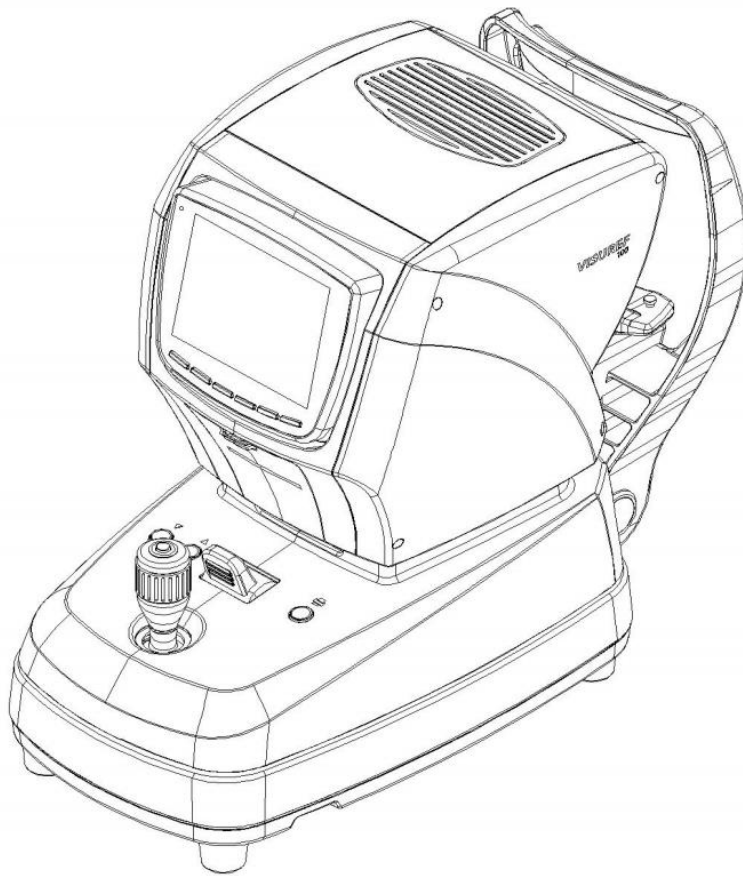


VISUREF 100

Autorefractor/Keratometer

Interface Definition
Version 1.6



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1. General

1.1 Purpose

This documentation specifies the interface for data output from the VISUREF 100.

1.2 Definitions and Acronyms

OS	Oculus sinister, left eye
OD	Oculus dexter, right eye
SPH	Sphere
CYL	Cylinder
KER	Keratometry
COR PWR	Corneal power
AVE	Average
EMR	Electronic medical record
VD	Vertex distance
PD	Interpupillary distance

1.3 Tables

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2. Intended Use

An autorefractor / keratometer is used to determine the refractive and keratometric properties of the human eye to assist eye care professionals when prescribing corrective eyeglasses and contact lenses.

