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DR 3900

Service instructions

04/2011 Edition 1.0

HACH LANGE

UNITED FOR WATER QUALITY

Content

1 General

The DR 3900 is a VIS spectral photometer with a wavelength range of 320 to 1100 nm. The instrument is supplied with a complete range of application programs and supports several languages.
The spectral photometer DR 3900 contains the following programs and modes of operation:

- Saved programs (pre-installed tests)
- Barcode program
- User programs
- Favorites
- Single-wavelength
- Multi-wavelength
- Wavelength scan
- Time scan

The spectral photometer DR 3900 carries out digital measurements in the measurement units of concentration, extinction or % transmission.
When a user-generated or programmed process is selected, a structured menu control and input requests guide the user through the test.
This menu system can also create reports, statistical evaluations of the calibration curves produced and reports about instrument diagnostics tests.

1.1 Instrument variants

The instrument variants of the DR3900 spectral photometer are listed below:

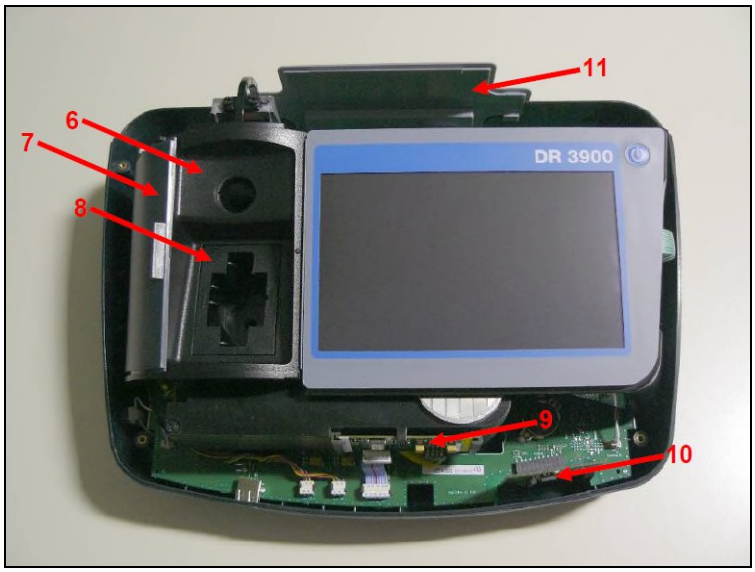
-	LPG440.99.00001	DR 3900	without RFID	Hach-Lange
-	LPG440.99.00011	DR 3900	with RFID	Hach-Lange
-	LPG440.99.00002	DR 3900	without RFID	HACH
-	LPG440.99.00012	DR 3900	with RFID	HACH

1.2 Specifications

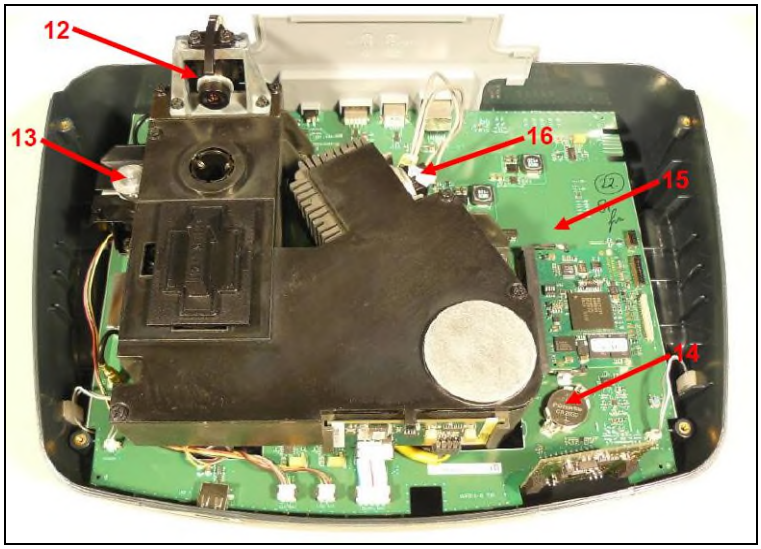
Refer to instruction manual

1.3 Position of individual components in the instrument

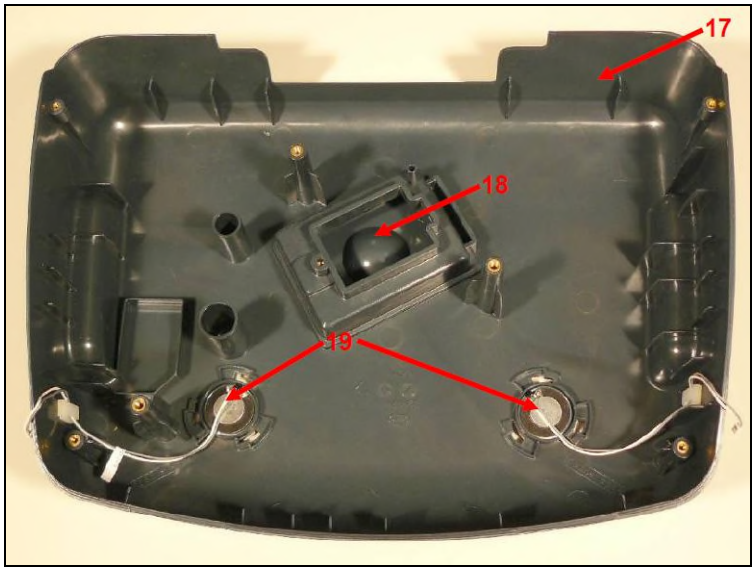
1 - Upper part of housing (LZV852)
2 - Light shield (LZV849)
3 - Front cover (LZV854)
4 - Instrument tag (included in LZV872)
5 - Display with touchscreen (LZV864)



6 - Cross rail (LZV858/LZV859)
7 - Sample chamber slide (LZV856)
8 - 50 mm cell compartment (LZV848)
9 - Grating motor board (with grating motor YAB118)
10 - RFID module (YAB120)
11 - Rear panel (LZV855)

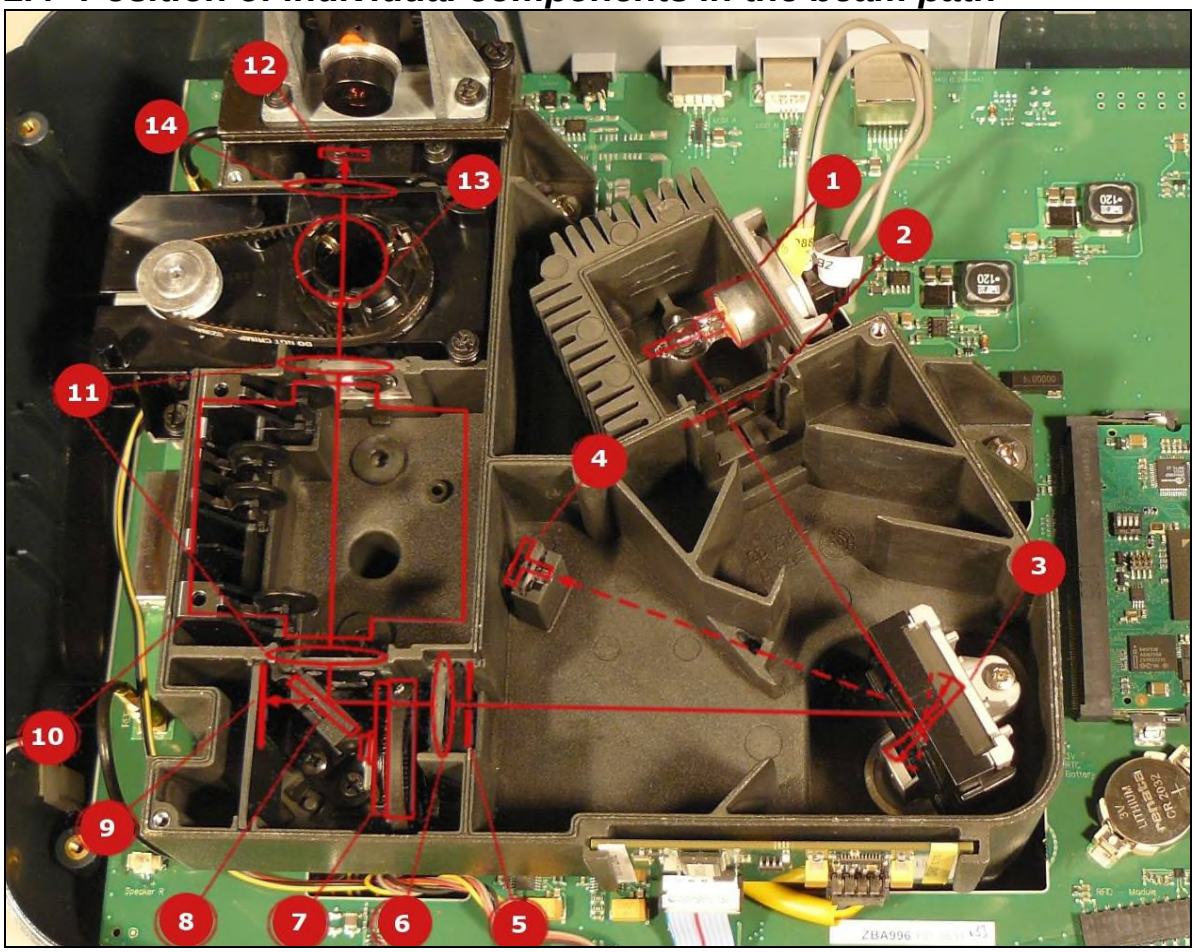


12 - Camera (LZV862)
13 - Stepper motor (LZV850)
14 - CR2032 lithium battery (LZV851)
15 - Main board with processor board (YAB119)
16 - Lamp plug (LZV754)



17 - Lower part of housing (LZV853)
18 - Lamp cover (LZV857)
19 - Speakers (LZV869)

1.4 Position of individual components in the beam path



1 - Halogen lamp (LZV565)
2 - Entry slit
3 - Concave grating (LZV592)
4 - Zero order light guide (LZV865)
5 - Exit slit
6 - Lens B (included in LZV587)
7 - Filter wheel (LZV591)
8 - Beam splitter mirror (LZV755)
9 - Reference element (YAB083)
10 - Cell compartment (2) for rectangular cuvettes
11 - Lens A (included in LZV587)
12 - Measurement element (LZV612)
13 - Cell compartment (1) for round cuvettes
14 - Lens C (included in LZV587)

2 Error messages/Event logger

2.1 General

Please also refer to section 3.6.8.1Event logger on page 56

The instrument history and details of any errors that have occurred are saved in the event logger.

In the case of errors that are unclear, or error descriptions from the customer, this function can be used for fast troubleshooting by Service.

In the error messages that are shown during the start procedure, error numbers are also specified. These correspond to the index numbers in the event logger.

2.2 Error messages in the UI:

Error message	Logger entry produced [xx] →Cause/explanation, please also refer to appropriate logger entry section 2.3 Event logger entries on page 10
Warning! Please use light shield.	[16] Check cuvette detection, refer to 3.6.6.1Cuvette detection on page 43
Barcode label not read!	[25,11] Test of 2D code detection, refer to section 3.6.6.3.2 2D Code on page 47 Camera adjust with VAA880, refer to section 3.6.6.3.1Basic Functions on page 46
An error occurred as the USB memory was read.	Check USB interface, refer to section 3.6.4.5 USB on page 30
An error occurred as the USB memory was written to.	Check USB interface, refer to section 3.6.4.5 USB on page 30
Please check for current update file.	[15,1]; [15,2]; [15,6]; [15,8]; [15,9]; [15,10]; [15,11];
Please close slide.	Check status of cover detection, refer to section 3.6.6.1Cuvette detection on page 43
Please check connection and contact administrator.	Check Ethernet port, refer to section 3.6.4.6 Ethernet on page 30
File for instrument update is missing.	[15,1]; [15,2]; [15,6]; [15,8]; [15,9]; [15,10]; [15,11];
File for instrument update is faulty.	[15,1]; [15,2]; [15,6]; [15,8]; [15,9]; [15,10]; [15,11];
It is recommended that a system check is carried out.	[7] ***Note:*** *After an initial failed air measurement at 560 nm (refer to error "Error Testprogram stopped! Please remove cuvette! Close the cover."), the instrument checks whether a cuvette is inserted. Only if a cuvette is not inserted is a second air measurement carried out and compared with the air values saved by the manufacturer. The message is shown at a deviation > 4 mExt. Press start to carry out a new air measurement and overwrite the manufacturer data.*
Error Barcode control number? Update program data!	Refer to section 3.6.8.2 Update on page 58
Error during call up of local IP address.	Check Ethernet port, refer to section 3.6.4.6 Ethernet on page 30
Error during setup of default gateways.	Check Ethernet port, refer to section 3.6.4.6 Ethernet on page 30

Error message	Logger entry produced [xx] →Cause/explanation, please also refer to appropriate logger entry section 2.3 Event logger entries on page 10
Error during setup of network drive!	Check Ethernet port, refer to section 3.6.4.6 Ethernet on page 30
Error during setup of subnet mask.	Check Ethernet port, refer to section 3.6.4.6 Ethernet on page 30
Error during copy of USB memory.	Check USB interface, refer to section 3.6.4.5 USB on page 30
Error in FTP connection.	Check Ethernet port, refer to section 3.6.4.6 Ethernet on page 30
Error Program not available. Update program data!	Refer to section 3.6.8.2 Update on page 58
Error Testprogram stopped! Please check lamp Close the cover. Error [xx]	[33,1]… [33,15]
Error Testprogram stopped! Please remove cuvette! Close the cover.	[6] ***Note:*** *Following successful calibration, an air measurement is carried out at 560 nm and compared with the air values saved by the manufacturer. The error message is shown at a deviation > 10 mExt.*
Error Testprogram stopped! Hardware fault. Error [x]	[31,1]… [31,21]; [32,1]… [32,10]
Error Too much ambient light! Position instrument in shade or close the cover.	[20]
No barcode!	[25,10]; [25,12]
Next service is due!	Refer to section 3.4 Service times on page 21
Network switched off.	Check Ethernet port, refer to section 3.6.4.6 Ethernet on page 30
Memory not sufficient for update.	[15,1]; [15,2]; [15,6]; [15,8]; [15,9]; [15,10]; [15,11];
System check not OK!	[35, 1]… [35,14]
Update file is faulty.	[15,1]; [15,2]; [15,6]; [15,8]; [15,9]; [15,10]; [15,11];

2.3 Event logger entries

Explanation of event logger content:

Display	Explanation	Example
First row:	Specification of instrument name and serial number	DR 3900, S/N 1357414
Second row:	Software version	Instrument version: 1.00
Other rows:	Date and time of logger entry, and an index number that describes the entry in more detail.	2010-12-01 12:45:43,2, 2010-12-01 12:45:46,4,130,

Note: *Normally, the entries 2 and 22 are appears in order with every device start. This is for information, only. It doesn't stand for an error.*

Explanation of the index numbers in the event logger:
The error numbers "[X]" in the error messages during the start procedure correspond to the index numbers in the logger description.

Index number		Explanation
2,(x)	**Photometer was switched on**	
	1	Device started in test programm only
6, x.xxxx, x.xxxx, (x.xxxx, x.xxxx, x)	**Error: Check air reading (remove cuvette first), measured value at 560 nm, stored air value at 560 nm**	
	value 1: [Abs]	measured air value (absorbance) @ 560 nm
	value 2: [Abs]	stored air value (absorbance) @ 560 nm
	value 3: [V]	measured reference value (brightness-darkness) @ 560 nm
	value 4: [V]	measured sample value (brightness-darkness) @ 560 nm
	value 5:	Lid: 0=open 1=closed
7, x.xxxx, x.xxxx, (x.xxxx, x.xxxx, x)	**Error: Check whether new air reading is necessary, measured value at 560 nm, stored air value at 560 nm**	
	value 1: [Abs]	measured air value (absorbance) @ 560 nm
	value 2: [Abs]	stored air value (absorbance) @ 560 nm
	value 3: [V]	measured value (brightness-darkness) @ 560 nm @ reference sensor
	value 4: [V]	measured value (brightness-darkness) @ 560 nm @ sample sensor
	value 5:	Lid: 0=open 1=closed
11, x, (x.xxxx, x.xxxx)	**An error occurred while the absorbance was being measured**	
	1	**ADC16**
	2	**ADC24**
	value 1: [V]	sample value of 16-bit check measurement
	value 2: [V]	reference value 16-bit ADC
	3	**Exceeds Range Limit (24-bit ADC)**
	value 1: [V]	sample value of 16-bit check measurement
	value 2: [V]	reference value 16-bit ADC
	4	**Reference Detector Signal too low**
	value 1: [V]	sample value (24-bit ADC)
	value 2: [V]	reference value (16-bit ADC)
12, x.xxxx, x.xxxx, x.xxxx, x. xxxx, x, xxxx, xx	**Error: An error occurred while the filter wheel was rotating.**	
	value 1: [V]	sample value - brightness (start position)
	value 2: [V]	sample value - middle (middle position: approx. 50% light)
	value 3: [V]	sample value - darkness (between two filter positions)
	value 4: [V]	sample value - brightness 2 (back to start position)
	value 5:	filter number
	value 6: [nm]	Lambda
	value 7:	filter offset (offset after calibration home position)
15, x,xxx	**Error during software update**	
	1	Database update with a zipped tar archive failed
	2	Database update with individual files failed
	6	General update with a zipped tar archive failed
	8	general update failed with several files
	9	general update with tar-archive failed
	10	general update with zip-archive failed
	11	CRC-Error in data base file (*.lst)
	value1:	file name
16	**Error: The light shield was not detected/was not in place when a round cuvette was plugged in**	
18	**The test program was started**	
19	**„Backup Restore" was executed**	

Index number		Explanation
20, x	**Check Sunlight: too much ambient light, because…**	
	1	ReadSampleFast() >= Get_MaxSampleLevel())
	2	ReadReferenceFast() >= Get_MaxReferenceLevel()
	3	BarCodePegelReal() >= gdbMaxCuvetteLevel (round cuvette detection)
	6	Lid: 0=open 1=closed
22, x.xxx, x.xxx, x.xxx, x.xxx, xx.x, x.xxx, x.xxx, x.xxx	**start-up information**	
	value 1: [Abs]	measured air value @ 560 nm
	value 2: [Abs]	stored air value @ 560 nm
	value 3: [V]	measured reference value (air value) @ 560 nm
	value 4: [V]	measured sample value (air value) @ 560 nm
	value 5: [C]	temperature lamp housing
	value 6: [V]	lamp voltage @ 560nm
	value 7: [V]	round cuvette detection - detection level (difference bright-dark)
	value 8: [V]	defined limit for round cuvette detection
23	**serial number was changed**	
	value 1:	serial number was changed
24, x.xxxx, x.xxxx, xx.x	**Lamp error**	
	value 1: [V]	difference between bright (lamp on) and dark (lamp off) @ sensor zero order (DR3900) resp. @Lamp sensor (lamp board; DR6000)
	value 2: [V]	dark value (lamp off)
	value 3: [C]	temperature lamp housing
25,xx,xx	**Error 2D-Code/Logo identification**	
	value 1:	status read cycle - read 2D-Code
	9	read time > 5s Datamatrix (2D-Code) succesful read / Logo detected (DMTX OK; LOGO OK)
	10	Datamatrix (2D-Code) succesful read / Logo not detected (DMTX OK LOGO Error)
	11	Datamatrix (2D-Code) read failure / Logo detected (DMTX Fehler LOGO OK)
	12	Datamatrix (2D-Code) read failure / Logo not detected (DMTX Error LOGO Error)
	13	data input from 8bit camera bus are not available (timeout)
	value 2:[ms]	elapsed time [ms] for search marker / read 2D-Code / decode datamatrix
	value 3:	correction level for read/decoding of 2d-code (0…5 = ok; >5 = errror) (correction)
	value 4:	shutter value of camera system (Shutter parameters)
	value 5:	analog gain of camera system (aGain)
	value 6:	digital gain of camera system (dGain)
	value 7:	version fo decoder sw module (decoder version)
	value 8:	version of 2d-Code sw module (Barcode module)
	value 9:	found position of the very first marker position during marker scan (found old position)
26, x	**start SW-Update**	
	value 1:	Software version: "UI(Kernel|Driver|Language|Sound|Guide|PdfConverter)Hach-LangeDB|HachDB"
27, x	**completed SW-Update**	
	value 1:	Software version: "UI(Kernel|Driver|Language|Sound|Guide|PdfConverter)Hach-LangeDB|HachDB"

Index number		Explanation
31, x, (x.xxxx)	**Error during core initialization (e.g. power supply, AD-converter 10-bit/16-bit/24-bit, etc.)**	
	1	**Error during initialization of generic IO-Ports (Linux-driver)**
	2	**Error during cycle of HW-Version of the mainboard**
	3	**Error during initialization of generic IO-Ports (hardware ports)**
	4	**Error during initialization of I2C bus (Linux driver)**
	5	**Error I2C-Busy-Flag (special hardware port) is shorted to ground/VCC**
	6	**Error during initialization of I2C port expander**
	7	**Error during initialization of 10bit AD converter (SH4-Controller)**
	8	**Error during read cycle of 10bit AD converter (SH4-Controller)**
	9	**Error power supply VCC (5,3V)**
	value 1: [V]	VCC (min=5.0V | max=5.5V)
	10	**Error during turn on 12MHz oscillator**
	11	**Error during turn on 24MHz oscillator**
	12	**Error during turn on sound chip**
	13	**Error power supply VM (18,0V)**
	value 1: [V]	VM (min=17V | max=19V)
	14	**Error power supply AVCC (5,0V)**
	value 1: [V]	AVCC (min=4.8V | max=5.2V)
	15	**Error during initialization of 16bit AD converter via I2C bus (ADS1100)**
	16	**Error during presetting lamp potentiometers via I2C-Bus to default parameters**
	17	**Error power supply lamp (4,5V…7,0V; target value = 5,0V)**
	value 1: [V]	lamp voltage (approx. 5V)
	18	**Error during initialization of 24-bit AD converter (LTC2440) via SPI bus and initialization of potentiometers via I2C bus**
	19	**Error during initialization of grating motor card (motor card doesn't response) via I2C bus**
	20	**Error during initialization of filter motor (filter motor controller doesn't response) via I2C bus**
	21	**Error during initialization of RFID module (RFID module doesn't response) via serial bus**
32, x, (x.xxxx, x.xxxx)	**Error during initialization of peripheral electronical devices (e.g. motor control, etc.)**	
	1	**Error during setting grating motor parameter (transmitted values don't correspond with read values)**
	2	**Error during setting filter motor parameter (transmitted values don't correspond with read values)**
	3	**Error during setting mirror motor parameter (transmitted values don't correspond with read values)**
	4	**Error during setting barcode motor parameter (transmitted values don't correspond with read values)**
	5	**Error during setting sample changer motor parameter (transmitted values don't correspond with read values)**
	6	**Error during read cycle of EEPROM on grating motor card**
	7	**Bad CRC checksum of grating motor correction table in the EEPROM (page 0-4)on the motor card**
	8	**Bad CRC- cecksum of the photometer calibration data in the EEPROM (page 5) on the motor card**
	9	**Error during initialization of the camera (Linux driver)**
	10	**RTC battery too low (buffer battery on mainboard)**
	value 1: [V]	battery voltage [max = 1,6V (values > 1,6V will not be written to logger file)]
	value 2: [V]	defined limit

Index number		Explanation
33	**Error during self check / calibriation**	
33, 1, x.xxxx, x.xxxx, x.xxxx,	**Calibration: lamp is off, nevertheless level @ zero order sensor is too high**	
	value 1: [V]	lamp voltage
	value 2: [V]	Dark value @ zero order sensor
	value 3: [V]	defined limit (max. allowed dark value)
33, 2, x.xxxx, x.xxxx, x.xxxx, x.xxxx	**Calibration: lamp is on, nevertheless level @ zero order sensor is too low**	
	value 1: [V]	lamp voltage
	value 2: [V]	Difference bright-dark @ zero order sensor
	value 3: [V]	Dark value @ zero order sensor
	value 4: [V]	defined limit (min. allowed dark value)
33, 3	**Calibration (Grating): grating performs 2nd search to find zero order beam @ zero order sensor**	
33, 4, xxxx, x.xxxx	**Calibration (Grating): grating error (zero order not found) @zero order sensor**	
	value 1:	
	0x01	Too much signal @ zero order sensor
	0x02	Too little signal @ zero order sensor
	0x03	No Peak found @ zero order sensor
	value 2: [V]	measured level @ zero order sensor
33, 5, xxx	**Calibration (Grating): Error during wave lenght positioning (Lambda); Preparation for filter calibration (status of step motor controller failure / step counter failure**	
	value 1: [nm]	Lambda
33, 6, xxxx, x.xxxx, x.xxxx, x.xxxx	**calibration (filter to start position): error during seeking filter no. 3**	
	value 1:	error code
	0x01	too much signal @ reference sensor
	0x02	no signal @ reference sensor
	value 2: [V]	max allowed dark value
	value 3: [V]	min measured level @ reference sensor
	value 4: [V]	max measured level @ reference sensor
33, 7, xxx, x.xxxx, x.xxxx	**Calibration (SeekingFilterMax): no useful maximum found in Scan range**	
	value 1:	filter offset (offset after calibration home position)
	value 2: [V]	min measured level @ reference sensor
	value 3: [V]	max measured level @ reference sensor
33, 8, xxxxxx xxx	**Calibration (filter to position 2): error while rotating filter wheel**	
	0x00001000	step motor controller status failure - FilterDriverError (MSFilterPosition)
	0x00002000	step counter failure - FilterPosError (MSFilterPosition)
33, 9, xxxxxx xxx, xxx	**Calibration (grating): error while positioning in front of 0nm ???**	
	value 1:	error code
	0x00000800	failure: step motor controller status / step counter - GratingDriverError
	value 2: [nm]	Lambda
33, 10, x.xxxx, x.xxxx	**Calibration (grating): grating performs 2nd search to find zero order @ reference sensor**	
	value 1: [V]	min measured level @ reference sensor
	value 2: [V]	max measured level @ reference sensor
33, 11, xxxx, x.xxxx, x.xxxx	**Calibration (grating): no maximum found @Reference sensor**	
	value 1:	error code
	0x02	no signal found
	0x03	no useful maximum found in scan range (no peak)
	value 2: [V]	min measured level @ reference sensor
	value 3: [V]	max measured level @ reference sensor

