95	_	127		191	¿	223	ß	255	ÿ