3. Connectors

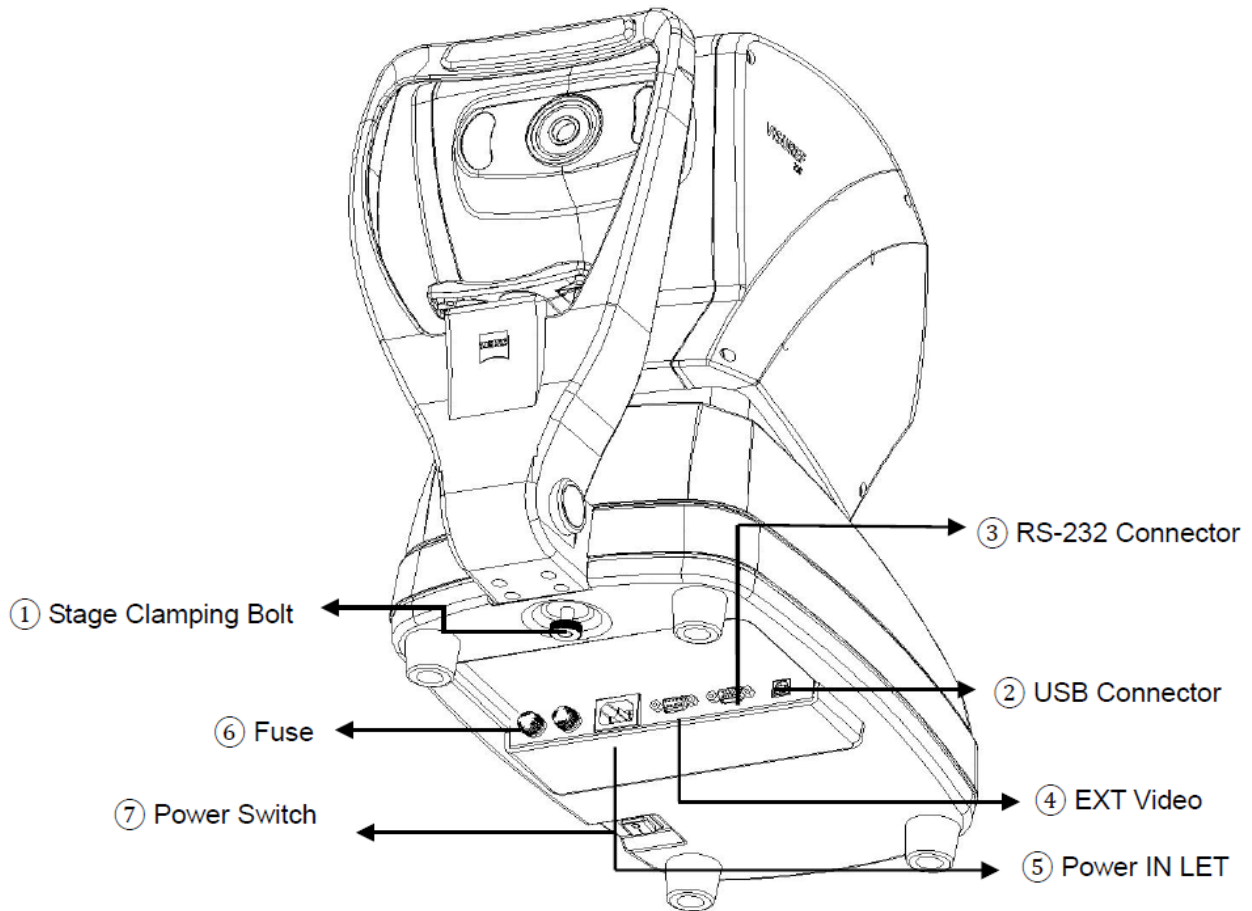


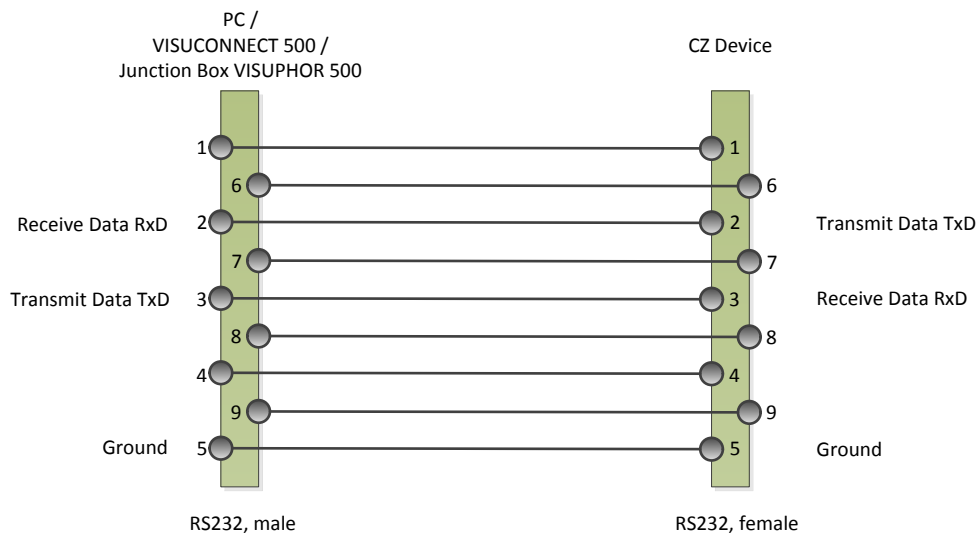
Figure 1 Connector location

1	Stage Clamping Bolt	To clamp the stage during transportation
2	USB Connector	For service
3	RS-232 Connector	Connect to PMS serial Interface
4	EXT Video	Connect to external video equipment
5	Power IN LET	Connector for the power supply cable
6	Fuse	Protects device from excessive electric power
7	Power Switch	Switch for turning device ON and OFF

Table 1 Available connectors

3.1 RS232 Connector Pin Setup

The VISUREF 100 supports data output operations via the RS-232 serial interface (female). The serial port of the VISUREF 100 requires a male serial connector cable. A 1:1 straight through cable is required to connect to a standard PC. Only pin numbers #2 (Received Data), #3 (Transmitted Data), and #5 (Ground) are used; all others are not used.



Pin	Signal	Pin	Signal
1	-	6	-
2	Transmit Data	7	-
3	Receive Data	8	-
4	-	9	-
5	Signal ground		

Figure 2 RS-232 DB 9 pin configuration of ZEISS device

3.2 Serial Interface Setup

Baud Rate	9600
Data Bits	8
Parity Bit	No Parity Bit
Stop Bits	1 Stop Bit
Code:	ASCII Code (transmitted as HEX)

Table 2 Serial interface setup

3.3 Data Transmission Mode

The data is transferred via a serial interface as soon the user pushes the "Print" button located on the device. The mode of data transfer is push, the EMR system cannot initiate data queries from the device itself.

4. Data Format

4.1 Obtained Data Overview

All transferred data is hexadecimal-encoded. The following data is obtained using the VISUREF 100. The data stream length remains unchanged regardless of user-selected measurement mode.