Index number		Explanation
33, 12, xxxxxx xxx, xxx	**Calibration (grating to position): error while setting up wave lenght ('LambdaEinstellen')**	
	value 1:	error code
	0x00000400	no useful wavelength
	0x00000800	failure: step motor controller status / step counter
	0x00001000	step motor controller status failure
	0x00002000	step counter failure
	value 2 [nm]	Lambda
33, 13, x.xxxx, x.xxxx, x.xxxx, xx.x, x.xxxx, xx.x, x	**Error round cuvette detectionadjust while start up**	
	value 1: [V]	detection level @ round cuvette sensor (Difference bright-dark)
	value 2: [V]	dark value @ round cuvette sensor
	value 3: [V]	defined limit (calculated from current temperature)
	value 4: [°C]	current temperature
	value 5: [V]	defined limit at adjust time
	value 6: [°C]	temperature at adjust time
	value 7:	Lid: 0=open 1=closed
33, 14	**Error round cuvette detection while start up**	
33, 15, xxxx	**Error rectangular cuvette detection while start up (Cell Compartement)**	
	value 1:	status rectangular cuvette detection
	0x10	10mm cuvette
	0x30	30mm cuvette adaptor B
	0x60	1'' rectangular cuvette
	0x90	50mm cuvette
	0xb0	10mm cuvette adaptor A
	0xe0	1'' round cuvette adaptor A
34	**Full System Check started (user has entered full system check)**	
35	**Error during Full System Check (Air measurement)**	
35, 1, x, x.xxxx , xxx	**Faulty dark measurement at AD converter(24-bit)**	
	value 1:	status
	1	bus error (SPI bus)
	2	communication error between CPU and ADC24 (Frame error)
	3	Overrange error
	4	Underrange error
	value 2: [V]	measured value of 16-bit check measurement
	value 3: [nm]	Lambda
35, 2, x , xxx	**Faulty dark measurement at AD converter(16-bit)**	
	value 1:	status
	2	communication error between CPU and ADC16 (no end of conversion)
	5	bus error (I2C bus)
	value 2: [nm]	Lambda
35, 3, x, x.xxxx , xxx	**Faulty bright measurement at AD converter(24-bit)**	
	value 1:	status
	1	bus error (SPI bus)
	2	communication error between CPU and ADC24 (Frame error)
	3	Overrange error
	4	Underrange error
	value 2: [V]	measured value of 16-bit check measurement
	value 3:	Lambda

Index number		Explanation
35, 4, x , xxx	**Faulty bright measurement at AD converter(16-bit)**	
	value 1:	status
	2	communication error between CPU and ADC16 (no end of conversion)
	5	bus error (I2C bus)
	value 2: [nm]	Lambda
35, 5, x.xxxx, x.xxxx, xxx	**Too less light during bright measurement @ sample sensor**	
	value 1: [V]	value (bright) @ sample sensor
	value 2: [V]	defined limit
	value 3: [nm]	Lambda
35, 6, x.xxxx, x.xxxx, xxx	**Too less light during bright measurement @ reference sensor**	
	value 1: [V]	value (bright) @ reference sensor
	value 2: [V]	defined limit
	value 3: [nm]	Lambda
35, 7, x.xxxx, x.xxxx, x.xxxx, xxx	**Too small difference bright/dark value @ reference sensor**	
	value 1: [V]	difference (bright-dark) @ reference sensor
	value 2: [V]	reference (value - dark) @ reference sensor
	value 3: [V]	defined limit
	value 4: [nm]	Lambda
35, 8, x.xxxx, x.xxxx, x.xxxx, xxx	**Too small difference bright/dark value @ sample sensor**	
	value 1: [V]	difference (bright-dark) @ sample sensor
	value 2: [V]	sample (value - dark) @ sample sensor
	value 3: [V]	defined limit
	value 4: [nm]	Lambda
35, 9, x.xxxx, x.xxxx, x.xxxx, xxx	**Calculated quotient (reference value ÷ sample value) is too small**	
	value 1: [V]	quotient
	value 2: [V]	reference value
	value 3: [V]	sample value
	value 4: [V]	defined limit
	value 5: [nm]	Lambda
35, 10, x.xxxx, x.xxxx, xxx	**calculated Absorbance value is too large**	
	value 1: [V]	calculated absorbance value
	value 2: [V]	defined limit
	value 3: [nm]	Lambda
35, 11, x.xxxx, x.xxxx, xxx	**Too much light during dark measurement @ sample sensor**	
	value 1: [V]	value (dark) @ sample sensor
	value 2: [V]	defined limit
	value 3: [nm]	Lambda
35, 12, x.xxxx, x.xxxx, xxx	**Too much light during dark measurement @ reference sensor**	
	value 1: [V]	value (dark) @ reference sensor
	value 2: [V]	defined limit
	value 3: [nm]	Lambda
35, 13	**Lid open**	

Index number		Explanation
35, 14, x, x.xxxx, x.xxxx, x.xxxx, xx.x, x.xxxx, xx.x, x	**Adjust round cuvette detection faulty**	
	value 1:	status: 0=no adjust executed 1=adjust executed
	value 2: [V]	detection level @ round cuvette sensor (difference bright-dark)
	value 3: [V]	dark value @ round cuvette sensor
	value 4: [V]	defined limit (calculated from current temperature)
	value 5: [°C]	current temperature
	value 6: [V]	defined limit at adjust time
	value 7: [°C]	temperature at adjust time
	value 8:	Lid: 0=open 1=closed
37,xxx, xx,xx	**Easy Update**	
	value 1:	test number
	value 2:	old (underlying) version
	value 3:	new version
38,xx,x xx,xxx	**RFID data error**	
	1	**worng article code/Tag-ID**
	2	**wrong lot number**
	3	**wrong expiration date**
	4	**EasyUpdateTest not completed**
	5	**wrong lenght of data (<=0 or >1024 Bytes)**
	6	**checksum error**
	7	**Coa-File - open/read-error**
	8	**Coa-File - write-error**
	9	**memory error**
	10	**error during unzip**
	value 1	article code
	value 2:	lot number
39	**Error during air measurement (TP / HWC / FI)**	
39, 1, x, x.xxxx , xxx	**Faulty dark measurement at AD converter(24-bit)**	
	value 1:	status
	1	bus error (SPI bus)
	2	communication error between CPU and ADC24 (Frame error)
	3	Overrange error
	4	Underrange error
	value 2: [V]	measured value of 16-bit check measurement
	value 3: [nm]	Lambda
39, 2, x , xxx	**Faulty dark measurement at AD converter(16-bit)**	
	value 1:	status
	2	communication error between CPU and ADC16 (no end of conversion)
	5	bus error (I2C bus)
	value 2: [nm]	Lambda
39, 3, x, x.xxxx , xxx	**Faulty bright measurement at AD converter(24-bit)**	
	value 1:	status
	1	bus error (SPI bus)
	2	communication error between CPU and ADC24 (Frame error)
	3	Overrange error
	4	Underrange error
	value 2: [V]	measured value of 16-bit check measurement
	value 3: [nm]	Lambda

Index number		Explanation
39, 4, x , xxx	**Faulty bright measurement at AD converter(16-bit)**	
	value 1:	status
	2	communication error between CPU and ADC16 (no end of conversion)
	5	bus error (I2C bus)
	value 2:	Lambda
39, 5, x.xxxx, x.xxxx, xxx	**Too less light during bright measurement @ sample sensor**	
	value 1: [V]	value (bright) @ sample sensor
	value 2: [V]	defined limit
	value 3: [nm]	Lambda
39, 6, x.xxxx, x.xxxx, xxx	**Too less light during bright measurement @ reference sensor**	
	value 1: [V]	value (bright) @ reference sensor
	value 2: [V]	defined limit
	value 3: [nm]	Lambda
39, 10, x.xxxx, x.xxxx, xxx	**calculated Absorbance value is too large**	
	value 1: [V]	calculated absorbance value
	value 2: [V]	defined limit
	value 3: [nm]	Lambda
39, 11, x.xxxx, x.xxxx, xxx	**Too much light during dark measurement @ sample sensor**	
	value 1: [V]	value (dark) @ sample sensor
	value 2: [V]	defined limit
	value 3: [nm]	Lambda
39, 12, x.xxxx, x.xxxx, xxx	**Too much light during dark measurement @ reference sensor**	
	value 1: [V]	value (dark) @ reference sensor
	value 2: [V]	defined limit
	value 3: [nm]	Lambda
39, 15, x.xxxx, x.xxxx, xxx	**Too large difference between measured absorance value and stored absorbance value (absolut value)**	
	value 1: [V]	difference value
	value 2: [V]	defined limit
	value 3: [nm]	Lambda
39, 16, x.xxxx, x.xxxx, xxx	**Too large single measurement absorbance value (absolut value)**	
	value 1: [V]	absorbance value
	value 2: [V]	defined limit
	value 3: [nm]	Lambda
40, <Version>, xx,x,x, xx.x,x, xx.x	**operating hour information** (will be stored when copying logger file)	
	value 1:	version information "1.00(4|1|1|1|1|1)10|3" Software version: "UI(Kernel|Driver|Language|Sound|Guide|PdfConverter)Hach-LangeDB|HachDB"
	value 2[hh,mm]:	operation hours instrument
	value 3:	operation counter halogen lamp
	value 4 [hh,mm]:	operation hours halogen lamp

3 Software

3.1 Language selection

The software of the DR 3900 supports several languages. When the instrument is switched on for the first time, a list for language selection opens up automatically after the boot procedure.
The Testprogram then starts automatically.

3.1.1 To change the language settings

1. Switch the instrument on
2. During the boot procedure, touch the screen at any position until the list for language selection is shown (approximately 45 seconds).
3. Select the required language.
4. Confirm this selection with OK.

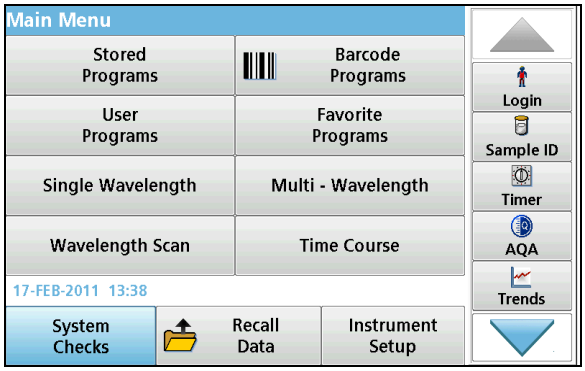
3.2 Password

Access to programs on the DR 3900 can be protected by a password (refer to DR 3900 instruction manual, section on safety settings).

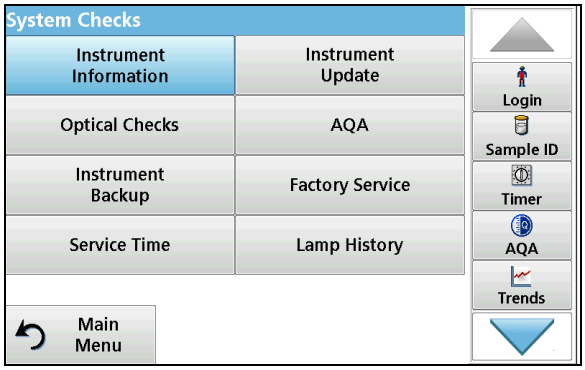
In an emergency (password forgotten or similar) it is possible to bypass the block with a universal password:

Universal password: *GAMMA*

3.3 Instrument information

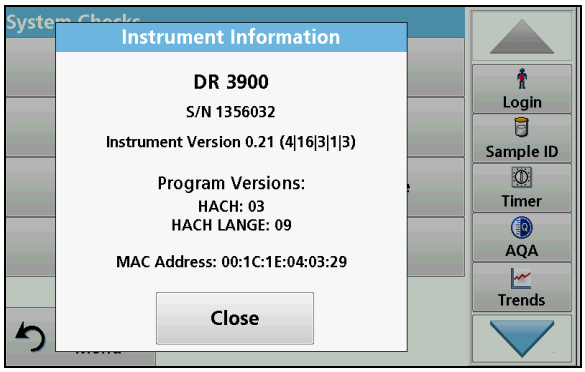


In the "Main menu" of the user program, confirm with "System check"



Then confirm with "Instrument information".

Press "Main menu" to go back to the main menu of the user program.



The instrument information is displayed.

Press "OK" to go back to the "System check" menu.

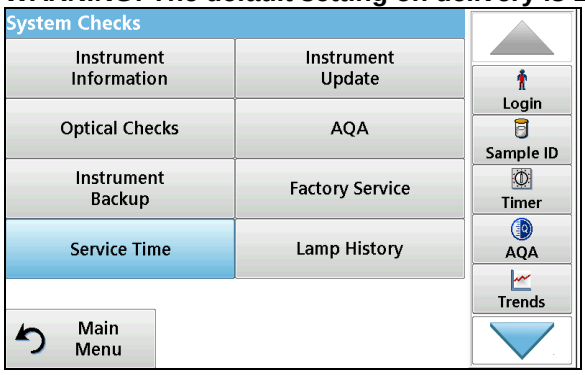
Explanation of the details in the "Instrument information" window:

Menu option	Explanation
DR 3900	Instrument name
S/N xxxxxxx	Instrument number
Instrument version x.xx (x|x|x|x|x)	Specification of the installed software version (kernel version|driver version|language version|sound version|help guide version)
Program version: HACH: xx HACH LANGE: xx	Name and version of the installed database
MAC address: xx:xx:xx:xx:xx:xx	The MAC address (Media Access Control Address) is the hardware address for the network adapter in the DR 3900.

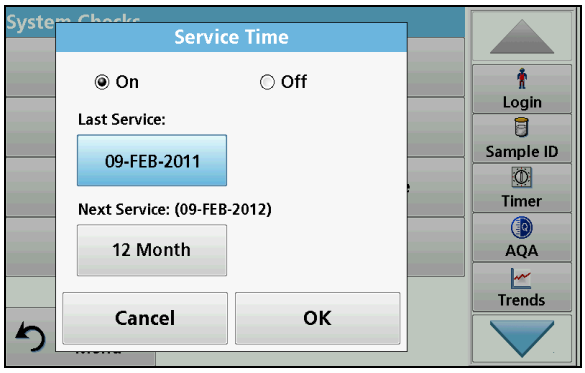
3.4 Service times

To make sure that regular inspections are carried out, an automatic reminder can be input for the service times. After the instrument is switched on, this reminder will be activated and displayed at the relevant time.

WARNING: The default setting on delivery is 12 months

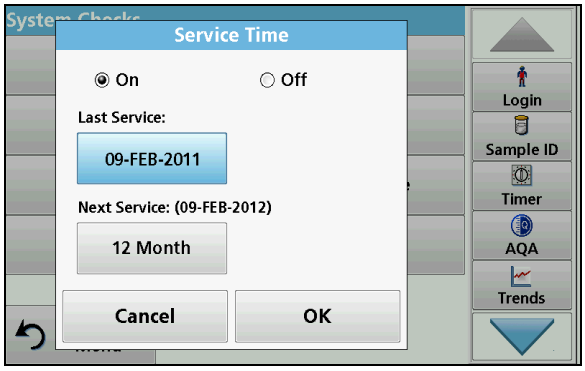


Select the service times in the "System check" menu.

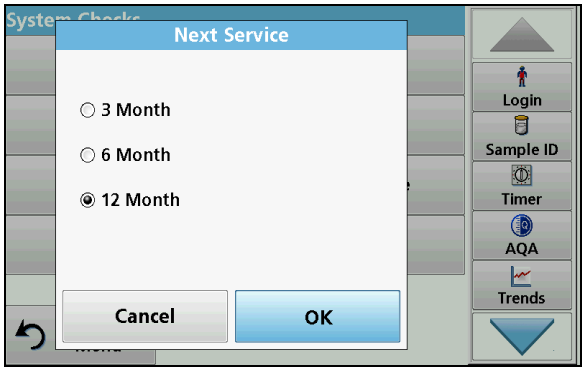


Select On and press Last inspection to enter the date of the last inspection.

Confirm with OK.



Select Next inspection



Select the time period before the next inspection

Confirm with OK.

Press OK to return to the "Main menu".

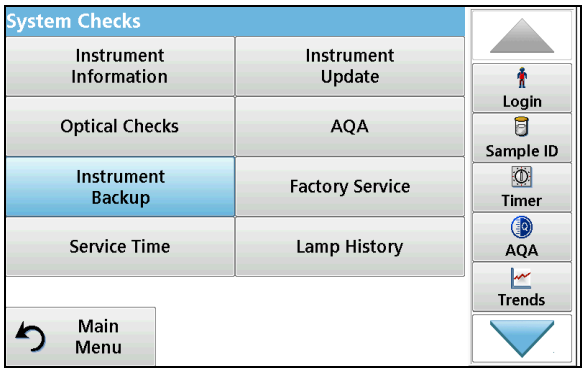
Note: *Once the next inspection is due, the following message is shown when the instrument is switched on:*

"Next inspection is due!"

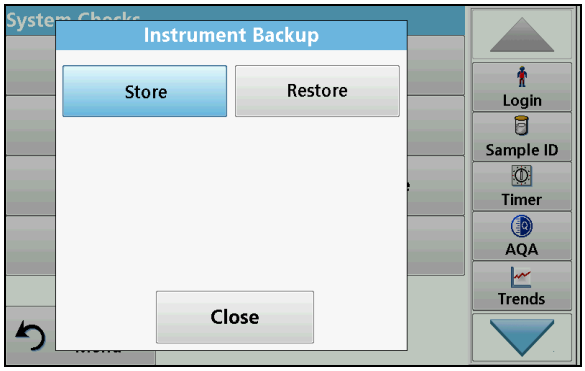
3.5 *Instrument backup*

The "Instrument backup" menu offers the option to save all the programs, measurement data, operator IDs, sample IDs, passwords and all adjustable data on a USB before the instrument is inspected.

3.5.1 Save



Select Instrument backup in the "System check" menu.



Connect a USB stick.

Press Store to start a backup.

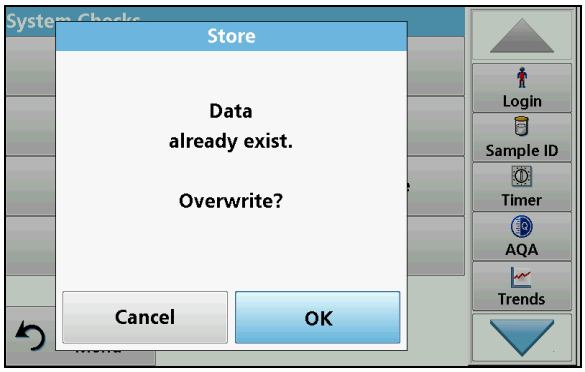
Note: *If the USB stick is not connected, the following message is shown:*

"Please insert USB memory."

Connect a USB stick.

Confirm with OK

Press Save again.

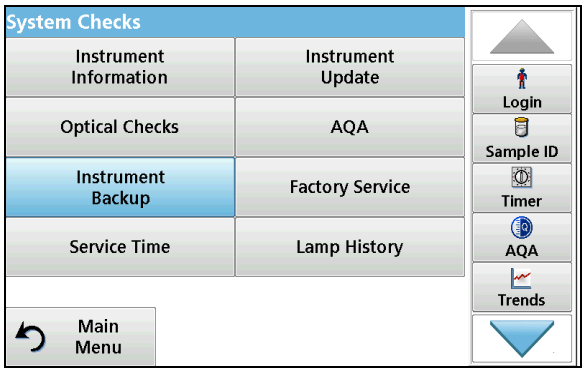


Note: *If the backup has already been saved, the following message is shown:*

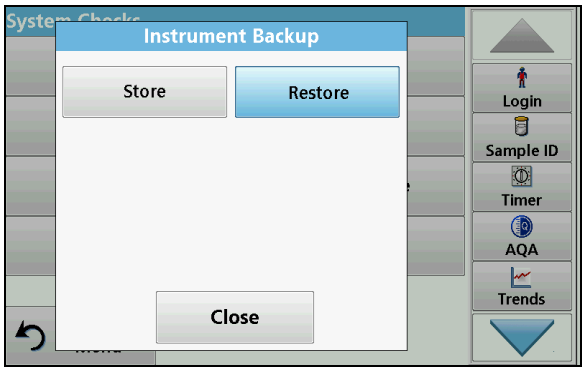
" Data already exist. Overwrite?“

Press OK to overwrite the data.

3.5.2 Restore

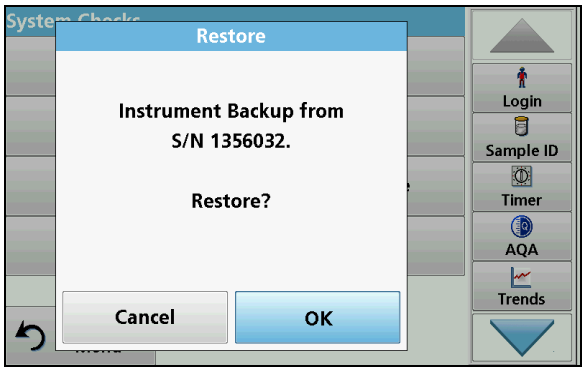


Select “Instrument Backup” in the "System checks" menu.



Connect a USB stick.

Press Restore to start a backup.



Confirm with OK, if the message

"Instrument backup for S/N XXXXXXX.

Restore?"

is shown.

Important note: *All the current data will be overwritten when the backup file is restored! It is recommended that an update is carried out after a successful restore (refer to Update page 58), so that the customer is provided with the most up-to-date programs and data.*

Restart the instrument after a successful backup.

3.6 Customer service menu

3.6.1 General

The instrument is operated using the touchscreen: The buttons available are shown (and labeled) in the display. It is possible to press the button within the display area. The button that has been pressed is then graphically highlighted.
Testprograms are operated using menus.
To call up the individual testprograms, it may be necessary to work through several menus. The whole menu path is always shown in the title line. The testprogram itself has a menu on the left side, and on the right side an output window (in which statuses or messages can be output).
At the bottom right is the Back button.

3.6.2 Start

Switch on.
There are 3 versions of the testprogram.

1. New PCBs (as spare part YAB119) are only described with the Testprogram
2. Instruments are described with the appropriate user program with integrated testprogram.
3. The current testprogram is always part of the VAA608. It is therefore recommended that the testprogram is always called up with the VAA608.

In the first version, the testprogram starts immediately after switch on.
In the second version, "System check" must first be pressed. Then "Customer service menu". Then code "1078" must be entered. This takes the user to the testprogram. ("Exit" goes back to the user program).
In the third version, the VAA608 it is plugged into the DR 3900 while it is switched off. The photometer is switched on after that. The photometer does not start with the user program, but instead with the testprogram.
The main menu is displayed following start up.
In the first version, a window "Init Photometer" is overlaid.
At this point, contact is made via the I2C bus to the individual motor controllers. If it is not possible to contact one of the controllers, an error message is shown. Only the driver parameters are set in the controllers, the definition of the motor position is not yet made.

3.6.3 Main menu

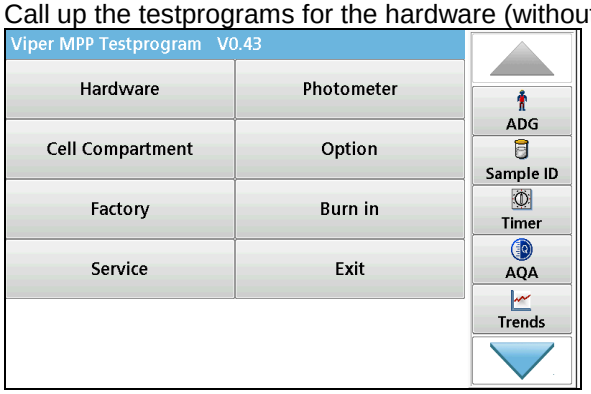
WARNING: Some functions in the testprogram are only intended for development or production. Observe the notes in the relevant passages!

The points of the testprogram main menu are listed in the following table with a brief explanation of their function. A more precise description is given in the following sections.

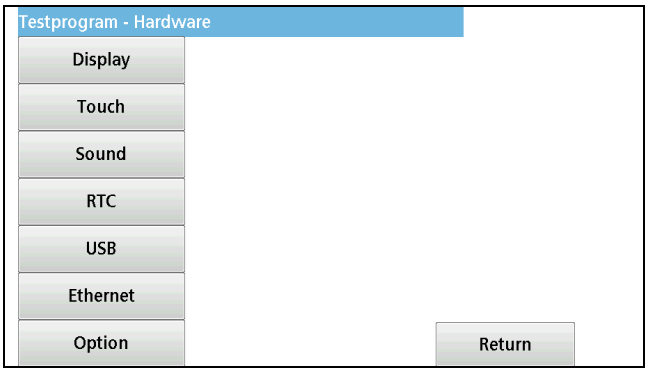
Menu option	Explanation
Hardware	Call up the testprograms for the hardware (without beam path) of the DR3900. (Refer to below)
Photometer	Call up the testprograms for the beam path. (Refer to on page 32)
Cell Compartment	Call up the testprograms for cuvette detection, camera and RFID. (Refer to on page 43)
Option	Various special testprograms/setup options. (Refer to on page 50)
Factory	CAUTION, for development and production only!
Burn in	CAUTION, for development and production only!
Service	Service tests to check all the hardware and the beam path of the DR3900. (Refer to on page 56)
Exit	Back to user program (only if the testprogram was started via the user program.)

3.6.4 Hardware

Call up the testprograms for the hardware (without beam path) of the DR3900.



In the Testprogram main menu, confirm with "Hardware".



The "Testprogram — Hardware" menu is shown in the display.

Press "Return" to go back to the previous menu.

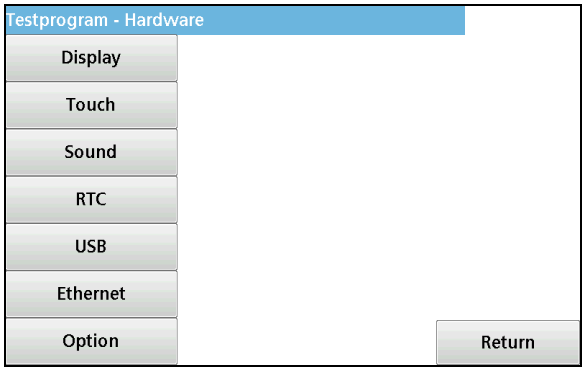
Explanation of menu options:

Menu option	Explanation
Display	Setup options and tests for the display. (Refer to on page 26)
Touch	Test and adjustment of the touchscreen. (Refer to on page 28)

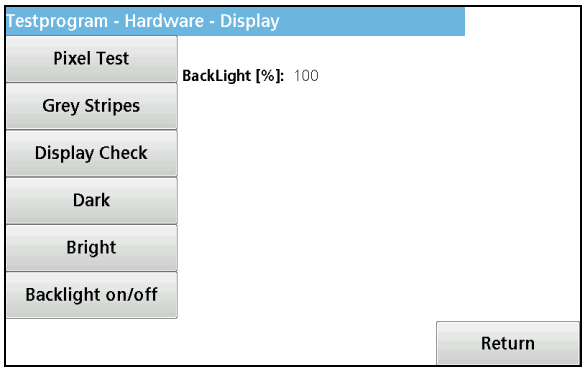
Sound	Test of the signal tones
RTC	Setup of date and time. (Refer to on page 29)
USB	Test of USB connections. (Refer to on page 30)
Ethernet	Test of the Ethernet connection. (Refer to on page 30)
Option →Power	Test of the power supplies. (Refer to on page 31)
Return	Back to the previous menu

3.6.4.1 Display

Testprograms and settings for the display are called up in the "Display" menu.



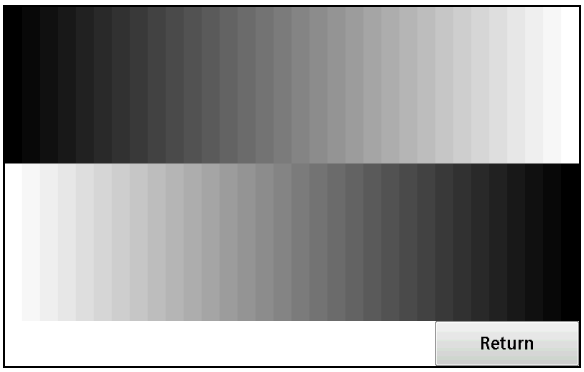
In the "Testprogram — Hardware" menu, press "Display" to confirm.

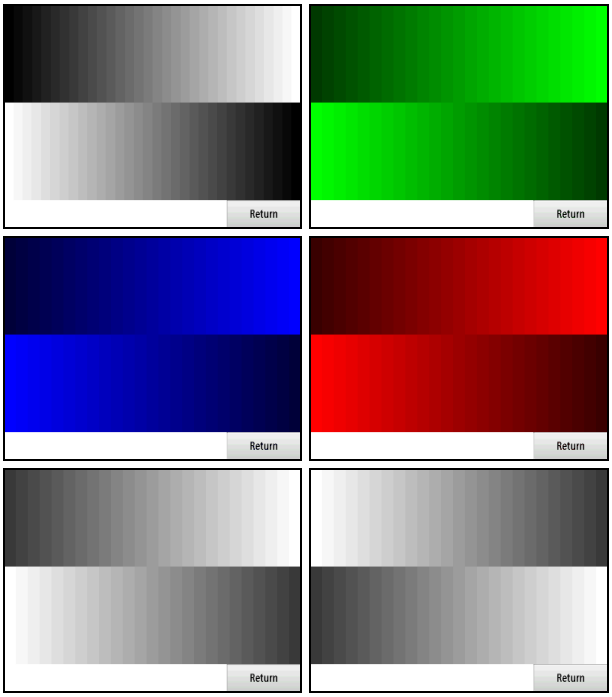


The "Testprogram — Hardware — Display" menu is shown in the display.

Press "Return" to go back to the previous menu.

Explanation of menu options:

Menu option	Explanation
Pixel test	The display first slowly goes black, and then fades to white again. In this way it is possible to check visually whether all the pixels are OK in the LCD. After the end of the test, press "Return" to go back to the "Testprogram — Hardware — Display" menu.
Gray stripes	The following screen is shown: 

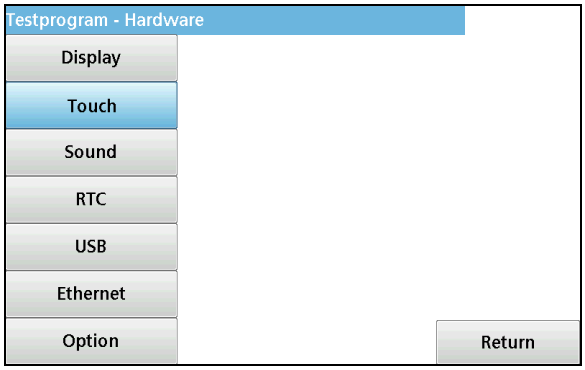
Display check	The following screens are shown in sequence: 
Dark	The LCD becomes darker. →Backlight [%]: reduces by 5% (Minimum: 0%)
Bright	The LCD becomes brighter. →Backlight [%]: increases by 5% (Maximum: 100%)
Backlight on/off	Switch LCD backlight to 0% or x% (x = previous value) **WARNING! Make a note of the button position, as the display is completely dark when it is set to 0%!**
Return	Back to the previous menu

Explanation of the specifications in the display window:

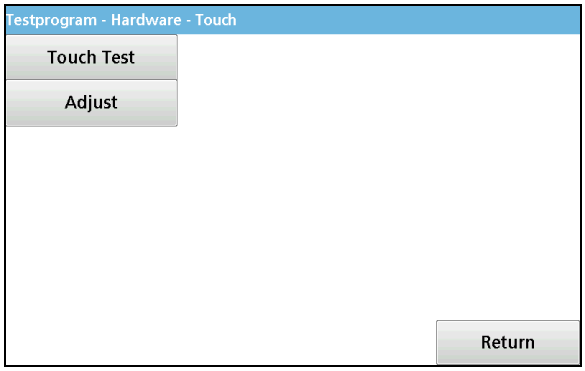
Display	Explanation
Backlight: [%]:	Shows the current level of LCD background lighting in %.

3.6.4.2 Touch

Testprograms and touchscreen settings are called up in the "Touch" menu.



In the "Testprogram — Hardware" menu, press "Touch" to confirm.



The "Testprogram — Hardware — Touch" menu is shown in the display.

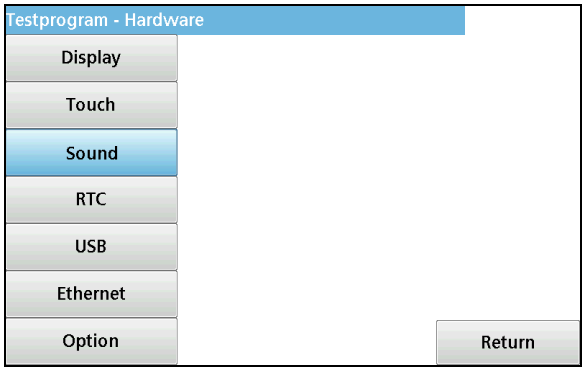
Press "Return" to go back to the previous menu.

Explanation of menu options:

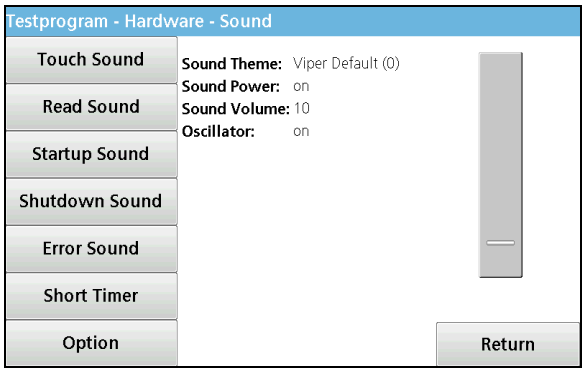
Menu option	Explanation
Touch test	A cross is shown under the position to be touched. In the top left corner the applicable AD converter values are displayed (0–1024).
Adjust	Five crosses are shown in sequence, which should be touched as precisely as possible. This means that each touchscreen is measured individually. Then two more crosses must be touched. These are used to check the adjustment.

3.6.4.3 Sound

Testprograms and settings for the signal tones are called up in the "Sound" menu.



In the "Testprogram — Hardware" menu, press "Sound" to confirm.



The "Testprogram — Hardware — Sound" menu is shown in the display.

Press "Return" to go back to the previous menu.

Explanation of the specifications in the display window:

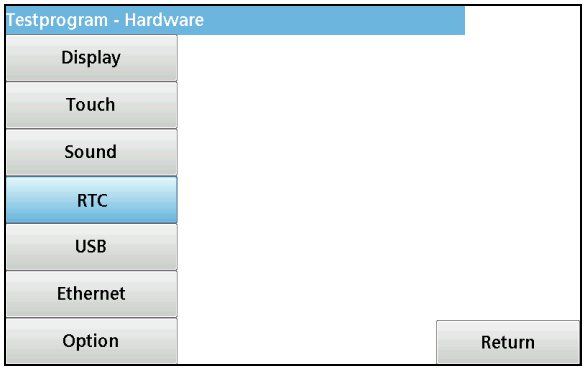
Display	Explanation
Sound theme:	Shows the active sound theme: (always Viper Default (0))
Sound power:	Displays the status "on" or "off". Default is "on"
Sound volume	Displays the volume set from 0…100 (can be changed by moving the bar to the right of the screen)
Oscillator:	Displays the status "on" or "off". Default is "on"

Explanation of menu options:

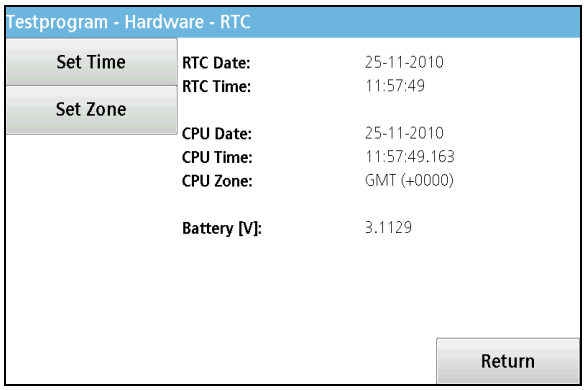
Menu option	Explanation
Touch sound	Touch sound is carried out
Read sound	Read sound is carried out
Startup sound	Startup sound is carried out
Shutdown sound	Shutdown sound is carried out
Error sound	Error sound is carried out
Short timer	Short timer sound is carried out
Option →Select theme	CAUTION, for development and production only!
Option →Power	CAUTION, for development and production only!
Option →Oscillator	CAUTION, for development and production only!
Option →Left/right test sound	Sound test: carried out 2x on the left 3x on the right

3.6.4.4 RTC (Real Time Clock)

The date and time are displayed and set in the "RTC" menu.



In the "Testprogram — Hardware" menu, press "RTC".



The "Testprogram — Hardware — RTC" menu is displayed.

Press "Return" to go back to the previous menu.

Explanation of menu options:

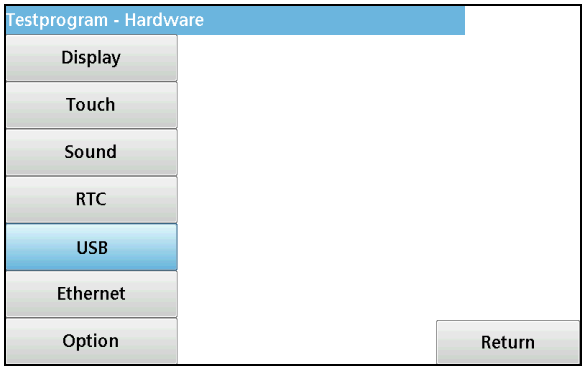
Menu option	Explanation
Set Time	Opens the input screen for the date and time.
Set Zone	CAUTION, for development and production only!

Explanation of the specifications in the display window:

Display	Explanation
RTC Date:	Date read from the clock component
RTC Time:	Time read from the clock component
CPU Date:	Date read from the processor
CPU Time:	Time read from the processor
CPU Zone:	CAUTION, for development and production only!
Battery:	Displays the approximate voltage value for the internal lithium battery. This battery is responsible for the function of the time and date when the instrument is switched off. ***Note:*** *the voltage displayed is a little lower than the actual battery voltage, but should not be < 1.95 V.*

3.6.4.5 USB

The USB connections are tested in the "USB" menu.

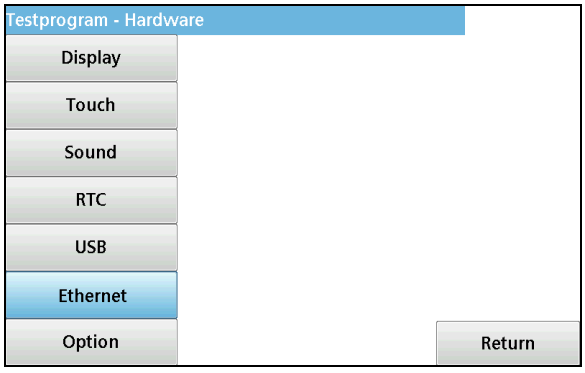


Note: a USB memory stick (VAA608) and a USB cable type St(A) — St(B) (XLH926) are required for the USB test.

In the "Testprogram — Hardware" menu, press "USB" to test the USB connections.

The program will prompt you to insert the USB memory stick (VAA608) and then the USB cable (XLH926).

3.6.4.6 Ethernet

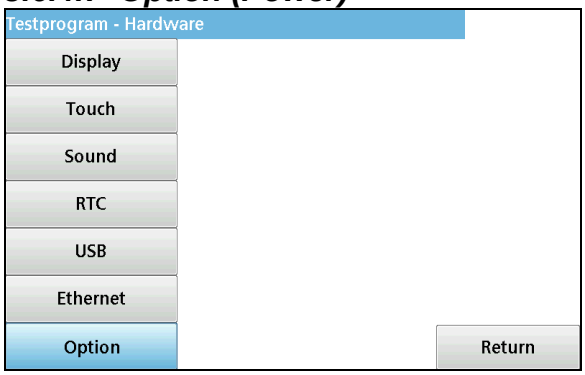


Note: an Ethernet cable (LZX998) and a PC/Notebook with an Ethernet interface are required for the Ethernet test.

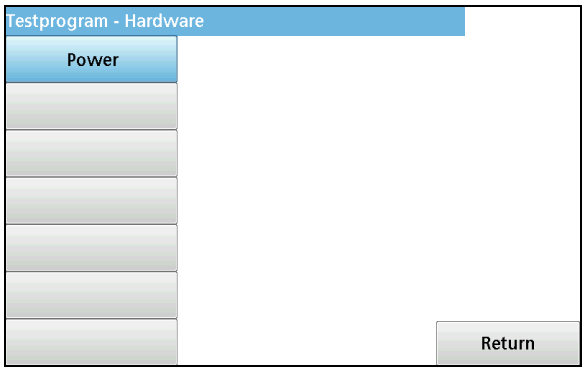
Press "Ethernet" to test the Ethernet connection.

The program will prompt you to connect the Ethernet cable between the PC/Notebook and the rear Ethernet socket on the instrument.

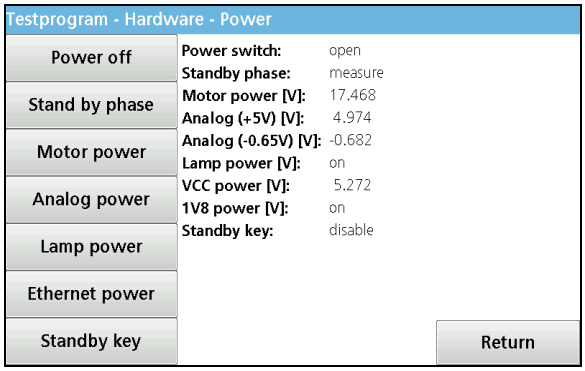
3.6.4.7 Option (Power)



In the "Testprogram — Hardware" menu, press "Option".



In the "Testprogram — Hardware — Option" menu, press "Power".



The "Testprogram — Hardware — Power" menu is displayed.

Press "Return" to go back to the previous menu.

Explanation of menu options:

Menu option	Explanation
Power off	Switches the instrument off.
Stand by phase	Switches the status from Standby phase
Motor power	Switches the power supply for the motor driver ICs on or off
Analog power	Switches the analog power supply on or off
Lamp power	Switches the power supply for the lamp on or off.
Ethernet power	Switches the power supply for the Ethernet port (1V8) on or off
Standby key	Switches the power switch function for the instrument on or off.

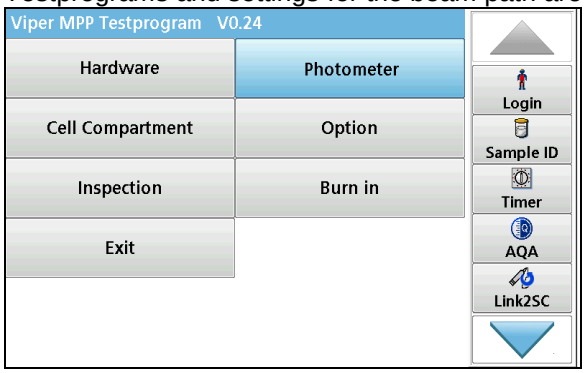
Explanation of the specifications in the display window:

Display	Explanation
Power switch:	CAUTION, for development and production only!
Standby phase.	measure:/active: (active application/green power LED) standby: (test mode/yellow standby LED)
Motor power [V]:	Motor driver ICs power supply (18 V)
Analog (+5 V) [V]:	Analog range positive power supply (5.0 V)
Analog (-0.65 V) [V]:	Analog range negative power supply (-0.65 V)
Lamp power [V]:	Status of the power supply to the lamp (on or off)

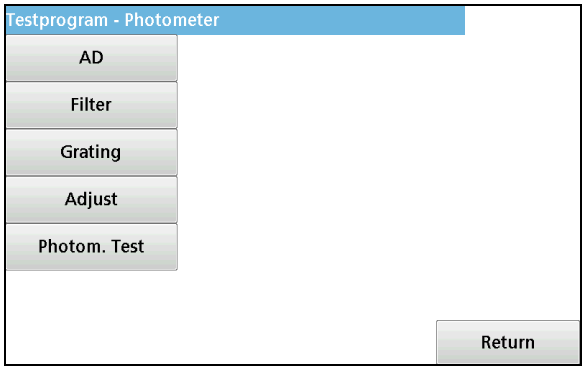
VCC power [V]:	General power supply to the peripherals (5.3 V)
1V8 power [V]:	Status of the power supply to the Ethernet port (on or off)
Standby key:	*CAUTION, for development and production only!*

3.6.5 Photometer

Testprograms and settings for the beam path are accessed in the "Photometer" menu.



In the Testprogram main menu, press "Photometer".



The "Testprogram — Photometer" menu is displayed.

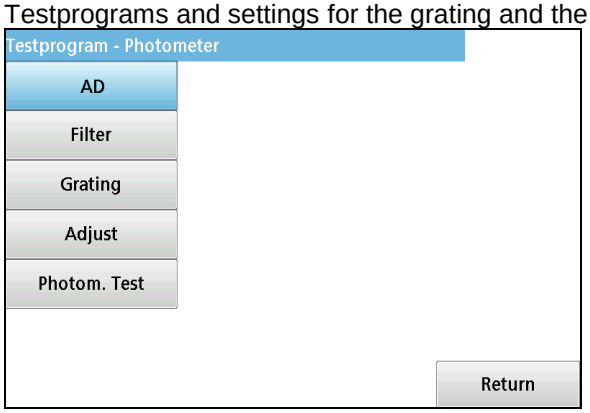
Press "Return" to go back to the previous menu.

Explanation of menu options:

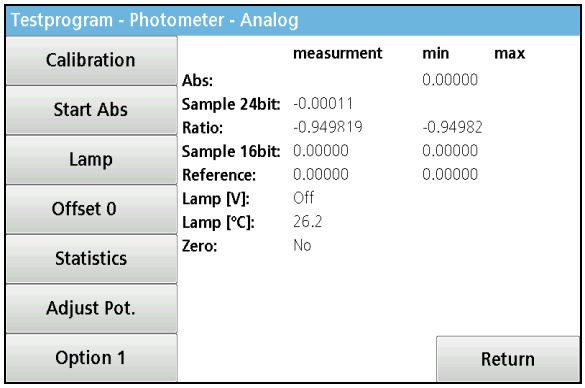
Menu option	Explanation
AD	Calls up testprograms and settings for the grating and the optical filter (refer to on page 33)
Filter	Calls up testprograms and settings for the optical filter (refer to on page 35)
Grating	Calls up testprograms and settings for the grating (refer to on page 38)
Adjust	Calls up setting options for the grating and the optical filter during alignment of the beam path (refer to on page 42)
Photometer Test	CAUTION, for development and production only

3.6.5.1 AD

Testprograms and settings for the grating and the optical filter are accessed in the "AD" menu.

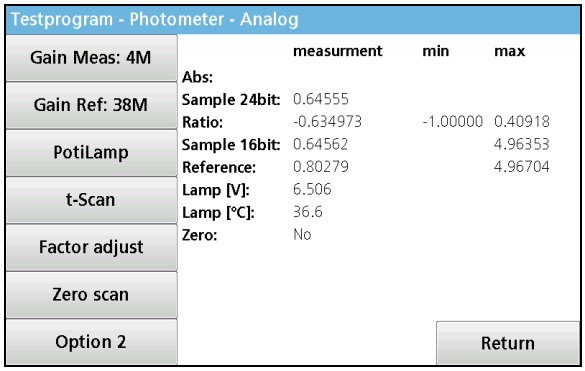


In the "Testprogram — Photometer" menu, press "AD".



The "Testprogram — Photometer — Analog" menu is displayed.

Press "Return" to go back to the previous menu.



Press "Option 1" for further menu options.

Press "Return" to go back to the previous menu.

Explanation of menu options:

Menu option	Explanation
Calibration 560 nm F:3	The photometer is calibrated (grating and filter). If calibration has already been carried out, a new screen opens to enter a wavelength. This is set after it is confirmed by pressing "OK" (grating and filter) and shown in the button. The button is then labeled, for example, "560 nm F:3" (560 nm — the set wavelength; F:3 — the filter position).
Start Abs	The DR3900 can also be measured when the sample chamber is open, so the dark value (lamp off) is subtracted from the actual measurement value (measured when the lamp is on). These measurements have a certain time connection. This button is used to initiate a measurement cycle (lamp on, measure, lamp off, measure). The result is displayed as an extinction value in the "Abs.:" output field.

Lamp	Press this button to switch the lamp on or off. This lamp is switched off in the DR3900 during normal operation. **CAUTION, when the lamp is operated for long periods, the chassis of the DR3900 becomes very hot!**
Offset 0 Offset x.xx	The current measurement value is taken as the offset. The label changes to "Offset x.xx". Press the button again to delete the offset again, and the label changes back to "Offset 0".
Statistics	The output screen displays the minimum / maximum values for these analog values in the same sequence as the analog values. Press this button to reset the minimum / maximum values
Adjust Pot.	The amplifications of the measurement and reference channel are set at a specific ratio to one another. ***Note:*** *This is automatically carried out during the HW Check (Service) and the Field Service Inspection.*
Option 1 →Gain Meas:	CAUTION, for development and production only!
Option 1 →Gain Ref:	CAUTION, for development and production only!
Option 1 →PotiLamp	CAUTION, for development and production only!
Option 1 →t-Scan	CAUTION, for development and production only!
Option 1 →Factor adjust	Point 33 of the Hardware Check (Service) is carried out here. (For the description, refer to 33 Adjust factor/offset (ratio between 16-bit and 24-bit converter) on page 96)
Option 1 →Zero scan	Points 35 and 36 of the Hardware check (Service) are carried out here. (For the description, refer to 35Measurement of air values (320 nm – 900 nm) and 36Air value check (criteria for error codes) on page 97)
Option 1 →Option 2	CAUTION, for development and production only!

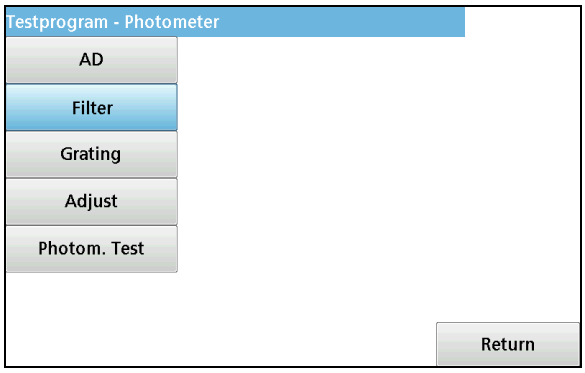
Explanation of the specifications in the display window:

Display	Explanation
Abs:	Displays the extinction measured.
Sample 24 bit:	Displays the measurement channel in volts (is calculated from the ratio).
Ratio:	The relationship between the measurement signal and 4.096 V (output from the 24-bit converter). If the measurement signal = ½ reference signal, relationship 1 is achieved. A larger measurement signal results in an error message. If the measurement signal = -½ reference signal, relationship -1 is achieved. A smaller measurement signal results in an error message. The signals are linked in the DR3900 hardware so that the measurement signal will only run between 0 and 1 times the reference signal (relationship -1 to +1). This relationship figure is the basis for the transmission.
Sample 16 bit:	Displays the measurement channel in volts (is measured directly with the 16-bit AD converter).
Reference:	Displays the values of the reference signal in volts. Measured with the 16-bit AD converter.