Measurement results of the refraction and keratometric readings of the eye in question are set. Only average values are transmitted. Measurement data of the eye not measured are set to hex: 0x2A (int: 42). If only keratometric readings are available placeholders representing the missing refraction are set to hex: 0x2A (int: 42).

If there is no measurement or only faulty measurements are obtained no data is transmitted.

Dataset	Length in bytes
Device name	13
Time stamp	18
Measured eye / Interpupillary distance / Vertex distance	13
Right eye refraction	23
Right eye keratometry	60
Left eye refraction	23
Left eye keratometry	60
Device serial number	14
Total	224

Table 3 Data set lengths

4.2 Definitions

Placeholder	Definition
[S]	"+" or "-", if not set: hex: 2A, int: 42
[N]	Number [0...9], if not set: hex: 2A, int: 42
[H][H]	Hexadecimal value, [H] represents a value between [0...9] or a character between [A...F]
[X]	Character between [0...9] and [A...Z]
[E][E]	Defines mode of measurement. Allowed values: [O][S] ... OS is measured, only left eye is measured [O][D] ... OD is measured, only right eye is measured [B][O] ... Both eyes are measured

Table 4 Data format definitions

If a data set is not defined the data package values are set to the **default value hex 0x2A (int: 42)**.

Fractional portion is separated by a period (Hex: 0x2E, int: 46), i.e. 2_50.

4.3 Control Characters

Character	Hex/Int	Definition
CR	0x0D / 13	Beginning / End of data set or data tag.
EOT	0x04 / 4	End Of transmission, characterizes the end of transmission of a complete data set.
*	0x2A / 42	Measurement value not applicable, not set.