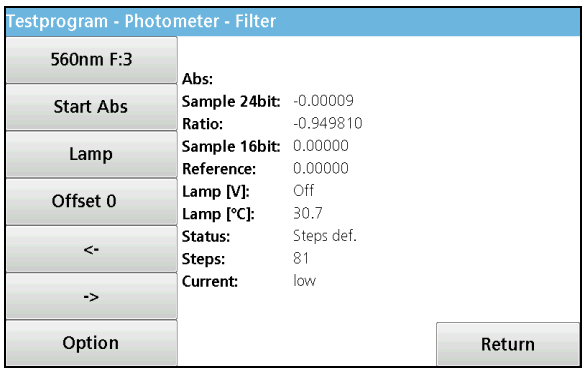
Lamp [V]:	Displays the voltage to the lamp in volts. The voltage is tailored to the wavelength that is set and is only displayed if the lamp is switched on. Wavelength range — Lamp voltage 320 nm … 339 nm — 6.5 V 340 nm … 374 nm — 6.5 V 375 nm … 479 nm — 6.0 V 480 nm … 699 nm — 5.0 V 700 nm … 794 nm — 4.7 V 795 nm … 1049 nm — 4.7 V 1050 nm … 1100 nm — 6.0 V
Lamp [°C]:	Temperature at the sensor (below the lamp housing).
Zero:	

3.6.5.2 Filter

The date and time are displayed and set in the "RTC" menu.

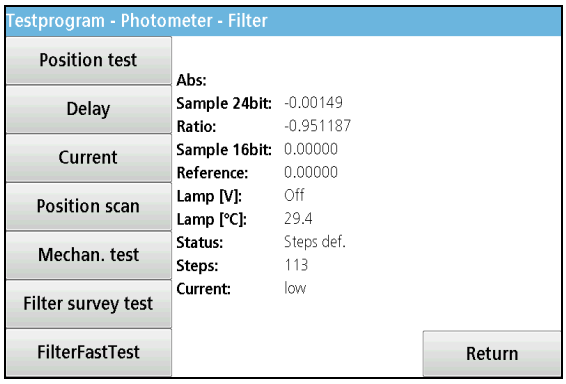


Press "Filter" in the "Self-check — Photometer" menu.



The "Self-check — Photometer — Filter" menu is displayed.

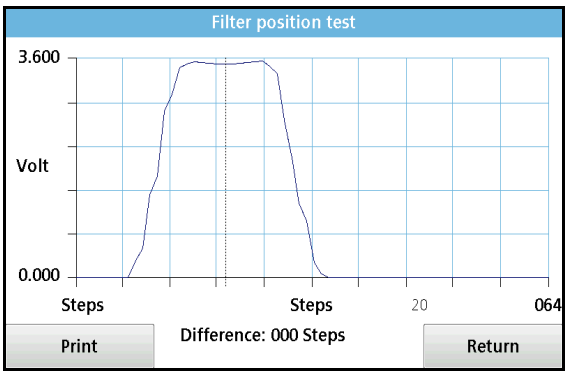
Press "Return" to go back to the previous menu.

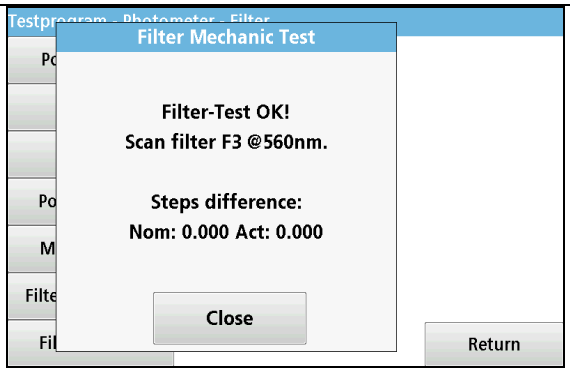


Press "Option" for further menu options.

Press "Return" to go back to the previous menu.

Explanation of menu options:

Menu option	Explanation
Calibration 560 nm F:3	The photometer is calibrated (grating and filter). If calibration has already been carried out, only the filter position is changed (F:0 to F:4 are possible). The button is then labeled, for example "560 nm F:3" (560 nm — the wavelength set; F:3 — the filter position).
Start Abs	The DR3900 can also be measured when the sample chamber is open, so the dark value (lamp off) is subtracted from the actual measurement value (measured when the lamp is on). These measurements have a certain time connection. This button is used to initiate a measurement cycle (lamp on, measure, lamp off, measure). The result is displayed as an extinction value in the "Abs.:" output field.
Lamp	Press this button to switch the lamp on or off. This lamp is switched off in the DR3900 during normal operation. CAUTION, when the lamp is operated for long periods, the chassis of the DR3900 becomes very hot!
Offset 0 Offset x.xx	The current measurement value is taken as the offset. The label changes to "Offset x.xx". Press the button again to delete the offset again, and the label changes back to "Offset 0".
<-	Moves the filter wheel by one step towards the smaller number of steps or the filter position (the button has a repeat function).
->	Moves the filter wheel by one step towards the larger number of steps or the filter position (the button has a repeat function). 32 steps is the equivalent of one filter position.
Option →Position test	The three filter positions are scanned and displayed as a graphic, and the middle of this curve is compared with the position from the calibration. The difference is displayed in steps below the graphic. 
Option →Delay	CAUTION, for development and production only!
Option →Current	The motor current can be switched off or on (low/high display under Current in the display screen). ***Note:*** *In position to save power, the motor current is switched off after it is moved to a position.* **CAUTION: If the power is left on for a long period, the motor becomes very hot!**
Option →Position scan	A scan of the filter positions (as for "Position test") can be carried out for each filter position (1…4).
Option →Mechan. Test	Quick test of all 4 filters (maximum, side, minimum approach and evaluation) 10 (1…500) complete revolutions. Tests whether filter 3 is at precisely +- 2 steps. The result is issued as a message.

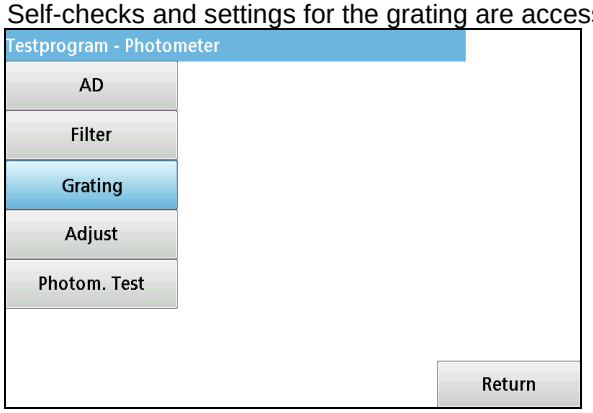
	
Option →Filter survey test	CAUTION, for development and production only!
Option →FilterFast Test	CAUTION, for development and production only!

Explanation of the specifications in the display window:

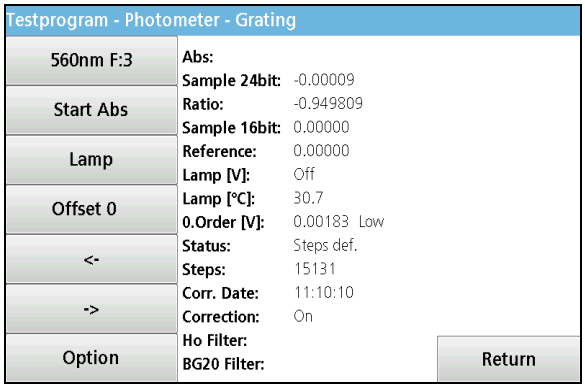
Display	Explanation
Abs:	Displays the extinction measured.
Sample 24 bit:	Displays the measurement channel in volts (is calculated from the ratio).
Ratio:	The relationship between the measurement signal and 4.096 V (output from the 24-bit converter). If the measurement signal = ½ reference signal, relationship 1 is achieved. A larger measurement signal results in an error message. If the measurement signal = -½ reference signal, relationship -1 is achieved. A smaller measurement signal results in an error message. The signals are linked in the DR3900 hardware so that the measurement signal will only run between 0 and 1 times the reference signal (relationship -1 to +1). This relationship figure is the basis for the transmission.
Sample 16 bit:	Displays the measurement channel in volts (is measured directly with the 16-bit AD converter).
Reference:	Displays the values of the reference signal in volts. Measured with the 16-bit converter.
Lamp [V]:	Displays the voltage to the lamp in volts
Lamp [°C]	Temperature at the sensor (below the lamp housing).
Status:	Status in the processor for the filter motor: - Reset (starting value for the motor driver) - Parameters set (motor is partly initialized) - Steps def. (motor is correctly initialized)
Steps:	Number of steps for the filter motor
Current:	Displays whether the motor current is switched to high or low.

3.6.5.3 Grating

Self-checks and settings for the grating are accessed in the "Grating" menu.

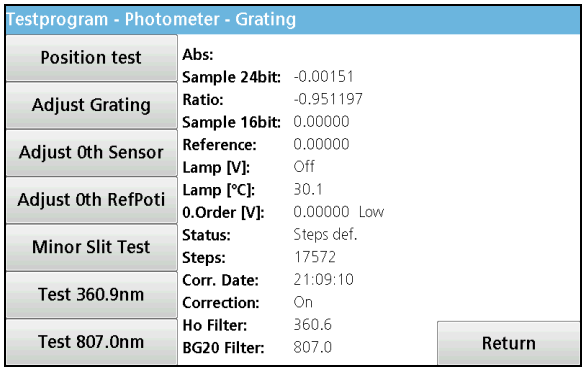


Press "Grating" in the "Self-check — Photometer" menu.



The "Self-check — Photometer — Grating" menu is displayed.

Press "Return" to go back to the previous menu.

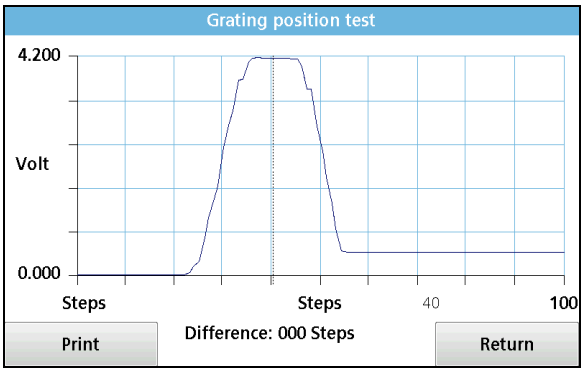


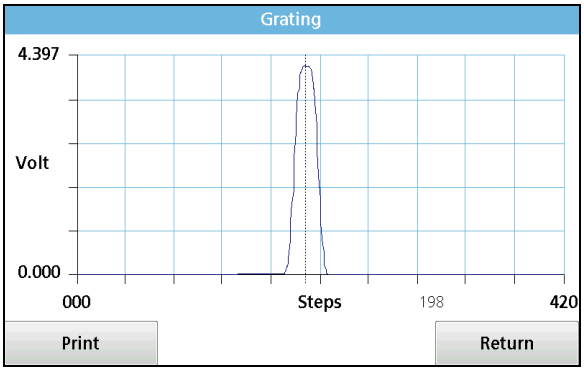
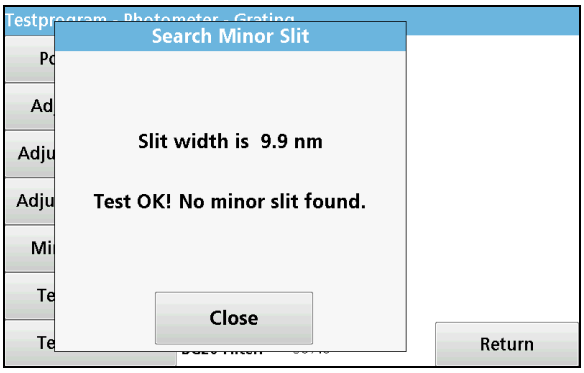
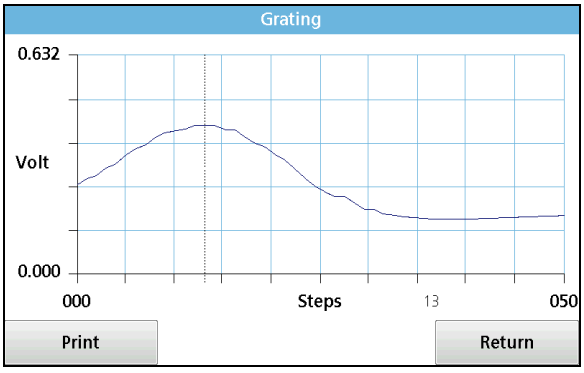
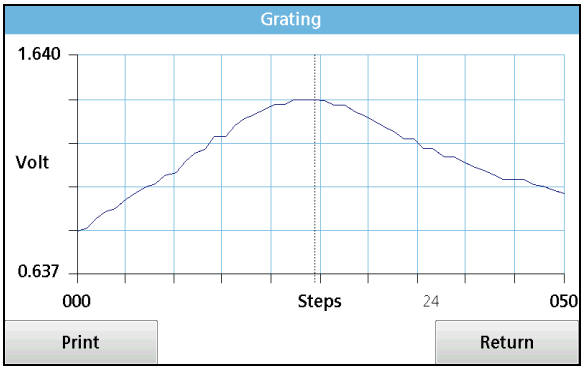
Press "Option" for further menu options.

Press "Return" to go back to the previous menu.

Explanation of menu options:

Menu option	Explanation
Calibration --- 560 nm F:3	The photometer is calibrated (grating and filter). The zero order is represented graphically. If calibration has already been carried out, only the selected wavelength is set (only on the grating). The button is then labeled, for example "560 nm F:3" (560 nm — the wavelength set; F:3 — the filter position).
Start Abs	The DR3900 can also be measured when the sample chamber is open, so the dark value (lamp off) is subtracted from the actual measurement value (measured when the lamp is on). These measurements have a certain time connection. This button is used to initiate a measurement cycle (lamp on, measure, lamp off, measure). The result is displayed as an extinction value in the "Abs.:" output field.
Lamp	Press this button to switch the lamp on or off. This lamp is switched off in the DR3900 during normal operation. CAUTION, when the lamp is operated for long periods, the

Menu option	Explanation
	chassis of the DR3900 becomes very hot!
Offset 0 Offset x.xx	The current measurement value is taken as the offset. The label changes to "Offset x.xx". Press the button again to delete the offset again, and the label changes back to "Offset 0".
<-	Moves the grating by one step towards the smaller number of steps or the filter position (the button has a repeat function).
->	Moves the grating by one step towards the larger number of steps or the filter position (the button has a repeat function). 1 step is equal to approximately 1/3 nm.
Option →Position test	Tests whether the grating detects the zero order with the same number of steps. The difference is displayed in steps below the graphic. 
Option →Adjust grating	Adjusts the wavelength alignment for the grating. Is determined on a BG20/2 filter at 807 nm position. An incorrect angle between the entry and exit gaps (each 30.8 degrees) and an incorrect number of line lead to errors in the correctness of the wavelength. The first question is whether the position of 807 nm should be scanned or is the changed angle to be entered via the keyboard. After scanning, a new angle is calculated (~ 61 degrees) and displayed. It can still be changed. This angle is saved and used as the basis for alignment for future wavelength calculations. The offset for the grating is then requested. This offset is set to 0 before the alignment. "Adjust" only changes the angle. The offset can be entered between –50 and +50. If necessary, it is determined under "Precision" (but not currently implemented).
Option →Adjust 0th sensor	The zero order is detected in the instrument using a light guide and a sensor. As the sensors have fluctuations between samples for the level, the process starts with a standard value and this button measures the level for this sample. The amplification of the sensor is set to minimum and the lamp to 5 V. The lamp is then set to 6 V and the amplification for the sensor is then set so that 10 V could be achieved for the zero order. The level is now recorded at 900 nm and increased by 50% as a limit value for the calibration before saving. Before measuring, the user is asked whether the measurement should be taken. The measured (or saved) level is the displayed and can be changed, if necessary. The setting of the potis is then displayed (fixed value in the current software).
Option →Adjust 0th RefPoti	Setting the amplification for the reference element to approximately 4 V (to calibrate the zero order using filter 2)

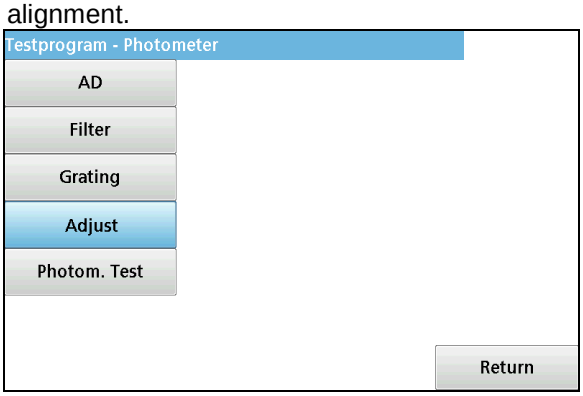
Menu option	Explanation
Option →Minor slit test	Scan +- 70 nm at zero order to find any gaps next to the actual exit slit. The result is displayed as a graphic and a message.  
Option →Test 360.9 nm	Tests the actual wavelengths. The holmium filter (from VAA591) must be inserted beforehand. The result is then shown graphically, followed by a value next to Ho Filter in the display screen. 
Option →Test 807.0 nm	Tests the actual wavelengths. The BG20/2 filter (from VAA591) must be inserted beforehand. The result is then shown graphically, followed by a value next to BG20/2 Filter in the display screen. 

Explanation of the specifications in the display window:

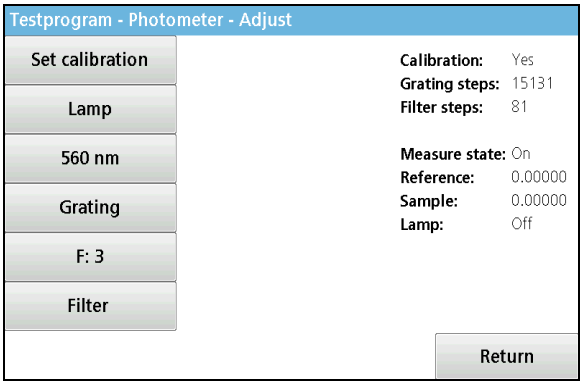
Display	Explanation
Abs:	Displays the extinction measured.
Sample 24 bit:	Displays the measurement channel in volts (is calculated from the ratio).
Ratio:	The relationship between the measurement signal and 4.096 V (output from the 24-bit converter). If the measurement signal = ½ reference signal, relationship 1 is achieved. A larger measurement signal results in an error message. If the measurement signal = -½ reference signal, relationship -1 is achieved. A smaller measurement signal results in an error message. The signals are linked in the DR3900 hardware so that the measurement signal will only run between 0 and 1 times the reference signal (relationship -1 to +1). This relationship figure is the basis for the transmission.
Sample 16 bit:	Displays the measurement channel in volts (is measured directly with the 16-bit AD converter).
Reference:	Displays the values of the reference signal in volts. Measured with the 16-bit converter.
Lamp [V]:	Displays the voltage to the lamp in volts
Lamp [°C]	Temperature at the sensor (below the lamp housing).
Zero order [V]:	Level of the zero order in volts.
Status:	Status in the processor for the grating motor: - Reset (starting value for the motor driver) - Parameters set (motor is partly initialized) - Steps def. (motor is correctly initialized)
Steps:	Number of steps for the grating motor
Corr. Date:	Date of step correction received by grating motor
Correctiont:	On/Off (Standard: On)
Ho Filter:	Displays the result after carrying out the 360.9 nm test
BG20 Filter:	Displays the result after carrying out the 807.0 nm test

3.6.5.4 Adjust

The "Adjust" menu brings up the setting options for the grating and the optical filters for the beam path alignment.



In the "Testprogram — Photometer" menu, press "Adjust".



The "Testprogram — Photometer — Adjust" menu is displayed.

Press "Return" to go back to the previous menu.

Explanation of menu options:

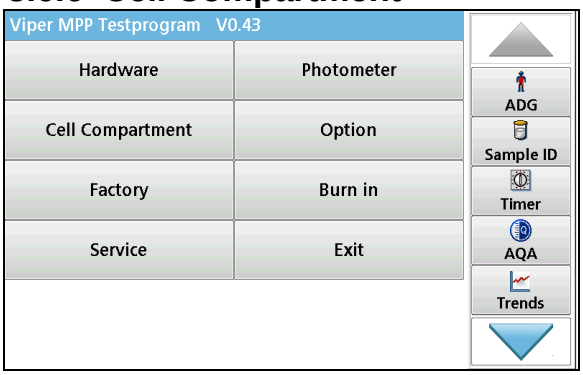
Menu option	Explanation
Set calibration	Calibration has not yet been carried out: The markers are set to calibrated. Assumes that the grating has been set to the zero order and filter 3 is in front of the exit gap. Calibration has been carried out: The markers are reset.
Lamp	Press this button to switch the lamp on or off. This lamp is switched off in the DR3900 during normal operation. CAUTION, when the lamp is operated for long periods, the chassis of the DR3900 becomes very hot!
560 nm	Moves to a wavelength to be entered. Only active if the instrument is calibrated.
Grating	A new menu opens for the grating movement:
<<- Grating Grating ->>	Moves the grating to the right or left. The buttons have a repeat function. The speed of the motor increases with each repeat.
<-Grating Grating ->	Moves the grating to the right or left (by eight steps). The buttons have a repeat function.
F: 3	Moves the next filter into position. Only active if the instrument is calibrated.
Filter	A new menu opens for the filter wheel movement:
<<- Filter Filter ->>	Moves the filter wheel to the right or left. The buttons have a repeat function. The speed of the motor increases with each repeat.
<-Filter Filter ->	Moves the filter to the right or left (by eight steps). The buttons have a repeat function.

Explanation of the specifications in the display window:

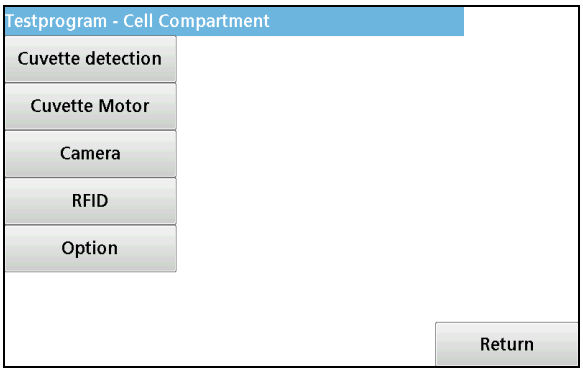
Display	Explanation
Calibration:	Status of the calibration marker.
Grating Steps:	Step counter for the grating motor

Filter Steps:	Step counter for the filter motor
Measure State:	Always "On"
Reference:	Displays the values for the reference signal in volts.
Sample:	Displays the values for the measurement signal in volts.
Lamp:	Displays the switched-on status of the lamp. Display "On/Off"

3.6.6 Cell Compartment



In the Testprogram main menu, press "Cell Compartment" .



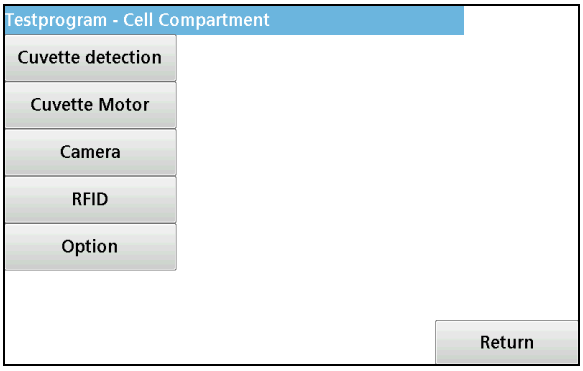
The "Testprogram — Cell Compartment" menu is displayed.

Press "Return" to go back to the previous menu.

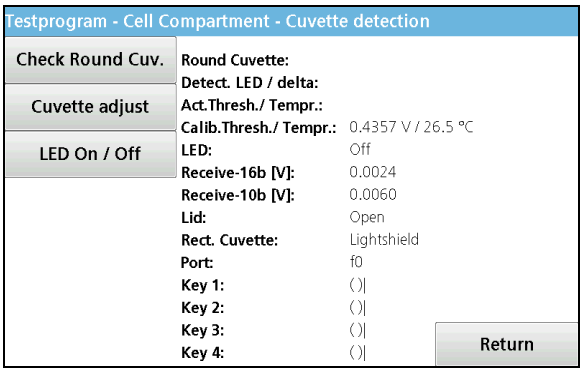
Explanation of menu options:

Menu option	Explanation
Cuvette detection	Test and configuration of the round cuvette detection (refer to below)
Cuvette Motor	Test and configuration of the round cuvette motor (refer to on page 45)
Camera	Test and configuration of the camera (refer to on page 45)
RFID	Test and configuration of the RFID module (refer to on page 48)
Option:	CAUTION, for development and production only
Return	Back to the previous menu

3.6.6.1 Cuvette detection



In the "Testprogram — Cell Compartment" menu, press "Cuvette detection" .



The "Testprogram — Cell Compartment — Cuvette detection" menu is displayed.

Press "Return" to go back to the previous menu.