Table 5 Data format definitions

5. Data Stream

5.1 Device Name

	1	2	3	4	5	6	7	8	9	10	11	12	13
	Device Name												
Data Stream (Hex)	41	0D	56	49	53	55	52	45	46	31	30	30	0D
Character (ASCII)	A	CR	V	I	S	U	R	E	F	1	0	0	CR
Integer (Dezimal)	65	13	86	73	83	85	82	69	70	49	48	48	13

5.2 Time Stamp

	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Time Stamp	Year				Month		Day			Hour		Minute		Seconds			
Data Stream (Hex)	20	0D	[H][H]	[H][H]	[H][H]	[H][H]	[H][H]	[H][H]	[H][H]	[H][H]	0D	[H][H]	[H][H]	[H][H]	[H][H]	[H][H]	[H][H]	0D
Character (ASCII)		CR	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	CR	[N]	[N]	[N]	[N]	[N]	[N]	CR
Integer (Dezimal)	32	13									13							13

5.3 Measured Eye, Vertex Distance and Pupil Distance

If one eye is measured, bytes 34 and 35 are set to OS or OD (hex: 0x4F|0x53, hex: 0x4F|0x44), respectively. If both eyes are measured, bytes 34 and 35 are set to BO (hex: 0x42|0x4F).

The interpupillary distance is only set, if values are available. If one eye is measured the pupil distance is set to 0x02A (int: 42), default value.

	32	33	34	35	36	37	38	39	40	41	42	43	44
	Measured Eye		Eye		VD [mm]					PD [mm]			
Data Stream (Hex)	20	0D	[H][H]	[H][H]	0D	[H][H]	[H][H]	2E	[H][H]	0D	[H][H]	[H][H]	0D
Character (ASCII)		CR	[E]	[E]	CR	[N]	[N]	.	[N]	CR	[N]	[N]	CR
Integer (Dezimal)	32	13			13			46		13			13

5.4 Right Eye Refraction

Right eye refraction readings are identified through byte 47 and 48 market as RR (hex: 0x52|0x52), right refraction.

	45	46	47	48	49	50	51	52	53	54	55	56
	Right Eye				Right SPH [D]							
Data Stream (Hex)	20	0D	52	52	0D	[H][H]	[H][H]	[H][H]	2E	[H][H]	[H][H]	0D
Character (ASCII)		CR	R	R	CR	[S]	[N]	[N]	.	[N]	[N]	CR
Integer (Dezimal)	32	13	82	82	13				46			13

57	58	59	60	61	62	63	64	65	66	67
Right CYL [D]						Right AXIS [°]				
[H][H]	[H][H]	[H][H]	2E	[H][H]	[H][H]	OD	[H][H]	[H][H]	[H][H]	OD
[S]	[N]	[N]	.	[N]	[N]	CR	[N]	[N]	[N]	CR
			46			13				13

5.5 Right Eye Keratometry

Right eye keratometric readings are identified through byte 70 and 71 market as RK (hex: 0x52|0x4B), right keratometry.

	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
	Right Keratometry				Right KER Radius Flat [mm]						Right COR PWR Flat [D]						
Data Stream (Hex)	20	OD	52	4B	OD	[H][H]	[H][H]	2E	[H][H]	[H][H]	OD	[H][H]	[H][H]	2E	[H][H]	[H][H]	OD
Character (ASCII)		CR	R	K	CR	[N]	[N]	.	[N]	[N]	CR	[N]	[N]	.	[N]	[N]	CR
Integer (Dezimal)	32	13	82	75	13			46			13			46			13

85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Right KER AXIS Flat [°]				Right KER Radius Steep [mm]						Right COR PWR Steep [D]					
[H][H]	[H][H]	[H][H]	OD	[H][H]	[H][H]	2E	[H][H]	[H][H]	OD	[H][H]	[H][H]	2E	[H][H]	[H][H]	OD
[N]	[N]	[N]	CR 13	[N]	[N]	.	[N]	[N]	CR 13	[N]	[N]	.	[N]	[N]	CR 13

101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116
Right KER AXIS Steep [°]				Right AVE KER Radius [mm]						Right AVE COR PWR [D]					
[H][H]	[H][H]	[H][H]	OD	[H][H]	[H][H]	2E	[H][H]	[H][H]	OD	[H][H]	[H][H]	2E	[H][H]	[H][H]	OD
[N]	[N]	[N]	CR 13	[N]	[N]	.	[N]	[N]	CR 13	[N]	[N]	.	[N]	[N]	CR 13