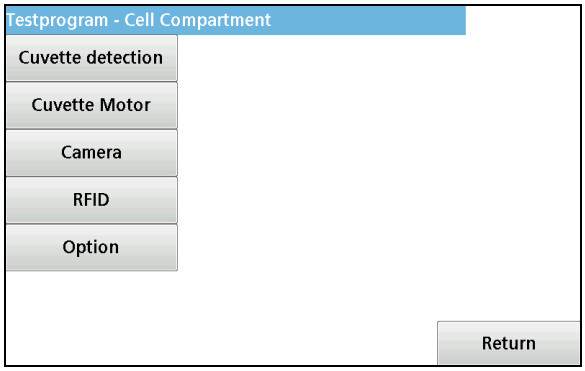
Explanation of menu options:

Menu option	Explanation
Check Round Cuv.	Starts the detection of the round cuvette. Result is shown in the display screen.
Cuvette adjust	Adjustment of the cuvette detection. Requires the removal of the cuvette. The "Dark" value is then measured and saved. The temperature is then measured and saved.
LED On/Off	Switches the LED for cuvette detection on or off.
Return	Back to the previous menu

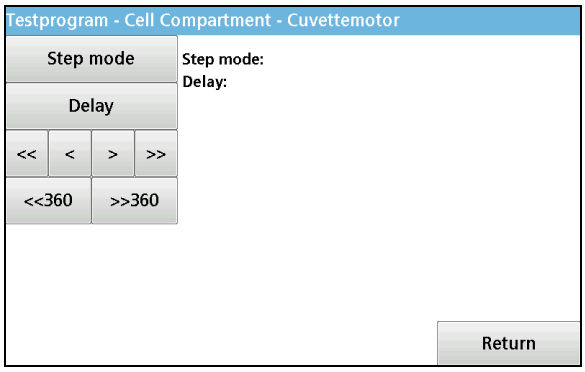
Explanation of the specifications in the display window:

Display	Explanation
Round Cuvette:	Result of "Check Round Cuv.": "In" or "Out".
Detect. LED/delta:	The last measured LED value from "Check Round Cuv." With percentage deviation from the adjustment value.
Act.Thresh./Tempr.:	The calculated threshold for cuvette detection for the current temperature.
Calib.Thresh./Tempr.:	The saved threshold for cuvette detection with the appropriate temperature.
LED:	Status of the LED: "On" or "Off"
Receive-16b:	Level of the sensor with the 16-bit ADC.
Receive-10b:	Level of the sensor with the 10-bit ADC. That is the faster converter, it is used for cuvette detection, the 16-bit converter is used for cuvette adjust.
Lid:	Status of the cover detection: "Open" or "Closed"
Rect. Cuvette:	Status of the cuvette detection →(corresponding port value) "empty" →(00) "10 mm" →(10) "10 mm + Adapter A" →(b0) "30 mm + Adapter B " →(30) "50 mm" →(90) "1" round" →(e0) "1" rect " →(60) " Adapter A " →(a0) " Adapter B " →(20) "Lightshield" →(f0) "failure" →(40), (50), (70), (80), (c0) or (d0)
Port:	Status of the switch in hex representation
Key 1:	Status of the rear switch (|): open ()|: pressed
Key 2:	Status of the middle switch (|): open ()|: pressed
Key 3:	Status of the middle switch (|): open ()|: pressed
Key 4:	Status of the front switch (|): open ()|: pressed

3.6.6.2 Cuvette Motor



In the "Testprogram — Cell Compartment" menu, press "Cuvette Motor" .



The "Testprogram — Cell Compartment — Cuvette Motor" menu is displayed.

Press "Return" to go back to the previous menu.

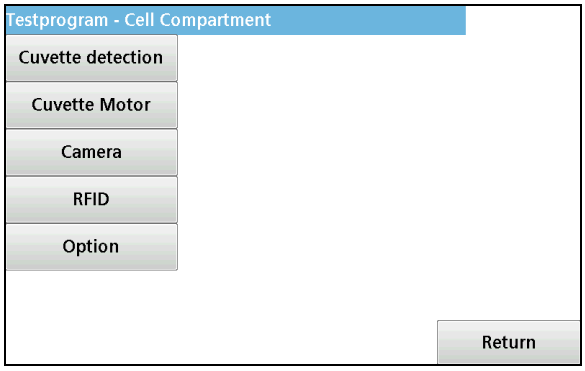
Explanation of menu options:

Menu option	Explanation
Step mode:	CAUTION, for development and production only
Delay:	CAUTION, for development and production only
"<<' "<' ">' ">>':	Moves the cuvette by ¼ or by 1/10 revolution
"<<360','>>360'	Moves the cuvette by one rotation
Return	Back to the previous menu

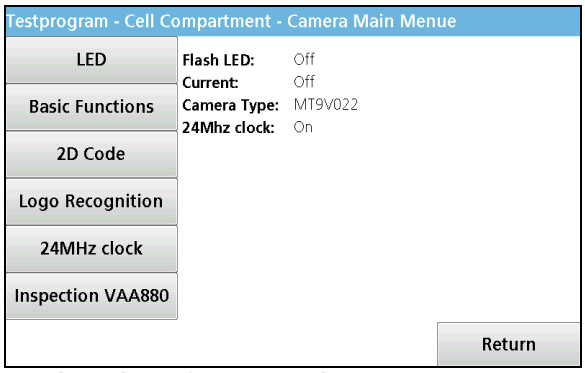
Explanation of the specifications in the display window:

Display	Explanation
Step mode:	Number of microsteps (default 04)
Delay:	Wait time between each microstep in ms (default 02)

3.6.6.3 Camera



In the "Testprogram — Cell Compartment" menu, press "Camera" .



"Testprogram — Cell Compartment — Camera Main Menu" is displayed.

Press "Return" to go back to the previous menu.

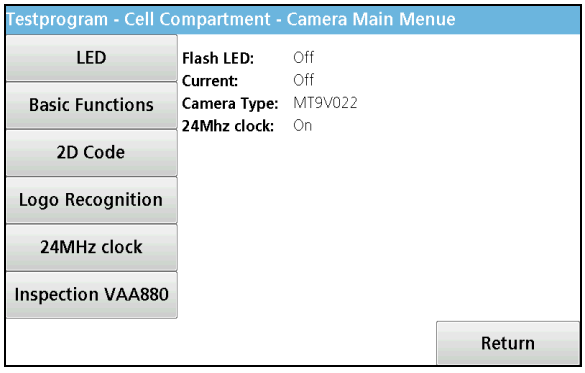
Explanation of menu options:

Menu option	Explanation
LED	Switches the camera LED on or off
Basic Functions	Calls up individual camera functions
2D Code	2D Code recognition test
Logo Recognition	CAUTION, for development and production only
24 MHz clock	CAUTION, for development and production only
Inspection VAA880	Camera adjustment with VAA880 (refer to description of Hardware Check (Service) points: 20 2D code camera calibration with VAA880 @camera module [optional] and 21 2D code camera calibration with VAA880 @camera module [optional] on page 93)
Return	Back to the previous menu

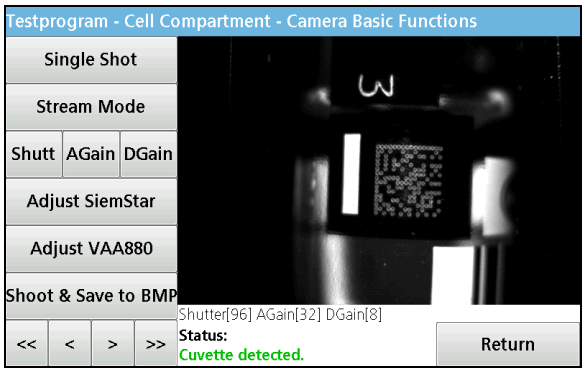
Explanation of the specifications in the display window:

Display	Explanation
Flash LED:	Status of the LED: "On" or "Off"
Receive-10b:	CAUTION, for development and production only
Current:	CAUTION, for development and production only
Light Shield:	CAUTION, for development and production only
Camera Type:	Recognized camera type (MT9V022 or MT9V024)
24 MHz clock:	CAUTION, for development and production only

3.6.6.3.1 Basic Functions



In "Testprogram — Cell Compartment — Camera Main Menu", press "Basic Functions".



The "Testprogram — Cell Compartment — Camera Basic Functions" menu is displayed.

Press "Return" to go back to the previous menu.

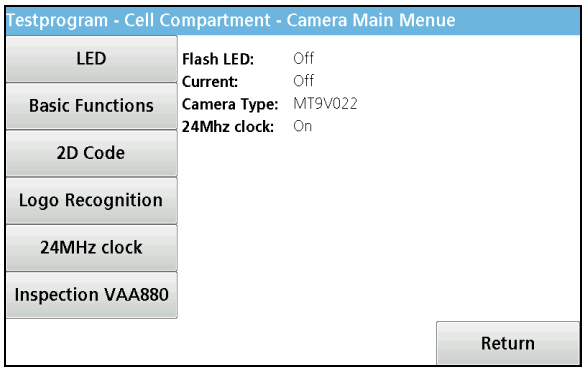
Explanation of menu options:

Menu option	Explanation
Single Shot	Takes a photo with the camera and displays it in the display screen.
Stream Mode	Takes permanent photos with the camera and displays them in the display screen.
Shutt|AGain|DGain	Option to configure the parameters for the camera that are used for the "Single Shot" and "Stream Mode" functions.
Adjust SiemStar	CAUTION, for development and production only
Adjust VAA880	CAUTION, for development and production only
Shot & Save to BMP	Creates a camera image and saves it as a *.bmp file on a connected USB stick
<<|<|>|>>	Rotates the cuvette to the left or right in small or large steps.
Return	Back to the previous menu

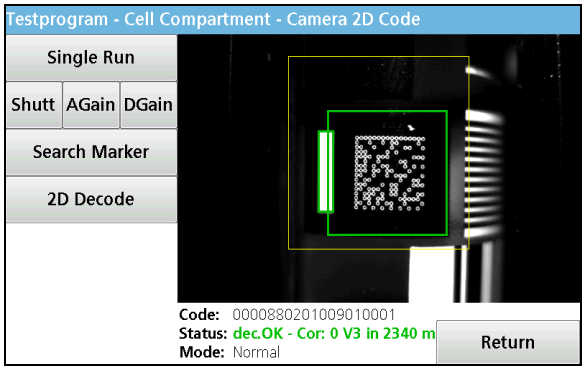
Explanation of the specifications in the display window:

Display	Explanation
Shutter[xx]AGain[xx]DGain[xx]	Displays the parameters configured for the camera
Status	Displays whether a cuvette has been detected (Cuvette detected or No Cuvette detected)

3.6.6.3.2 2D Code



In the "Testprogram — cell compartment — Camera Main Menu", press "2D Code".



The "Testprogram — cell compartment — Camera 2D Code" menu is displayed.

Press "Return" to go back to the previous menu.

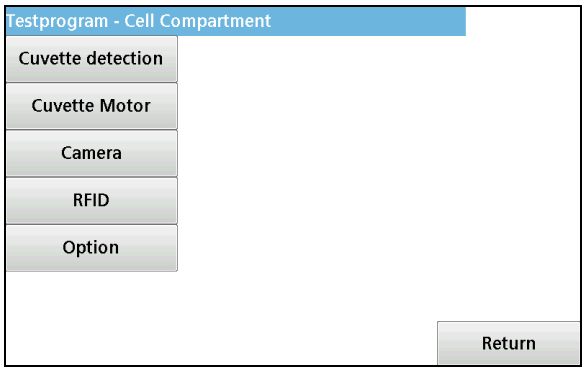
Explanation of menu options:

Menu option	Explanation
Single Run	Carries out the function as in UI if a cuvette is inserted. The marker is searched for first, followed by the 2D Code Decoded. The result is displayed below the camera image.
Shutt|AGain|DGain	CAUTION, for development and production only
Search Marker	CAUTION, for development and production only
2D Decode	CAUTION, for development and production only
Return	Back to the previous menu

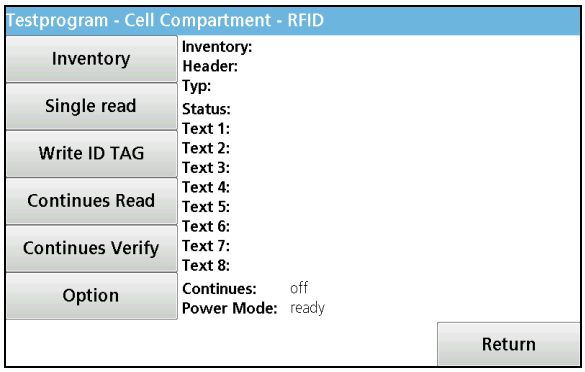
Explanation of the specifications in the display window:

Display	Explanation
Code:	Displays the content of the 2D Code if it is read properly.
Status	CAUTION, for development and production only
Mode:	CAUTION, for development and production only

3.6.6.4 RFID



In the "Testprogram — Cell Compartment" menu, press "RFID".



The "Testprogram — Cell Compartment — RFID" menu is displayed.

Press "Return" to go back to the previous menu.

Explanation of menu options:

Menu option	Explanation
Inventory	Reads the "Inventory" area once
Single read	Reads the TAG once. Inventory must be read first! This searches for the appropriate structure and then displays the content.
Write ID TAG	Describes a TAG as Operator TAG, Bottle TAG, Location TAG or Box TAG. This writes the corresponding structure and a fixed content on the TAG Inventory must be read first!
Continues Read	Calls up a continuous read. Inventory is read continuously first. If a TAG is detected here, its content is read and displayed
Continues Verify	Calls up a continuous read. Inventory is read continuously first. If a TAG is detected here, its content is read and compared with

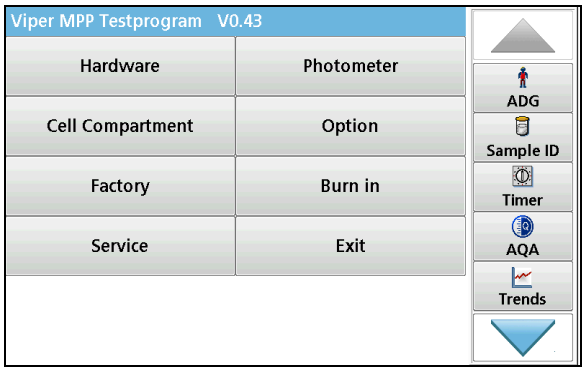
		the content of the standard.
Option		Go to further menu options (back with "Return")
	Raw Read	Reads the TAG once. The content is displayed without any structural dependency. If inventory was read first, the maximum number of blocks that are on this TAG is read. If no inventory was available, the number of blocks to be read can be input (maximum 256)
	TAG Check	Tests the TAG. The TAG is described with serial numbers, then the tag is read completely and the content is compared with these serial numbers. If inventory was read first, the maximum number of blocks that are on this TAG is edited. If no inventory was available, the number of blocks to be edited can be input (maximum 256)
	Read Stand1	Reads the TAG once. The content is saved without structural dependency in buffer standard 1 or standard 2. Inventory is accessed once beforehand for this.
	Read Stand2	
	Single Verify	Reads the TAG once and compares it with the content of standard 1 or standard 2. Inventory is accessed once beforehand for this.
	Standby	Switches off the power to the RFID chip
	Config Reader	This allows the parameters of the read chip to be changes. Values are not saved and the default values are provided again after a restart.
Return		Back to the previous menu

Explanation of the specifications in the display window:

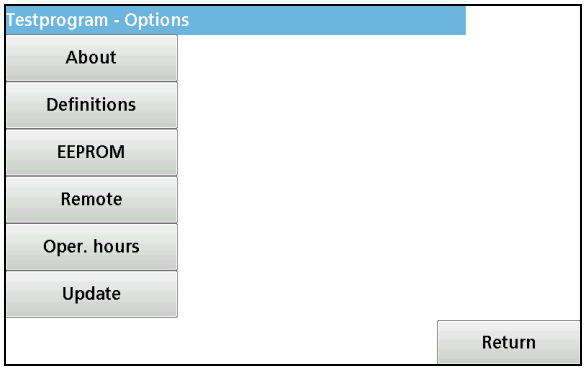
Display	Explanation
Inventory:	Indicates how long access lasted, how many TAGs were detected and how many blocks the TAG has
Header:	Representation of the header in hex-numbers: E004010... E0 = identifier for header 0401 = identifier for equipment producer and TAG type Remainder = serial number for the TAG (this means that each TAG is unique)
Type:	NXP ICS20 -> BDH015/BDH017 NXP ICS20 = identifier for equipment producer and TAG type (converted by software from the hex-numbers) BDH. = Hach Lange number for the TAG (converted by software from the hex-numbers)
Status:	Indicates how long access lasted, how many TAGs were detected, how many bytes were read and how many blocks had to be requested repeatedly.
Text1:	Text read from the TAG
Text2:	
Text3:	
Text4:	
Text5:	
Text6:	
Text7:	
Text8:	
Continues:	On or off: is switched on or off with either Continues Read or Continues Verify
Power Mode:	Ready or Standby: is set by pressing Standby

3.6.7 Option

A range of settings are configured in the "Option" menu.



In the Testprogram main menu, press "Option".



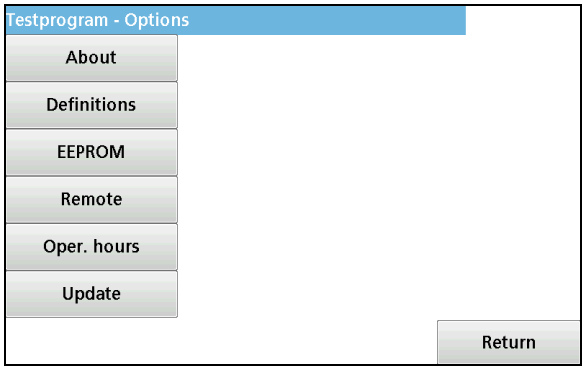
The "Testprogram — Option" menu is displayed.

Press "Return" to go back to the previous menu.

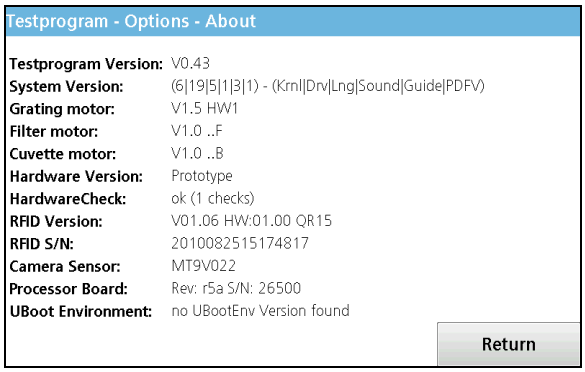
Explanation of menu options:

Menu option	Explanation
About	Displays the names and versions of various programs and the result of the complete test (refer to below)
Definitions	Access to device definitions (refer to on page 51)
EEPROM	Displays the factory settings (refer to on page 53)
Remote	CAUTION, for development and production only!
Oper. Hours	Currently no function
Update	Update of the instrument software via the USB-interface (refer to on page 55)
Return	Back to the previous menu

3.6.7.1 About



In the "Testprogram — Option" menu, press "About".



The "Testprogram — Option — About" menu is displayed.

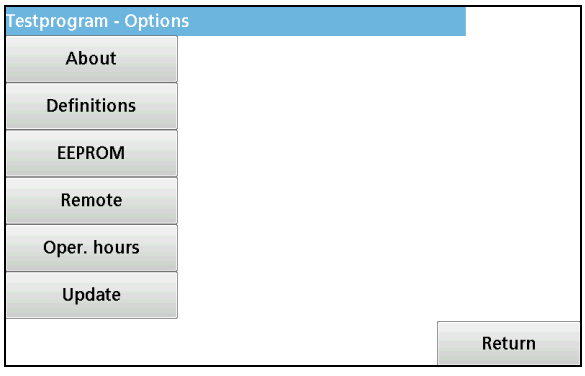
Press "Return" to go back to the previous menu.

Explanation of the specifications in the display window:

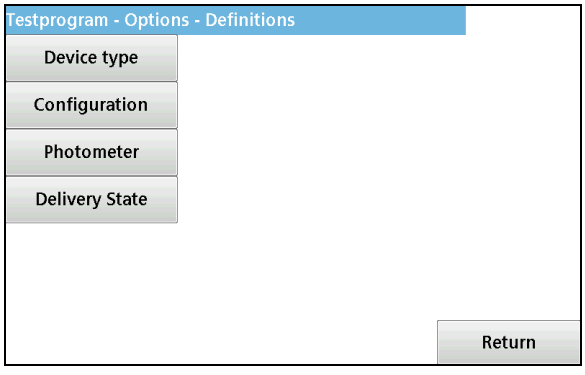
Display	Explanation
Testprogram Version:	Displays the version of the testprogram.
System Version	Displays the version of the system (kernel version |driver version |language version |sound version |help guide version |PDF Viewer version).
Grating motor:	Displays the version of the program for the grating motor board.
Filter motor:	Displays the version of the program for the motor CPU for the filter motor.
Cuvette motor:	Displays the version of the program for the motor CPU for the cuvette motor.
Hardware Version:	Displays the hardware version of the device: "Breadboard", Alphaboard", "Prototype", "Pilot Series" or "Series"
Hardware Check:	Displays the last result and the number of hardware checks: "not done", "ok" or "x errors".
RFID Version:	Displays the version of the RFID module.
RFID S/N.:	Displays the serial number of the RFID module.
Camera Sensor:	Displays the version of the camera module.
Processor Board:	Displays the version of the processor board.
UBoot Environment:	Displays the boot version and boot configuration.

3.6.7.2 Definitions

The "Definitions" menu requests and sets device definitions.



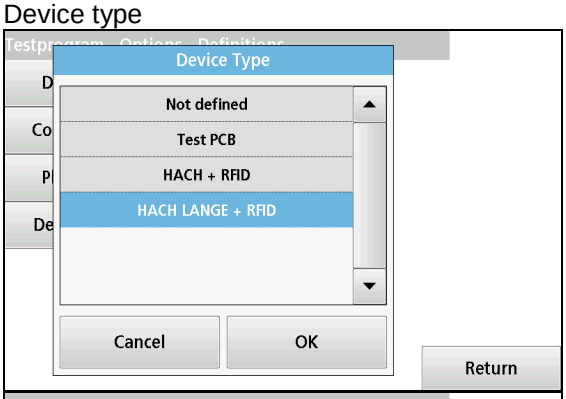
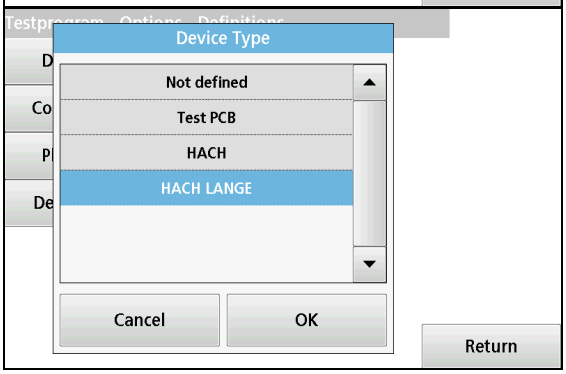
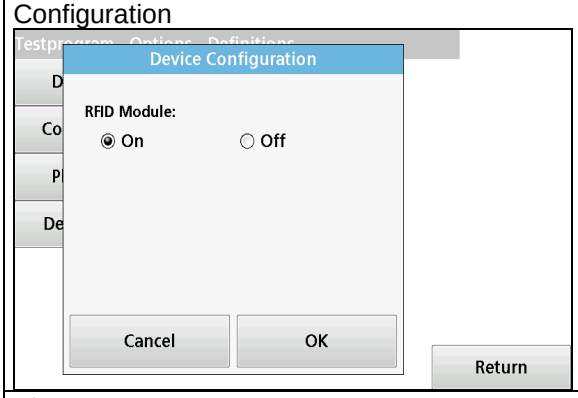
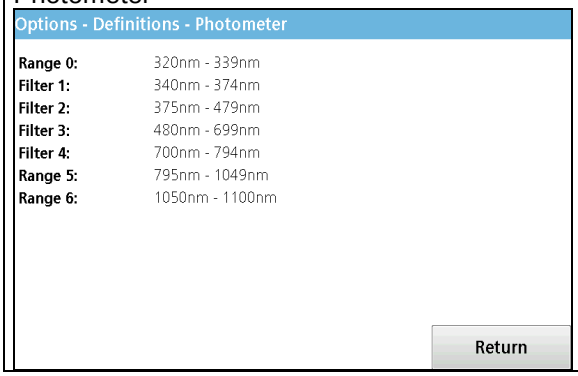
In the "Testprogram — Option" menu, press "Definitions".

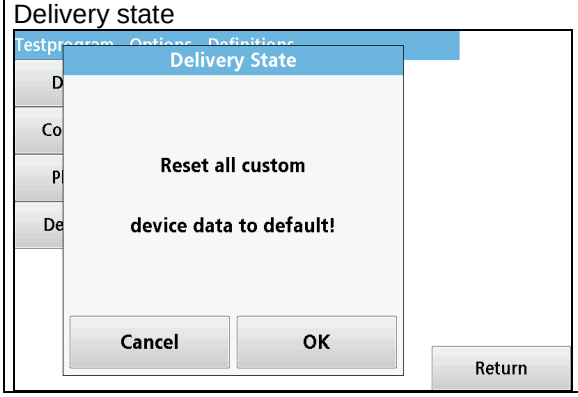


The "Testprogram — Option — Definitions" menu is displayed.

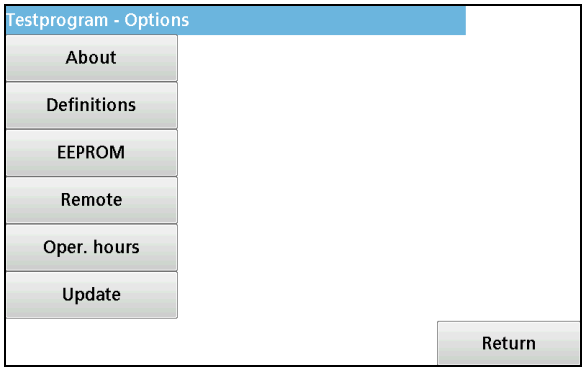
Press "Return" to go back to the previous menu.

Explanation of menu options:

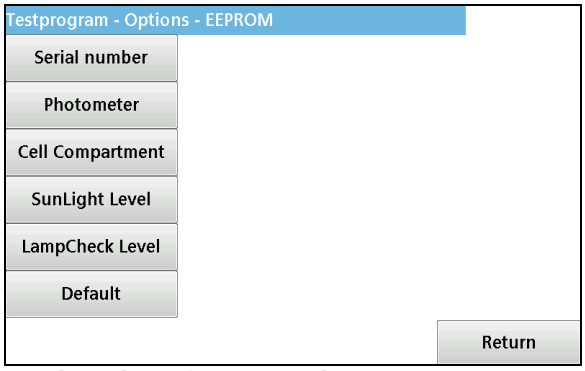
Menu option	Explanation
Device type   	Depending on how the configuration is set, the following settings are available here: - Not defined - Test PCB - HACH + RFID - HACH LANGE + RFID - Or - Not defined - Test PCB - HACH - HACH LANGE For the "Hardware Check" ("Inspection"), the program has to know whether an instrument (including instrument variants) or a PCB is to be tested. This is saved as "Device Type" on the grating motor card. The status is undefined on a new grating motor board. It can be changed. If "not defined" is changed to a different definition, it is saved immediately. If the definition is changed, however, the question "Set new device type?" is shown. If "OK" is pressed here, the question is followed by a code number. This code number is confidential and can only be requested from the development department itself. "Device Type" is saved on the grating motor board, for example an instrument is still a "HACH LANGE" instrument even after the main processor is replaced.
Configuration  	The setting for whether an RFID module is (→On) or is not (→Off) built into the instrument can be configured here.
Photometer  	The switch points for the filter are displayed.

Delivery state 	When "OK" is pressed to confirm, all customer settings in the user program are reset to the default values (factory settings). All measurement data is deleted. The language selection menu is shown automatically the next time the instrument is started.

3.6.7.3 EEPROM



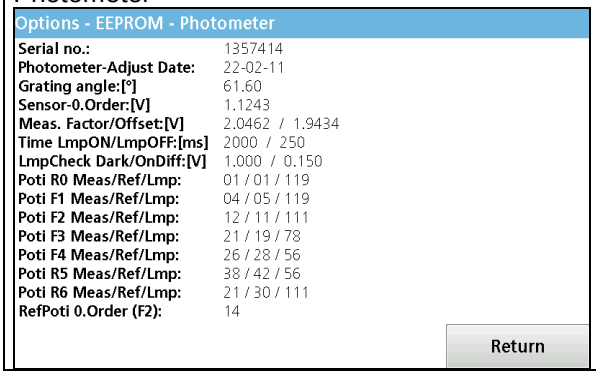
In the "Testprogram — Options" menu, press "EEPROM".

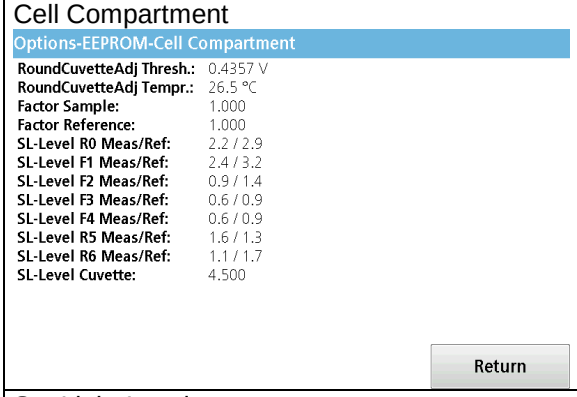


The "Testprogram — Options — EEPROM" menu is displayed.

Press "Return" to go back to the previous menu.

Explanation of menu options:

Menu option	Explanation
Serial number	Opens the input screen for the serial number for the instrument. After the grating motor board is replaced (including the grating motor), the serial number for the device then has to be input.
Photometer 	Refer to Explanation of specifications in the display screen after pressing "Photometer":

Cell Compartment  	Refer to Explanation of specifications in the display screen after pressing "Cell Compartment":
SunLight Level	CAUTION, for development and production only!
LampCheck Level	CAUTION, for development and production only!
Default	CAUTION, for development and production only! Default overwrites the factory setting for the device parameters. A further confirmation is required to prevent accidental overwriting.

Explanation of specifications in the display screen after pressing "Photometer":

Display	Explanation
Serial no.:	The serial number entered
Adjust date:	Day of the last factory alignment
Grating Angle: [°]	The aligned angle
Sensor-zero order:[V] :	The aligned threshold
Meas. factor/offset.:[V]	The aligned factor/offset 16-bit to 24-bit
Time lmpON/lmpOFF:[ms]	The wait time after switching the lamp on/off
LmpCheck Dark/OnDiff:[V]	The maximum tolerable signal from the zero order sensor if the lamp is off./The minimum difference to be achieved from the signal zero order sensor if the lamp is on. *Note: threshold values for the lamp check*
Poti R0 Meas/Ref/Lmp:	The aligned poti setting for the virtual filter 0 (physical filter 1) meas/ref/lamp
Poti F1 Meas/Ref/Lmp:	The aligned poti setting for filter 1 for meas/ref/lamp
Poti F2 Meas/Ref/Lmp:	The aligned poti setting for filter 2 for meas/ref/lamp
Poti F3 Meas/Ref/Lmp:	The aligned poti setting for filter 3 for meas/ref/lamp
Poti F4 Meas/Ref/Lmp:	The aligned poti setting for filter 4 for meas/ref/lamp
Poti R5 Meas/Ref/Lmp:	The aligned poti setting for the virtual filter 5 (physical filter 4) meas/ref/lamp
Poti R6 Meas/Ref/Lmp:	The aligned poti setting for the virtual filter 6 (physical filter 4) meas/ref/lamp
RefPoti zero order (F2)	The aligned poti setting for calibration of the O arrangement (white light) with the reference element (high accuracy)

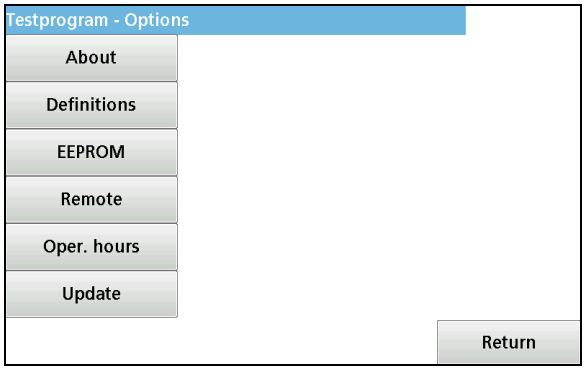
Explanation of specifications in the display screen after pressing "Cell Compartment":

Display	Explanation
RoundCuvetteAdj Thresh.:	The aligned threshold for cuvette detection
RoundCuvetteAdj Tempr.:	The corresponding temperature for the aligned threshold for cuvette detection
Factor Sample:	Factor for the thresholds given below for sunlight identification
Factor Reference:	Factor for the thresholds given below for sunlight identification
SL-Level R0 Meas/Ref:	Thresholds for sunlight identification for R0
SL-Level F1 Meas/Ref:	Thresholds for sunlight identification for F1
SL-Level F2 Meas/Ref:	Thresholds for sunlight identification for F2
SL-Level F3 Meas/Ref:	Thresholds for sunlight identification for F3
SL-Level F4 Meas/Ref:	Thresholds for sunlight identification for F4
SL-Level R5 Meas/Ref:	Thresholds for sunlight identification for R5
SL-Level R6 Meas/Ref:	Thresholds for sunlight identification for R6
SL-Level Cuvette:	Thresholds for sunlight identification for cuvette detection

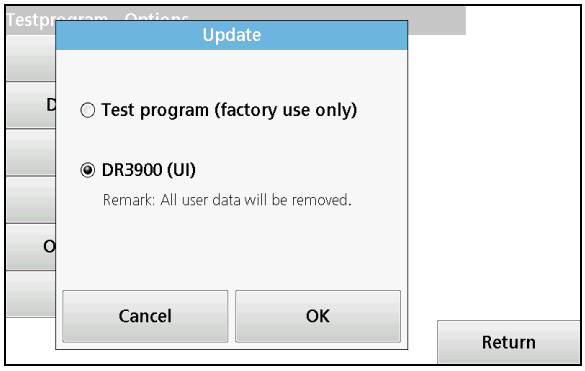
3.6.7.4 Update

Caution: All customer-specific settings (operator ID, sample ID), stored measurement results and user programs created by the customer are deleted!
Please only use this update if the instrument is to be configured to factory settings or if the computer card has been replaced after a repair.
(For a simple update, refer to Update on page 58)

"Update" updates the software for the device via the USB-interface. A USB memory stick with the corresponding software (VAA608) is required for this.



In the "Testprogram — Options" menu, press "Update".

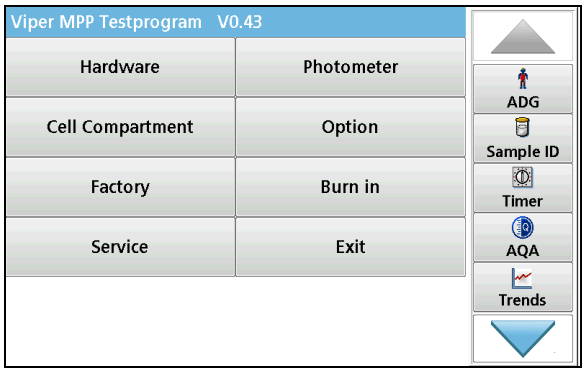


In the new window, selected the program to be updated "DR 3900 (UI)" and press "OK" to confirm the selection. This then searches for the program on the memory stick.

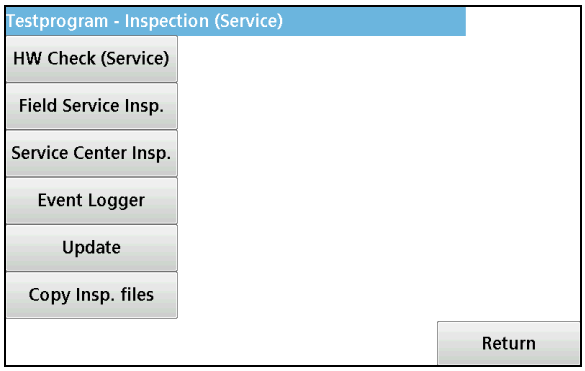
If the program is detected, the current program is deleted in the DR 3900 and the new one is installed in the DR 3900 along with the corresponding databases. This process takes approximately
one minute. After the installation is complete, the message "OK" "Restart Device" is shown. The DR 3900 must now be restarted. The restart can take up to two minutes longer and the test database is installed during this time — do not switch off the instrument!

If no memory stick is inserted or the appropriate program is not available, error messages appear.

3.6.8 Service



In the Testprogram main menu, press "Service".



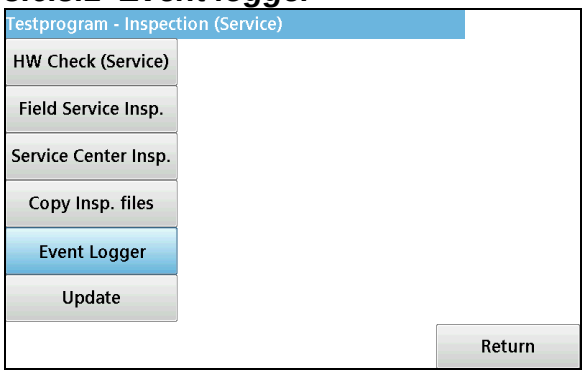
The "Testprogram — Inspection (Service)" menu is displayed.

Press "Return" to go back to the previous menu.

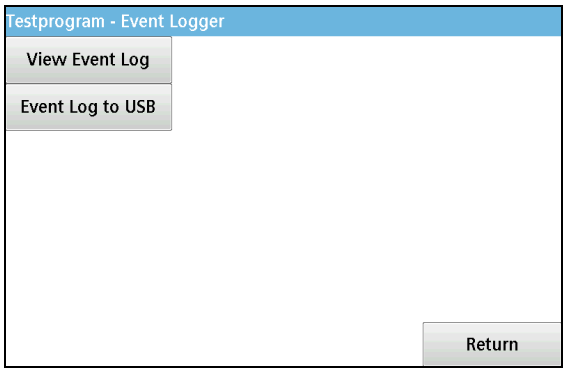
Explanation of menu options:

Menu option	Explanation
HW Check (service)	A complete test of the instrument as a whole including all alignment processes (refer to 6.3 Hardware check (service) on page 90)
Field Service Insp.	Final test of the device in the event of servicing (refer to 6.4 Field Service Insp. on page 106)
Service Center Insp.	CAUTION, for the Service Center only!
Event logger	Copies the event logger for the device to a USB memory stick (refer to below)
Update	Update of the instrument software via the USB-interface (refer to on page 58)
Copy Insp. Files	Copies the inspection file for the instrument to a USB memory stick (refer to on page 58)
Return	Back to the previous menu

3.6.8.1 Event logger



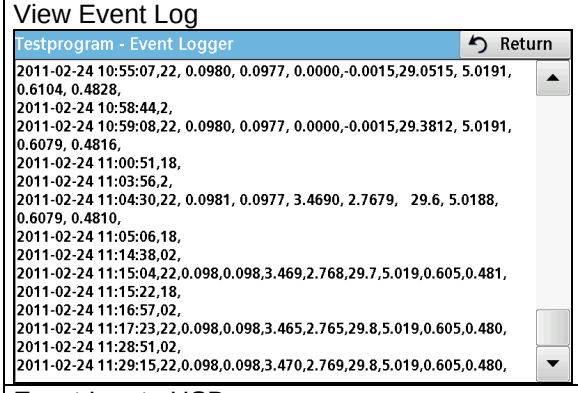
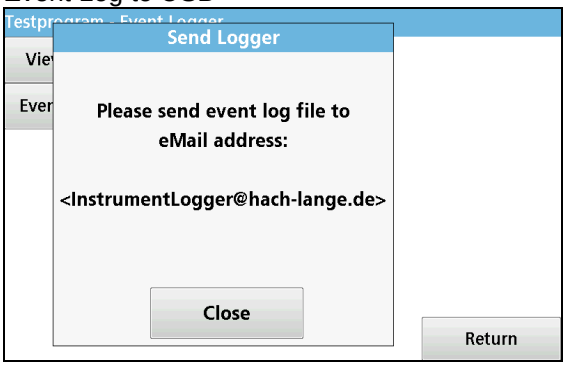
In the "Testprogram — Inspection (Service)" menu, press "Event Logger".



The "Testprogram — Event Logger" menu is displayed.

Press "Return" to go back to the previous menu.

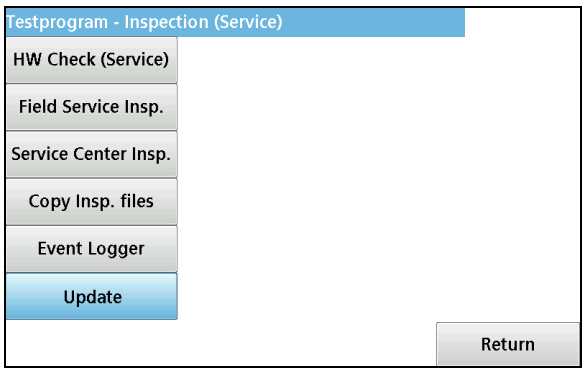
Explanation of menu options:

Menu option	Explanation
View Event Log 	Displays the event log for the instrument in the display window. For the explanation of the entries, refer to section 2.3 Event logger entries on page 10 Press "Return" to go back to the previous menu.
Event Log to USB 	Copies the event log file of the device to a USB memory stick in an archive file "Logger_LPG440_serialnumber.tar.gz" The current archive file contains the logger text file (Logger_LPG440_xxxxxxxx.txt). For the explanation of the entries, refer to section 2.3 Event logger entries on page 10 After copying of the event log file the message: "Please send event log file to eMail address: InstrumentLogger@hach-lange.de" appears. ***Note:*** *Please send the complete archive file 'Logger_LPG440:xxxxxxx.tar.gz' to e-mail account:* *InstrumentLogger@hach-lange.de.*
Return	Back to the previous menu

3.6.8.2 Update

Caution: All customer-specific settings (operator ID, sample ID), stored measurement results and user programs created by the customer are retained!

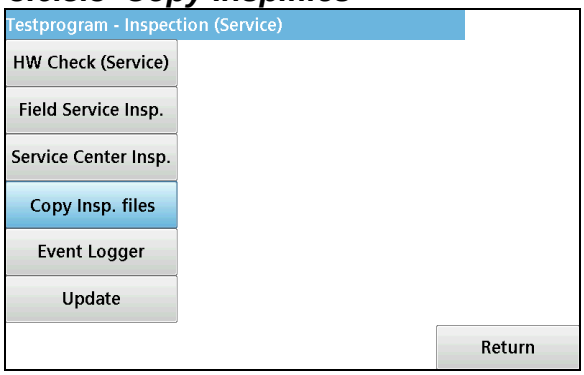
***Note**: use this update after the inspection etc.!*



In the "Testprogram — Inspection (Service)" menu, press "Update".

Now insert the VAA608 USB stick and press OK to confirm. The update is carried out automatically.

3.6.8.3 Copy Insp.files



In the "Testprogram — Inspection (Service)" menu, press "Copy Insp. files".

A hwc_xxx_.csv with the results of the last hardware check and 2 bmp files from the camera alignment are saved on the USB stick in the "Measurement data" folder.

4 Repairs

CAUTION: a Hardware Check Adjust (HW Check (Service)) and the service inspection must always be carried out after individual components are replaced.

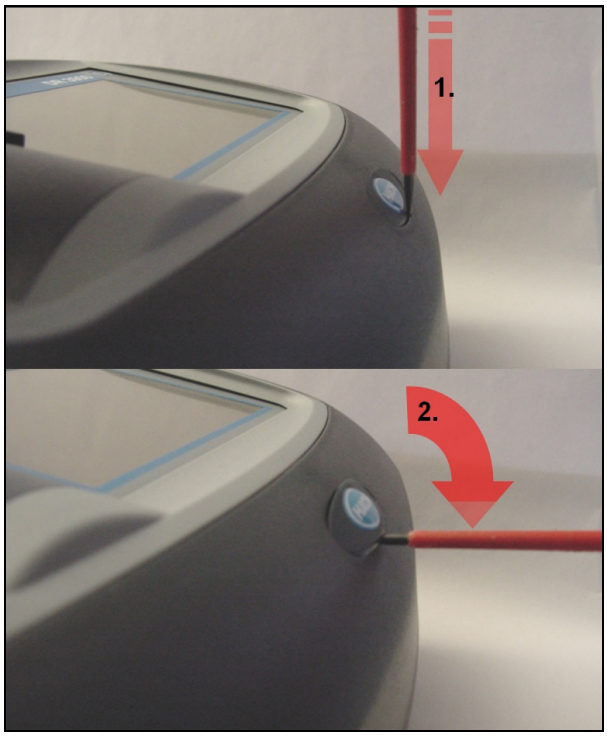
4.1 Open the instrument

The text below refers to opening the DR3900. The installation to close it is done by deconstructing it in reverse order.

SAFETY INFORMATION:

The mains plug must be removed before the instrument is opened!

1. Remove the light shield (1) or the cell adapter from the 50 mm cuvette intake.



2. To remove the instrument plate (2), lift it out with a screwdriver.

3. Remove the screw (3) underneath the instrument plate.

4. Lift the front cover forwards until you can remove it from the instrument.

5. Remove the four screws (4) on the top of the housing.

6. Remove the top of the housing by lifting it upwards.

Note: *pay attention to the RFID module (5) during assembly.*

To close the instrument, follow points one to six in reverse order.

4.2 RFID Module

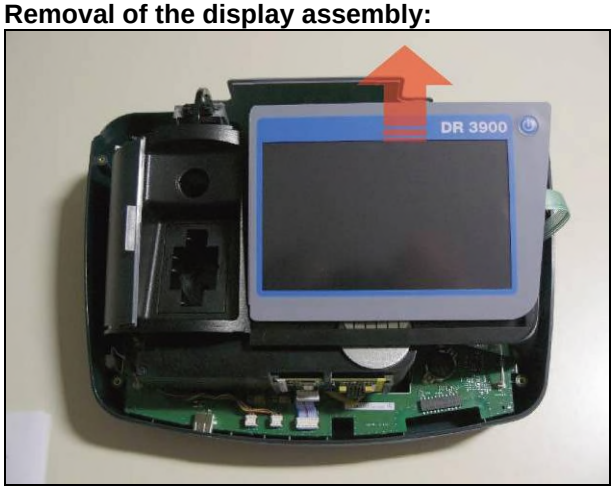
Removal of the RFID module

1. Open the instrument (refer to Open the instrument on page 59).
2. Pull the RFID module (1) forwards.

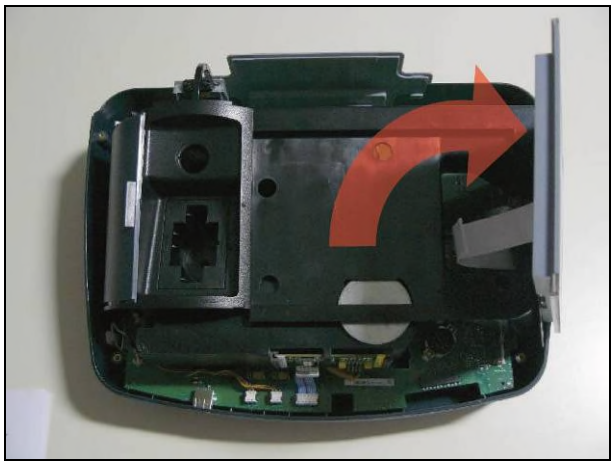
To close the instrument, follow points one and two in reverse order.

4.3 Display assembly

Removal of the display assembly:



1. Open the instrument (refer to Open the instrument on page 59).
2. Lift the display assembly at the rear and carefully pull backwards to remove it.



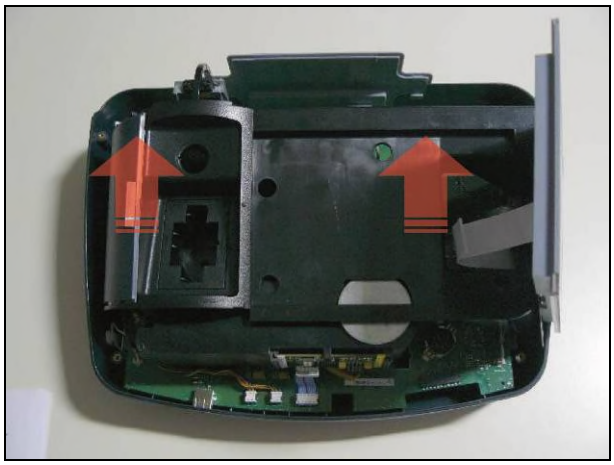
3. The display assembly can now be carefully turned over to the right and placed on the bottom part of the housing.

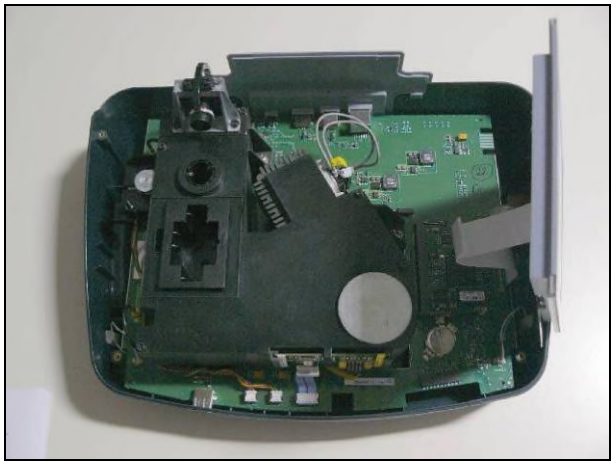
4. Loosen the electrical contacts (1) to remove the display assembly completely; however, in many cases complete removal is not required.

To close the instrument, follow points one to four in reverse order.

4.4 Cross rail

Removal of the cross rail:





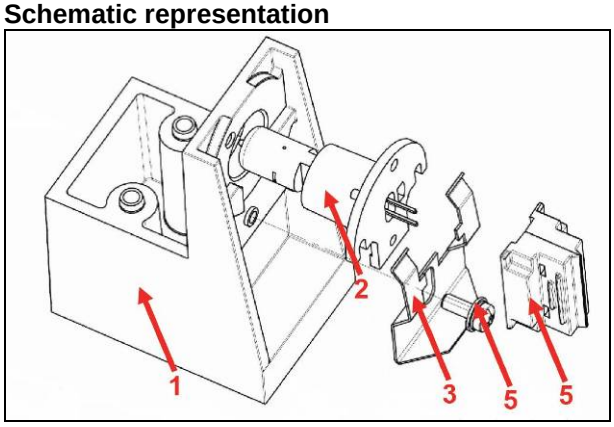
1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide.

To close the instrument, follow points one to three in reverse order.

4.5 Halogen lamp

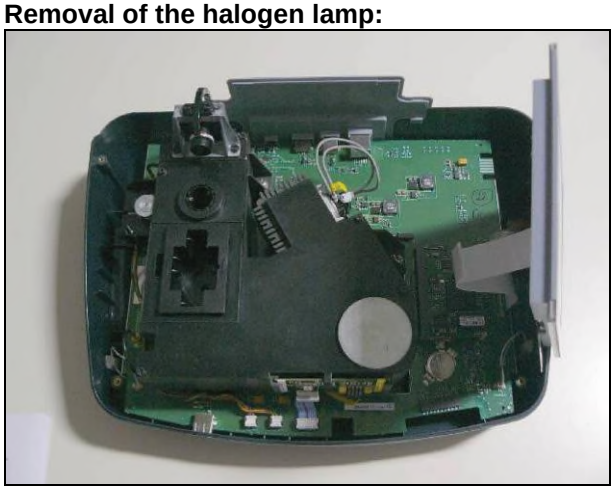
The halogen lamp for the DR 3900 can be replaced from underneath the instrument as described in the user manual. The halogen lamp can also be replaced when the instrument is open.