117	118	119	120	121	122	123	124	125	126	127
Right KER CYL [D]						Right KER AXIS [°]				
[H][H]	[H][H]	[H][H]	2E	[H][H]	[H][H]	OD	[H][H]	[H][H]	[H][H]	OD
[S]	[N]	[N]	.	[N]	[N]	CR 13	[N]	[N]	[N]	CR 13

5.6 Left Eye Refraction

Left eye refraction readings are identified through byte 130 and 131 market as LR (hex: 0x4C|0x52), left refraction

	128	129	130	131	132	133	134	135	136	137	138	139
	Left Eye					Left SPH [D]						
Data Stream (Hex)	20	0D	4C	52	0D	[H][H]	[H][H]	[H][H]	2E	[H][H]	[H][H]	0D
Character (ASCII)		CR	L	R	CR	[S]	[N]	[N]	.	[N]	[N]	CR
Integer (Dezimal)	32	13	76	82	13				46			13

	140	141	142	143	144	145	146	147	148	149	150
	Left CYL [D]						Left AXIS [°]				
	[H][H]	[H][H]	[H][H]	2E	[H][H]	[H][H]	0D	[H][H]	[H][H]	[H][H]	0D
	[S]	[N]	[N]	.	[N]	[N]	CR	[N]	[N]	[N]	CR
				46			13				13

5.7 Left Eye Keratometry

Left eye keratometric readings are identified through byte 153 and 154 market as LK (hex: 0x4C|0x4B), left keratometry.

	151	152	153	154	155	156	157	158	159	160	161
	Left Eye				Left KER Radius Flat [mm]						
Data Stream (Hex)	20	0D	4C	4B	0D	[H][H]	[H][H]	2E	[H][H]	[H][H]	0D
Character (ASCII)		CR	L	K	CR	[N]	[N]	.	[N]	[N]	CR
Integer (Dezimal)	32	13	76	75	13			46			13

162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177
Left COR PWR Flat [D]					Left KER AXIS Flat [°]					Left KER Radius Steep [mm]					
[H][H]	[H][H]	2E	[H][H]	[H][H]	0D	[H][H]	[H][H]	[H][H]	0D	[H][H]	[H][H]	2E	[H][H]	[H][H]	0D
[N]	[N]	.	[N]	[N]	CR	[N]	[N]	[N]	CR	[N]	[N]	.	[N]	[N]	CR
		46			13				13			46			13

178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193
Left COR PWR Steep [D]					Left KER AXIS Steep [°]					Left AVE KER Radius [mm]					
[H][H]	[H][H]	2E	[H][H]	[H][H]	0D	[H][H]	[H][H]	[H][H]	0D	[H][H]	[H][H]	2E	[H][H]	[H][H]	0D
[N]	[N]	.	[N]	[N]	CR	[N]	[N]	[N]	CR	[N]	[N]	.	[N]	[N]	CR
		46			13				13			46			13

194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
Left AVE COR PWR [D]						Left KER CYL [D]						Left KER AXIS [°]				
[H][H]	[H][H]	2E	[H][H]	[H][H]	0D	[H][H]	[H][H]	[H][H]	2E	[H][H]	[H][H]	0D	[H][H]	[H][H]	[H][H]	0D
[N]	[N]	.	[N]	[N]	CR	[S]	[N]	[N]	.	[N]	[N]	CR	[N]	[N]	[N]	CR
		46			13				46			13				13

5.8 Device Serial Number

	211	212	213	214	215	216	217	218	219	220	221	222	223	224
	SN													
Data Stream (Hex)	20	0D	[H][H]	[H][H]	[H][H]	[H][H]	[H][H]	[H][H]	[H][H]	[H][H]	[H][H]	[H][H]	0D	04
Character (ASCII)		CR	[X]	[X]	[X]	[X]	[X]	[X]	[X]	[X]	[X]	[X]	CR	EOT
Integer (Dezimal)	32	13											13	4