Schematic representation

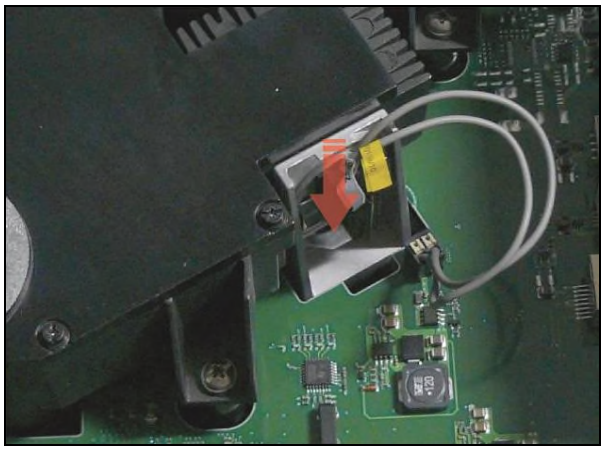


1 - Lamp holder
2 - Halogen projector lamp (LZV565)
3 - Flat spring
4 - Combi screw M3x8-Z1-3-8.8-R2 (part of LZV884)
5 - Lamp plug (LZV754)

Removal of the halogen lamp:



1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).



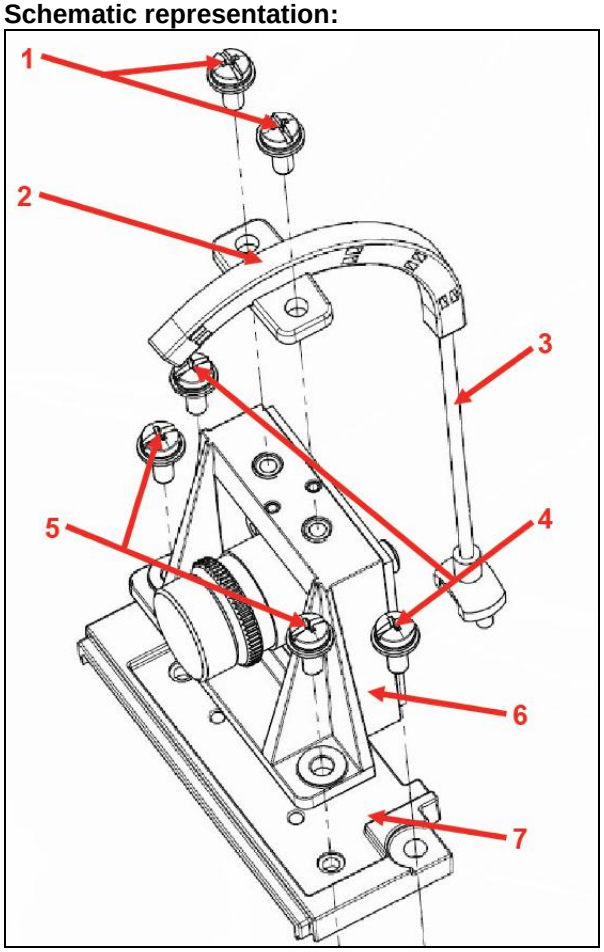
4. Push the terminal slide down to the stop.

5. Take hold of the plug and pull it and the lamp out of the lamp holder
6. Remove the plug from the lamp

To close the instrument, follow points one to six in reverse order.

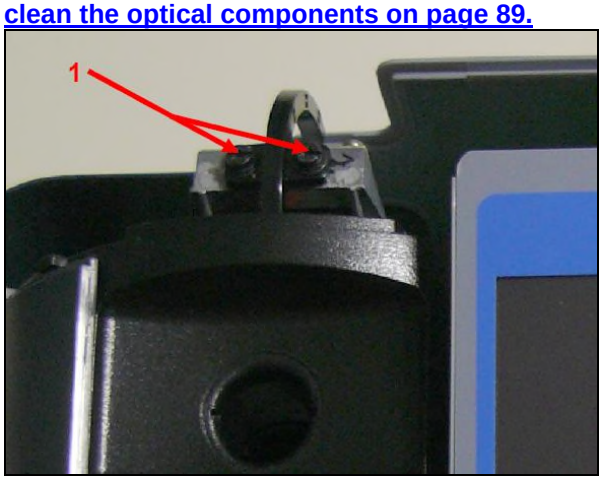
4.6 Camera

Schematic representation:

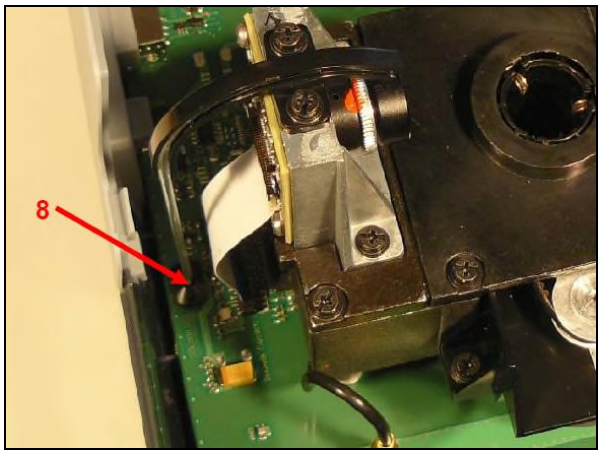


1 - Combi screws M3x8-Z1-3-8.8-R2R (to attach the light guide holder (2) to the camera (6)) (part of LZV884)
2 - Light guide holder
3 - Flexible light guide (LZV867)
4 - Combi screws M3x8-Z1-3-8.8-R2R (to attach the camera holder (7) to the beam path chassis) (part of LZV884)
5 - Combi screws M3x8-Z1-3-8.8-R2R (to attach the camera (6) to the camera holder (7)) (part of LZV884)
6 - Camera aligned (LZV862)
7 - Camera holder

Removal of the light guide:
CAUTION during cleaning and maintenance — please refer to section 6.2 How to handle and clean the optical components on page 89.



1. Open the instrument (refer to Open the instrument on page 59).
2. Remov the screws (1) for the light guide holder.
3. Remove the light guide holder (2) with the light guide (3).

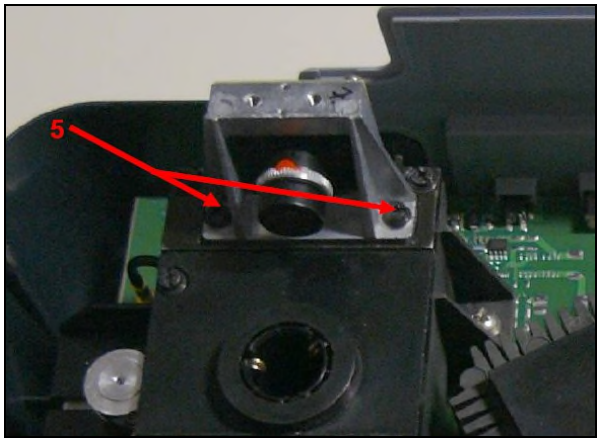


4. Remove the light guide (3) from the light guide holder (2).

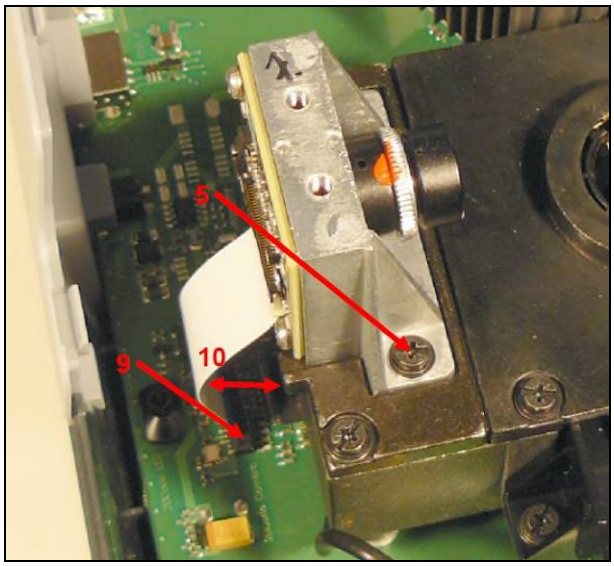
During assembly, make sure that the light guide is fed into the housing intended for the light guide (8) on the main board.

To close the instrument, follow points one to four in reverse order.

Removal of the camera:



1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the light guide holder with the light guide (refer to Removal of the light guide)
3. Remove the screws for the camera (5).



4. Loosen the electrical contact (9) to remove the camera completely.

During assembly, make sure that the curvature (10) that occurs in the camera connector points away from the beam path.

To close the instrument, follow points one to four in reverse order.

4.7 Beam path/main board

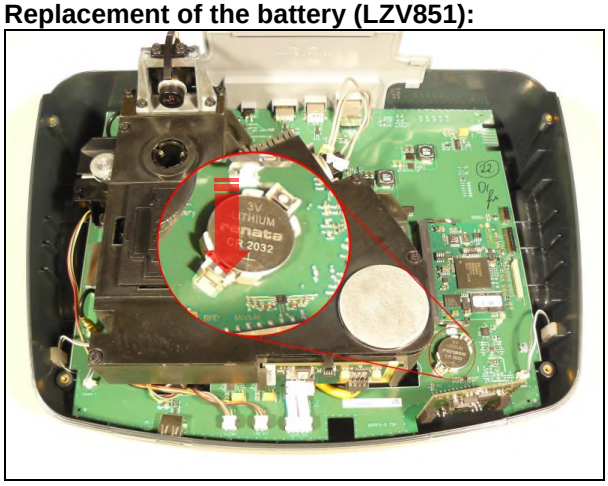
4.7.1 Battery

The testprogram shows the approximate voltage value for the internal lithium battery (refer to RTC (Real Time Clock) on page 29).

This battery is responsible for the function of the time and date when the instrument is switched off.

Note: the nominal voltage of the battery is 3 V. The voltage displayed in the testprogram is a little lower than the actual battery voltage, but should not be < 1.95 V (otherwise the battery should be replaced).

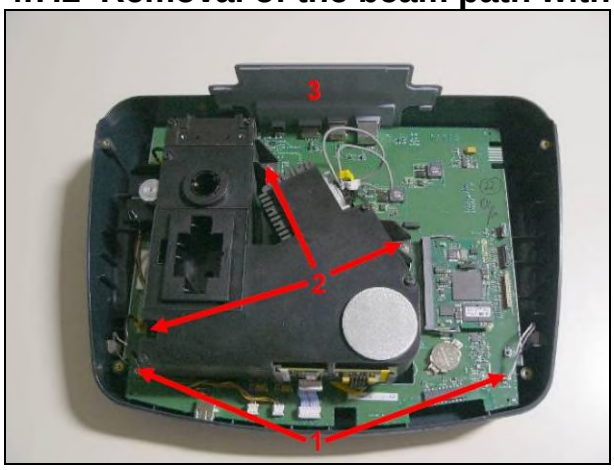
Replacement of the battery (LZV851):



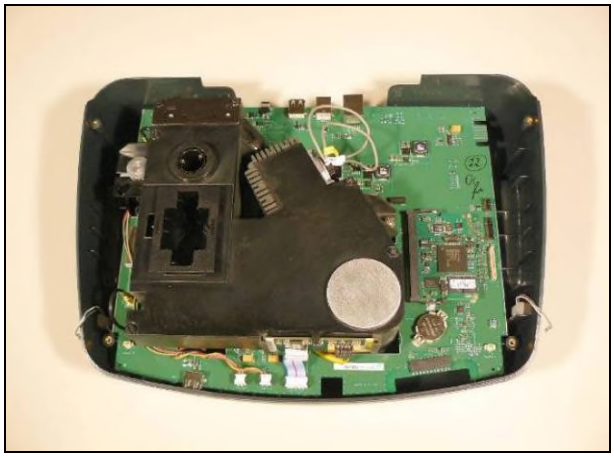
1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Use a flat screwdriver to carefully lift out the battery (LZV851) at the front left.

To install, follow points one to four in reverse order.

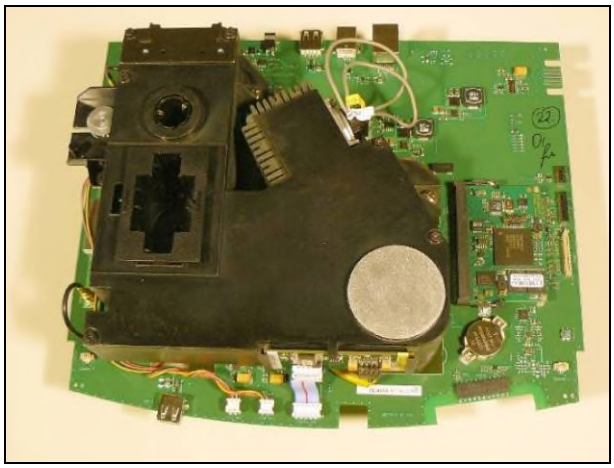
4.7.2 Removal of the beam path with main board



1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the camera, if necessary (refer to Camera on page 64).
5. Undo the electrical contacts for the two speakers (1).
6. Remove the three screws (2) that secure the beam path.



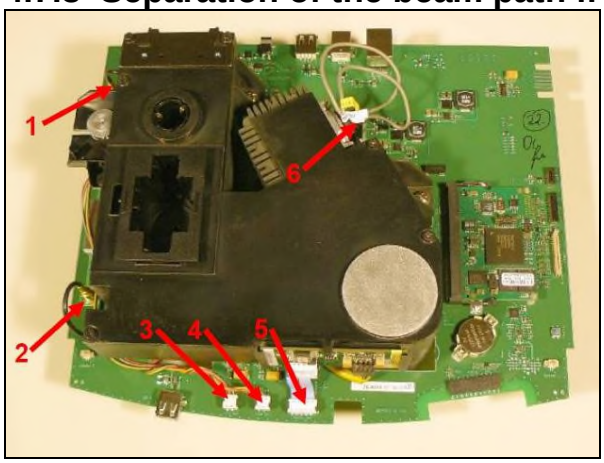
7. Lift the beam path and main board at the back a little to allow the rear wall of the housing (3) to be removed.



8. The beam path and main board can now be removed completely from the bottom part of the housing.

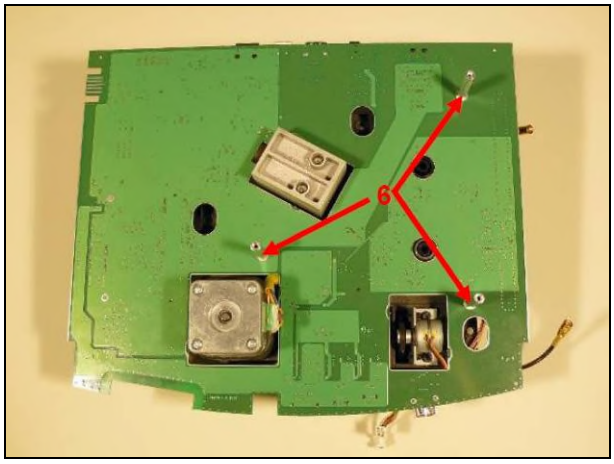
To install, follow points one to eight in reverse order.

4.7.3 Separation of the beam path from the main board

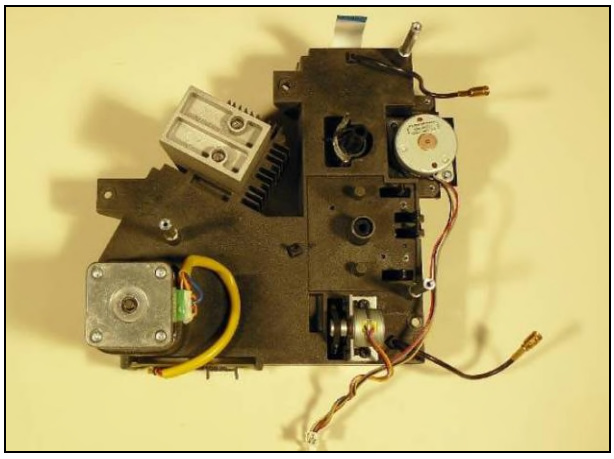


1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the camera (refer to Camera on page 64).
5. Remove the complete beam path from the lower part of the housing (refer to Removal of the beam path with main board on page 67).
6. Disconnect the electrical connections (measurement element (1), reference element (2), cuvette motor (3), filter wheel motor (4), grating motor (5), lamp cable (6))

Note: To remove the plugs (3),(4),(5), please always use the Lumberg AZ30 (LZV882) pull-off tongs!



7. Remove the 3 spacing bolts (7)
8. The main board can now be completely separated from the beam path.

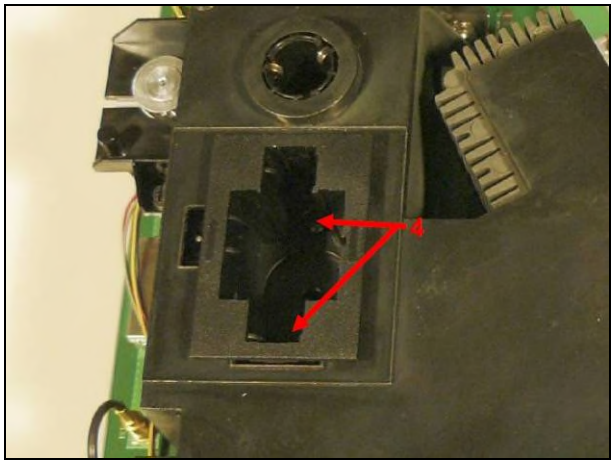


9. To enable better handling of the beam path, it is recommended to attach the 3 spacing bolts back into their threads on the beam path chassis.

To close the instrument, follow points one to eight in reverse order.

4.7.4 50 mm cell compartment

The 50 mm cell compartment on the DR 3900 can also be replaced (by the customer) when the instrument is closed, as described in the user manual.

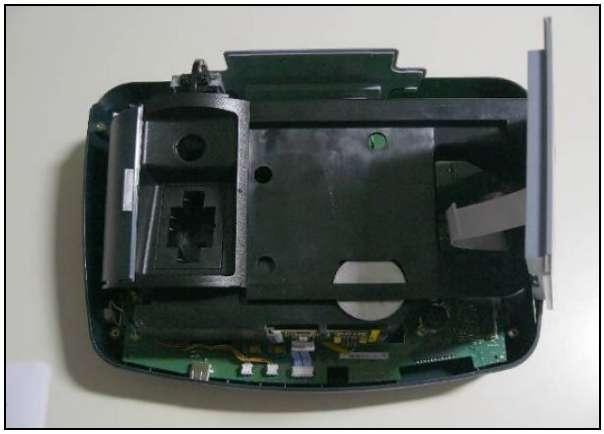


1. Undo the 2 screws (4) in the cell compartment.
2. Pull the cell compartment upwards to remove it.

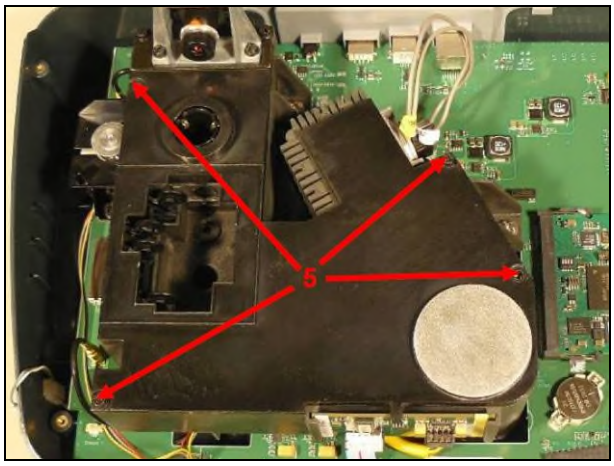
To close the instrument, follow points one and two in reverse order.

4.7.5 Open the beam path

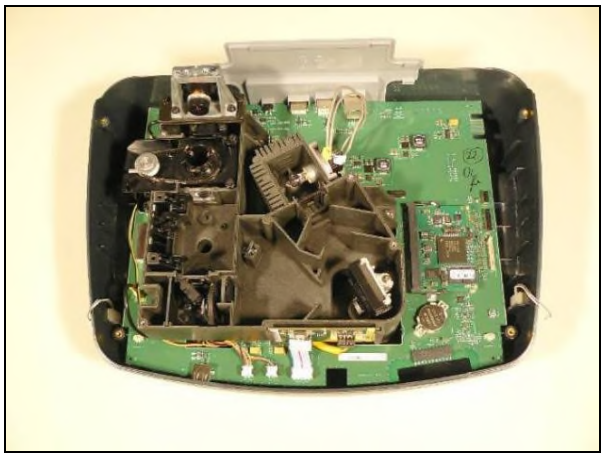
It is only necessary to remove the beam path from the housing chassis before opening the instrument in certain circumstances, for example, to replace the filter wheel or the grating motor.



1. Open the instrument (refer to Open the instrument on page 59).
2. Lift the display assembly at the rear and carefully pull backwards to remove it.
3. The display assembly can now be carefully turned over to the right and placed on the bottom part of the housing.



4. Remove the cross rail with the sample chamber slide
5. Remove the cell compartment (refer to 50 mm cell compartment above)
6. Remove the 4 screws (5) of the beam path cover.



7. Remove the beam path cover.

To close the instrument, follow points one to seven in reverse order.

4.7.6 Concave grating

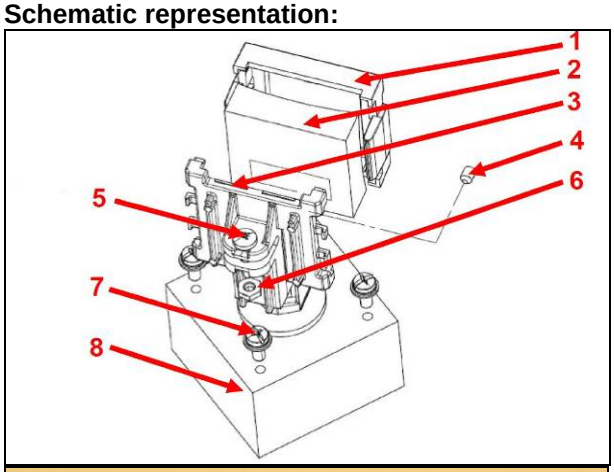
CAUTION: **When you replace the concave grating (LZV592), you must also replace the full grating holder set (LZV863).**

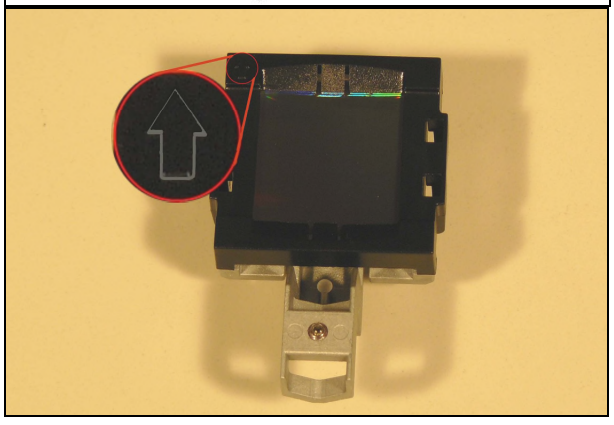
CAUTION during cleaning and maintenance — please refer to section 6.2 How to handle and clean the optical components on page 89.

Note: *During assembly, the height adjustment of the grating must be set!*

After replacing the grating, the adjustment of the beam path must be checked or carried out! (Refer to Adjust the beam path from on page 83)

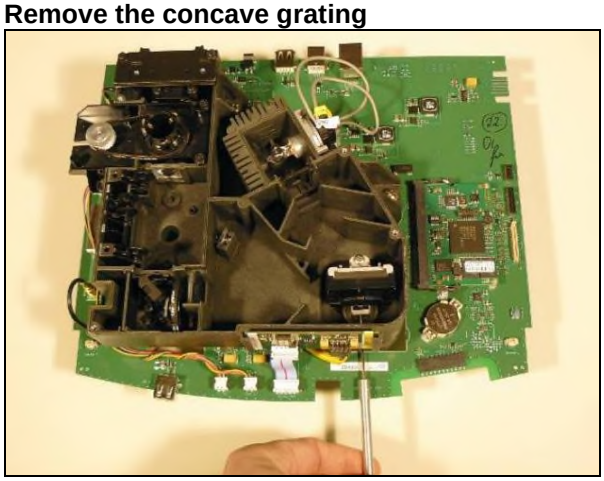
Schematic representation:





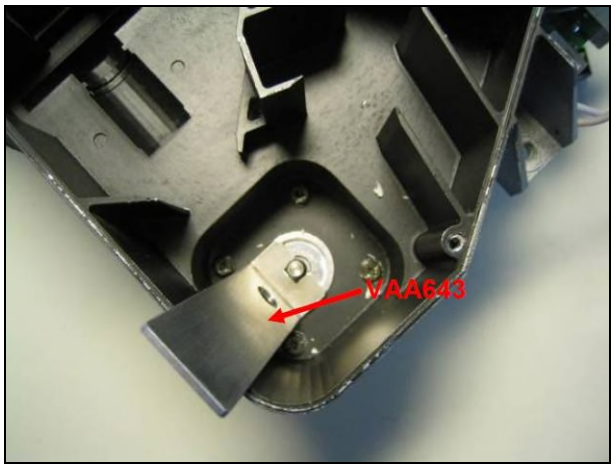
1 - Grating frame (included in LZV863)
Note: *Install with the arrow pointing upwards!*
2 - Concave grating (LZV592)
Note: *Install with the label facing downwards!*
3 - Grating holder (included in LZV863)
Note: *The grating holder is made from a magnesium alloy and must not be machined.*
4 - 1.5 mm hexagon socket headless screw with lock washer (included in LZV863)
5 - Cross recessed pan head screw M3x14 A4 (included in LZV863)
6 - Hexagon nut M3 A4 (included in LZV863)
7 - Combi screw M3x8-Z1-3-8.8-R2R (for attachment of no. 8 to the beam path chassis)
8 - Stepper motor with motor plate (YAB118)

Remove the concave grating



1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the complete beam path from the lower part of the housing (refer to Removal of the beam path with main board on page 67).
5. Remove the cell compartment (refer to 50 mm cell compartment on page 69)
6. Open the beam path (Open the beam path on page 69)
7. Undo the headless screw (4) through the bore hole in the lower part of the chassis and pull the grating holder (3) with the frame (1) and the concave grating (2) to remove from the motor shaft.