6. Example Data Set

In this example only left eye refraction and keratometry is measured.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Text	A	CR	V	I	S	U	R	E	F	1	0	0	CR		CR	2	0	1	3	0	3	2	5	CR	1
Int	65	13	86	73	83	85	82	69	70	49	48	48	13	32	13	50	48	49	51	48	51	50	53	13	49
Hex	41	0D	56	49	53	55	52	45	46	31	30	30	0D	20	0D	32	30	31	33	30	33	32	35	0D	31

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
7	3	3	2	3	CR		CR	O	S	CR	1	3	.	5	CR	*	*	CR		CR	R	R	CR	*	
55	51	51	50	51	13	32	13	79	83	13	49	51	46	53	13	42	42	13	32	13	82	82	13	42	
37	33	33	32	33	0D	20	0D	4F	53	0D	31	33	2E	35	0D	2A	2A	0D	20	0D	52	52	0D	2A	

	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
*	*	.	*	*	CR	*	*	*	.	*	*	CR	*	*	*	CR		CR	R	K	CR	*	*	.	
42	42	46	42	42	13	42	42	42	46	42	42	13	42	42	42	13	32	13	82	75	13	42	42	46	
2A	2A	2E	2A	2A	0D	2A	2A	2A	2E	2A	2A	0D	2A	2A	2A	0D	20	0D	52	4B	0D	2A	2A	2E	

	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
*	*	CR	*	*	.	*	*	CR	*	*	*	CR	*	*	.	*	*	CR	*	*	.	*	*	CR	
42	42	13	42	42	46	42	42	13	42	42	42	13	42	42	46	42	42	13	42	42	46	42	42	13	
2A	2A	0D	2A	2A	2E	2A	2A	0D	2A	2A	2A	0D	2A	2A	2E	2A	2A	0D	2A	2A	2E	2A	2A	0D	

	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
*	*	*	CR	*	*	.	*	*	CR	*	*	.	*	*	CR	*	*	*	.	*	*	CR	*	*	
42	42	42	13	42	42	46	42	42	13	42	42	46	42	42	13	42	42	42	46	42	42	13	42	42	
2A	2A	2A	0D	2A	2A	2E	2A	2A	0D	2A	2A	2E	2A	2A	0D	2A	2A	2A	2E	2A	2A	0D	2A	2A	

126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
*	CR		CR	L	R	CR	+	0	9	.	2	5	CR	-	0	1	.	2	5	CR	0	7	6	CR
42	13	32	13	76	82	13	43	48	57	46	50	53	13	45	48	49	46	50	53	13	48	55	54	13
2A	0D	20	0D	4C	52	0D	2B	30	39	2E	32	35	0D	2D	30	31	2E	32	35	0D	30	37	36	0D

151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	CR	L	K	CR	0	7	.	9	2	CR	4	2	.	5	0	CR	1	4	2	CR	0	7	.	8
32	13	76	75	13	48	55	46	57	50	13	52	50	46	53	48	13	49	52	50	13	48	55	46	56
20	0D	4C	4B	0D	30	37	2E	39	32	0D	34	32	2E	35	30	0D	31	34	32	0D	30	37	2E	38

176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
7	CR	4	3	.	0	0	CR	0	7	2	CR	0	7	.	8	9	CR	4	2	.	7	5	CR	-
55	13	52	51	46	48	48	13	48	55	50	13	48	55	46	56	57	13	52	50	46	55	53	13	45
37	0D	34	33	2E	30	30	0D	30	37	32	0D	30	37	2E	38	39	0D	34	32	2E	37	35	0D	2D

201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224
0	0	.	5	0	CR	1	4	2	CR		CR	9	7	0	1	1	0	1	3	0	8	CR	EOT
48	48	46	53	48	13	49	52	50	13	32	13	57	55	48	49	49	48	49	51	48	56	13	4
30	30	2E	35	30	0D	31	34	32	0D	20	0D	39	37	30	31	31	30	31	33	30	38	0D	04

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VISUREF 100 Interface Definition
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Specifications subject to changes