Note: The headless screw (4) is coated with a lock washer and therefore requires some additional force.

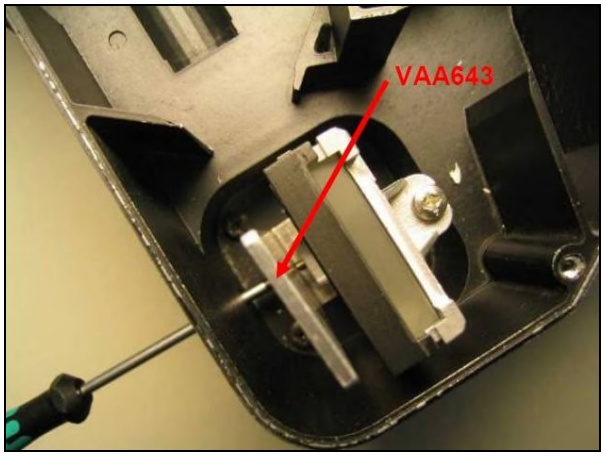


CAUTION: Do not touch the optical surface with your fingers!

8. Now dismantle the assembly according to the schematic diagram and replace the grating holder (3) and the frame (1), or replace the whole assembly (LZV863 and LZV592).

For assembly please note:

The grating is to be carefully inserted into the chassis together with the VAA643, which determines the height of the grating, the active optical surface of the grating and the milled side of the motor shaft point towards the chassis hole.



CAUTION: Do not touch or scratch the active optical surface. Dust particles must only be removed using the bellows. Fingerprints only may be cleaned with collodium. Never try to clean the reflective surface using a cloth or cotton swab: these will scratch!

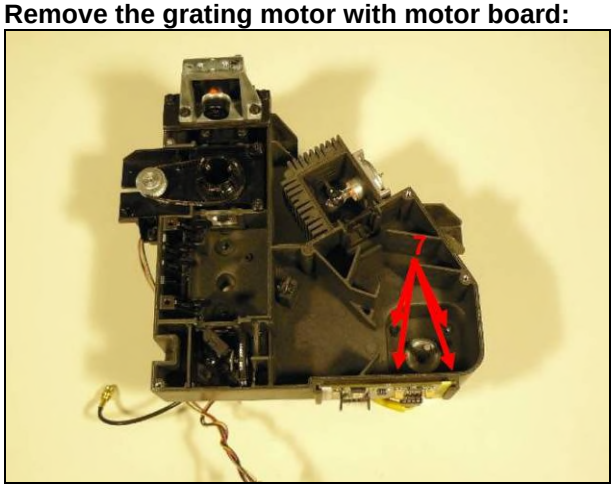
*When both components are positioned on the bottom, tighten the headless screw on the milled side (the manufacturer recommends a tightening torque of **30 cNm**).*

To assemble, follow points one to six in reverse order.

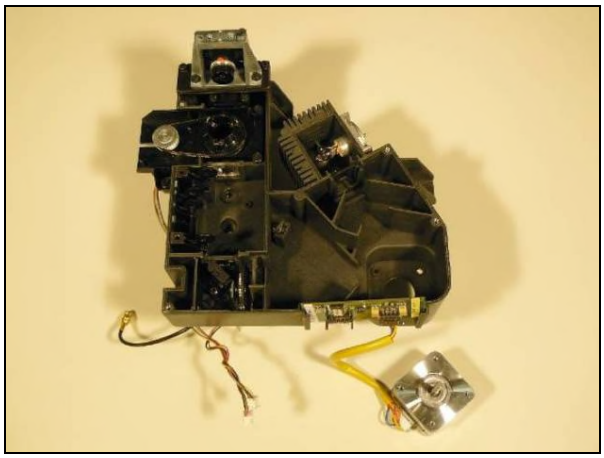
4.7.7 Grating motor and motor board

WARNING: The device type and the RFID configuration, as well as various calibration values of the beam path are detailed on the grating motor board. After you replace the grating motor board, the device type and the RFID configuration must be set in the testprogram accordingly (refer to section 3.6.7.2 Definitions on page 51). A complete hardware check (service) is also required (refer to section 6.3 Hardware check (service) Seite 90).

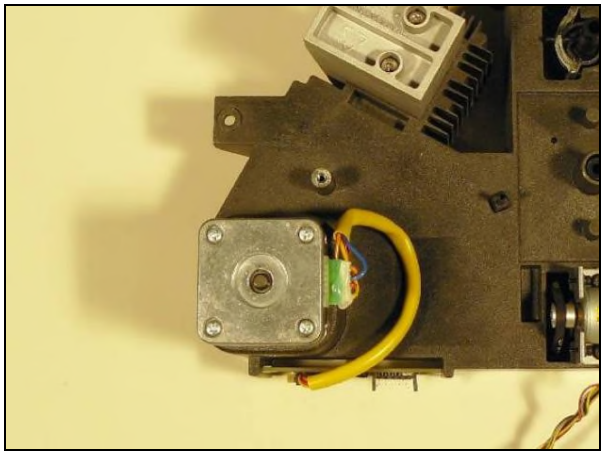
Remove the grating motor with motor board:



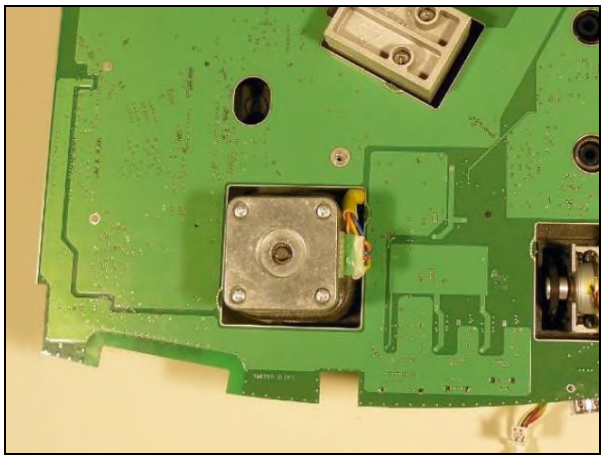
1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the complete beam path from the lower part of the housing (refer to Removal of the beam path with main board on page 67).
5. Remove the cell compartment (refer to 50 mm cell compartment on page 69)
6. Open the beam path (Open the beam path page on page 69)
7. Remove the concave grating with grating holder (Concave grating page on page 70)
8. Separate the beam path from the main board (refer to Separation of the beam path from the main board page on page 68)
9. Remove the 4 screws (7) from the grating motor.



10. The grating motor together with the motor board can now be removed.



CAUTION: Make sure that the cables are connected correctly during assembly. The motor cable must be laid under the main board and must not run around the outside. Otherwise this may result in damage to the RFID module.

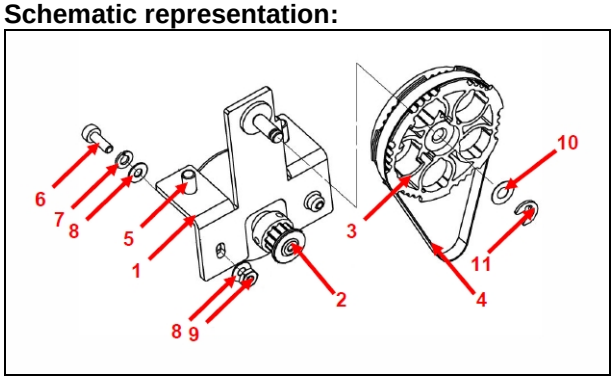


To close the instrument, follow points one to ten in reverse order.

4.7.8 Filter wheel and stepper motor filter changer

CAUTION during cleaning and maintenance — please refer to section 6.2 How to handle and clean the optical components on page 89.

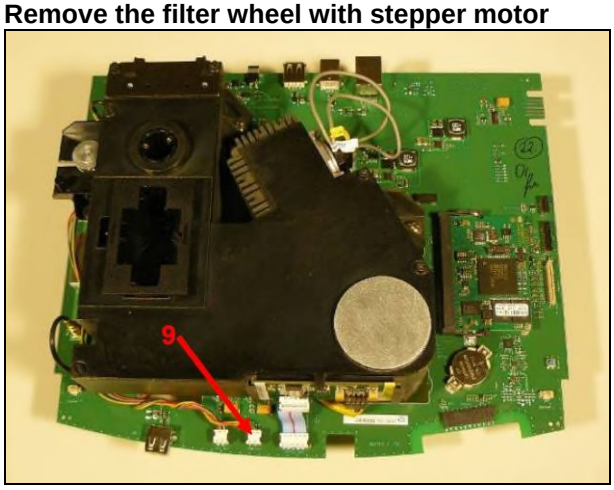
Schematic representation:



1 - Filter wheel holder
2 - Stepper motor (LZV614)
3 - Filter wheel (LZV591)
4 - Toothed belt (65 teeth) (LZV593)
5 - Combi screw M3x6-Z1-3-8.8-R2R (included in LZV884)
6 - Hexagon head cylinder screw M2x6 (included in LZV884)
7 - Spring washer DIN 137 (included in LZV884)
8 - Flat washer DIN 433 — 2.2 (included in LZV884)
9 - Hexagon nut ISO 4032 — M 2
10 - Adjusting washer (included in LZV884)
11 - Lock washer (included in LZV884)

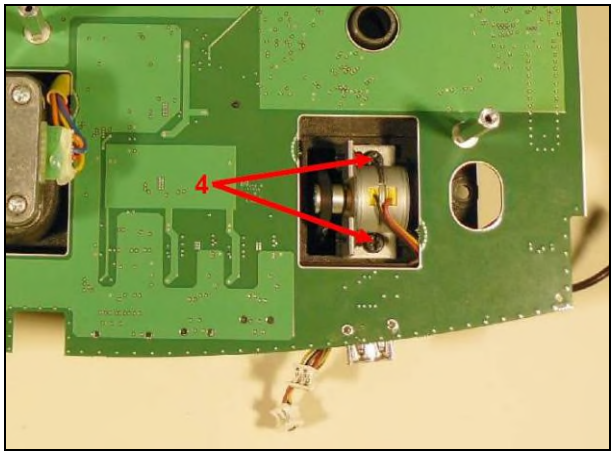
CAUTION: After replacing the components, the adjustment of the beam path must be checked! (Refer to Adjust the beam path from on page 83)

Remove the filter wheel with stepper motor



1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the complete beam path from the lower part of the housing (refer to Removal of the beam path with main board on page 67).
5. Remove the plug (9) for the stepper motor from the main board.

***Note**: To remove the plug, always use the Lumberg AZ30 pull-off tongs (LZV882)!*



6. Remove the 2 screws (4).
7. Remove the whole assembly from the beam path chassis.
8. You can now dismantle the assembly according to the schematic representation and replace the motor (3) or the filter wheel (5).

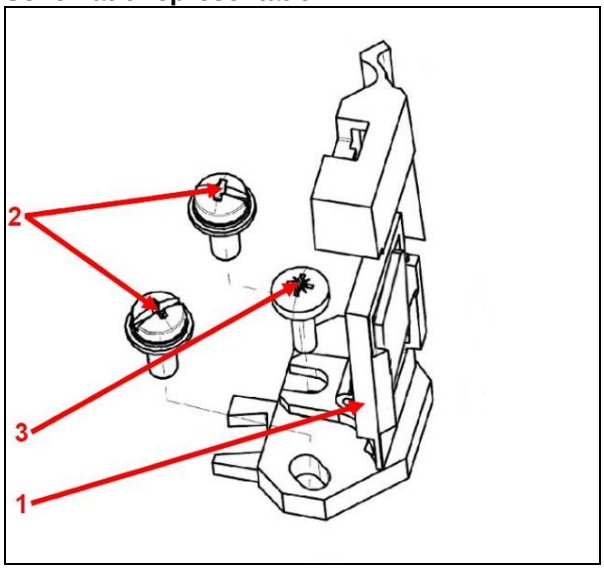
***Note:** When you tighten the two screws (4), make sure that the filter wheel holder (2) does not rotate.*
After you replace the component, check that the filter wheel runs freely and you cannot hear any rubbing noises.

To assemble, follow points one to eight in reverse order.

4.7.9 Beam splitter mirror

CAUTION during cleaning and maintenance — please refer to section 6.2 How to handle and clean the optical components on page 89.

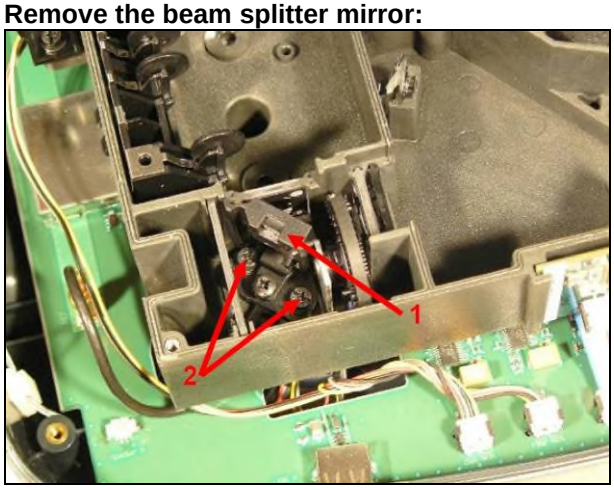
Schematic representation:



1 - Beam splitter mirror (LZV755)
2 - Combi screw M3x8-Z1-3-8.8-R2R (included in LZV884)
3 - Cross-recessed pan head screw,sw M3x8 (included in LZV884)

CAUTION: Do not touch the optical surface with your fingers!
CAUTION: After replacing the component, the adjustment of the beam path must be checked! (Refer to Adjust the beam path Seite 83)

Remove the beam splitter mirror:

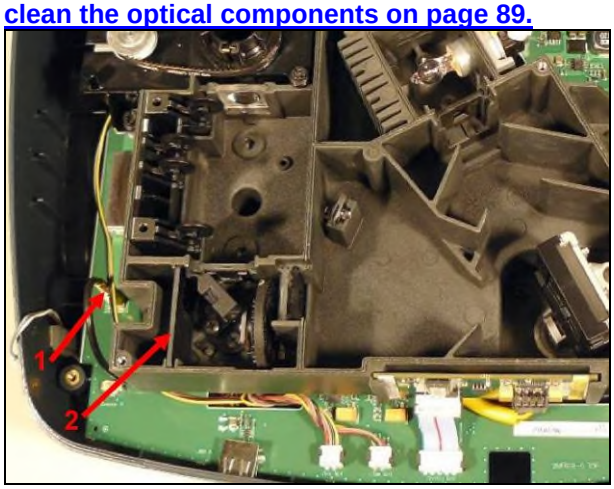


1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the cell compartment (refer to 50 mm cell compartment on page 69)
5. Open the beam path (Open the beam path on page 69)
6. Remove the 2 screws (1) from the beam splitter mirror (3).
7. Remove the beam splitter mirror (3)

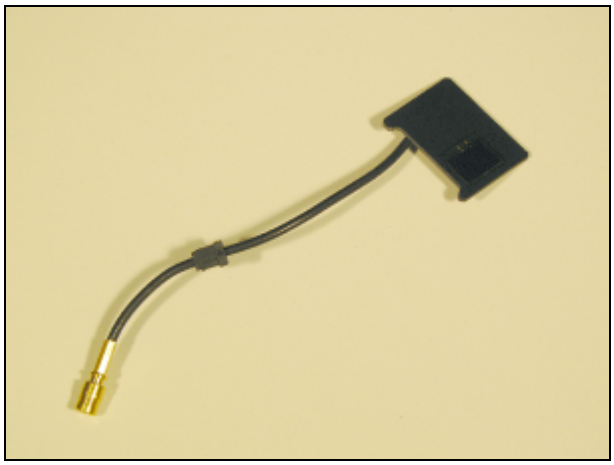
To assemble, follow points one to seven in reverse order.

4.7.10 Reference PCB

CAUTION during cleaning and maintenance — please refer to section 6.2 How to handle and clean the optical components on page 89.



1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the cell compartment (refer to 50 mm cell compartment on page 69)
5. Open the beam path (Open the beam path on page 69)
6. Remove the plug (1) for the reference PCB (2) from the main board.

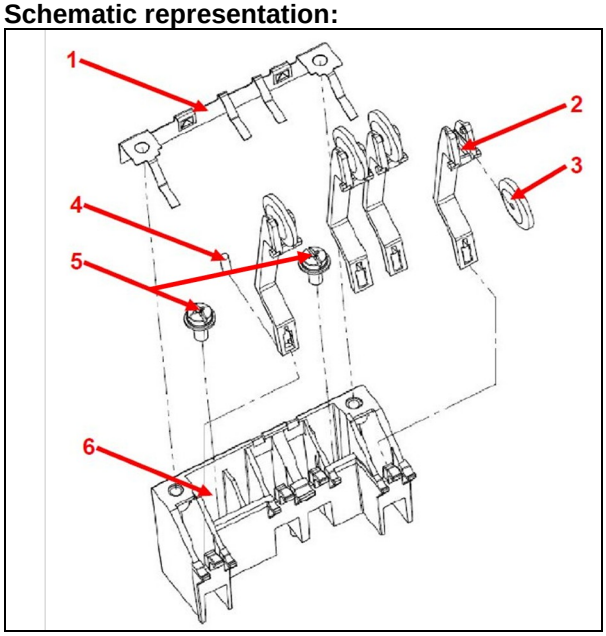


7. Remove the grommet (3) from the beam path chassis.
8. Pull the reference PCB (2) upwards to remove from the beam path chassis.

To assemble, follow points one to eight in reverse order.

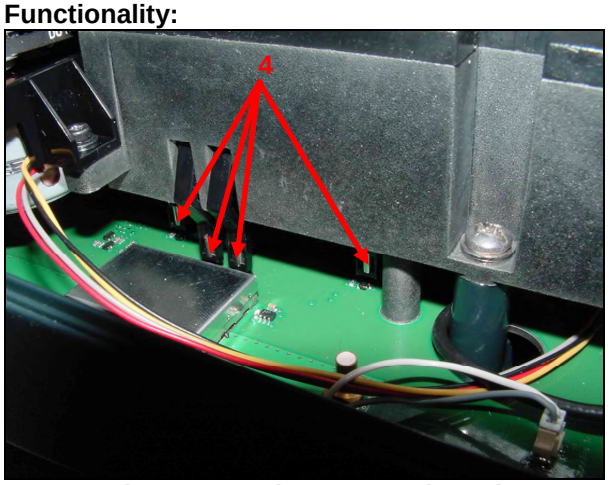
4.7.11 Rectangular cuvette detection

Schematic representation:



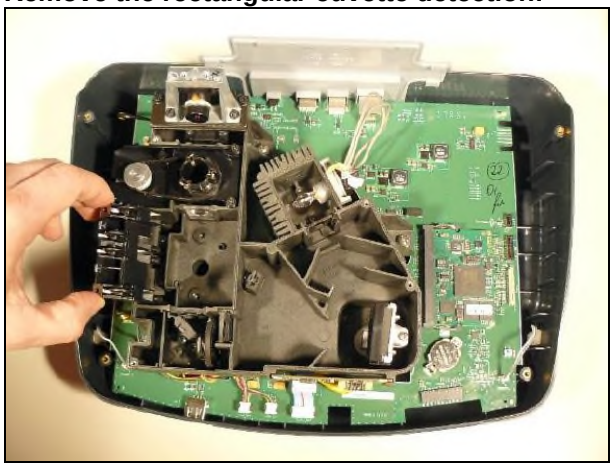
1 - Flat spring (included in LZV868)
2 - 4 levers (included in LZV868)
3 - 4 rollers (included in LZV868)
4 - 4 magnets, cylinders (included in LZV868)
5 - 2 combi screws M3x8-Z1-3-8.8-R2R (included in LZV868)
6 - Holder (included in LZV868)

Functionality:



The status of the individual levers is detected using the 4 magnets (4) via hall-effect switch modules on the main board. The status of the hall-effect switch modules can be queried in the testprogram. According to the switching statuses, the instrument detects the adapter in use and the cuvettes used in the 50 mm cell compartment (refer to Cuvette detection on page 43).

Remove the rectangular cuvette detection:

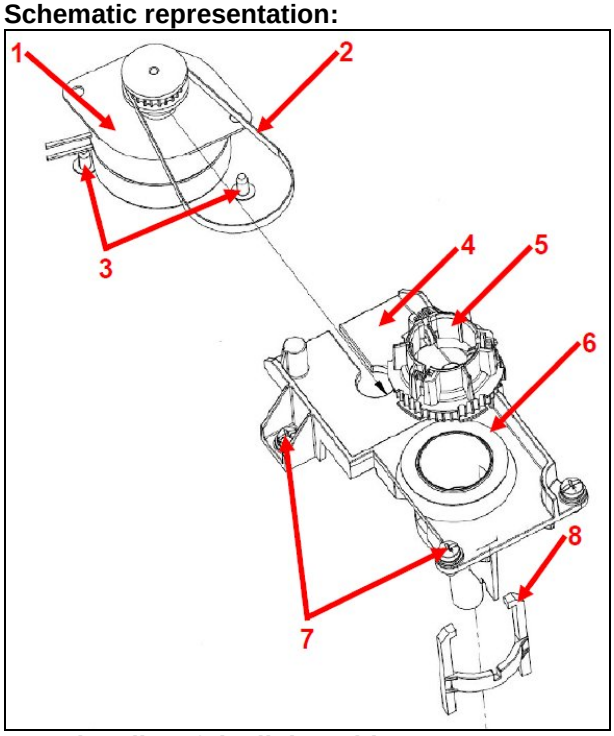


1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the cell compartment (refer to 50 mm cell compartment on page 69)
5. Open the beam path (Open the beam path on page 69)
6. Remove the 2 screws (5).
7. The rectangular cuvette detection can now be completely removed.

To assemble, follow points one to seven in reverse order.

4.7.12 Round cell compartment with drive and cuvette detection light guide

Schematic representation:

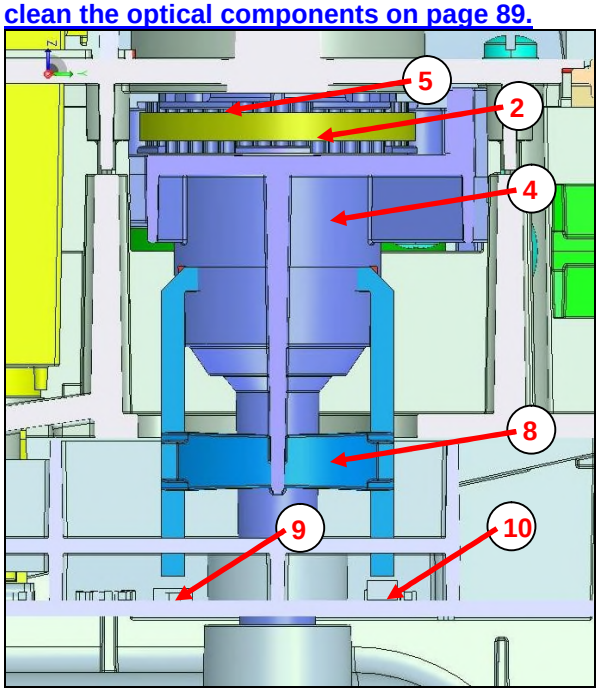


1 - Motor (LZV850)
2 - Toothed belt (76 teeth) (LZV594)
3 - Screw for plastic 3.0 x 6 (included in LZV884)
4 - Round cuvette holder (LZV861)
5 - Driving collar Dm 16/13 mm (A23757)
6 - Adjusting washer (included in LZV884)
7 - Combi screw M3x8-Z1-3-8.8-R2R (included in LZV884)
8 - Cuvette detection light guide (LZV866)

CAUTION: Do not touch the optical surface with your fingers!

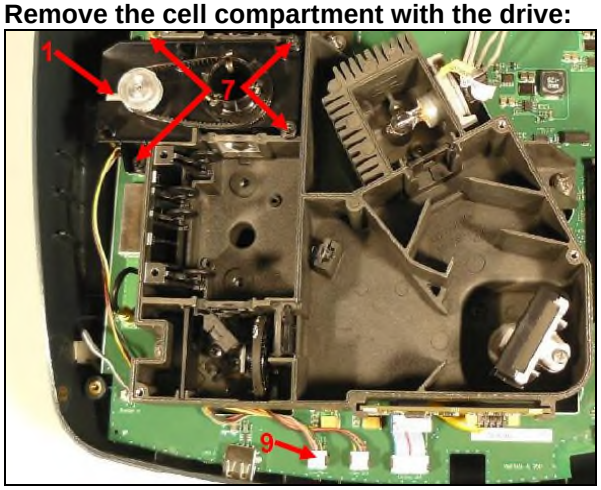
Functionality of the light guide:

CAUTION during cleaning and maintenance — please refer to section 6.2 How to handle and clean the optical components on page 89.



The light guide is used for cuvette detection in the 13 mm or 16 mm cell compartment. The light from the LED (10) on the main board is conducted via the light guide (8) through the cell compartment (4) and back via the light guide (8) to an Si photodiode (9) on the main board. The level of the Si photodiode (9) is used to evaluate the cuvette detection (refer to Cuvette detection on page 43).

Remove the cell compartment with the drive:



1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the cell compartment (refer to 50 mm cell compartment on page 69)
5. Open the beam path (Open the beam path on page 69)
6. Remove the plug (9) for the motor (1) from the main board.

Note: *To remove the plug, always use the Lumberg AZ30 pull-off tongs (LZV882)!*

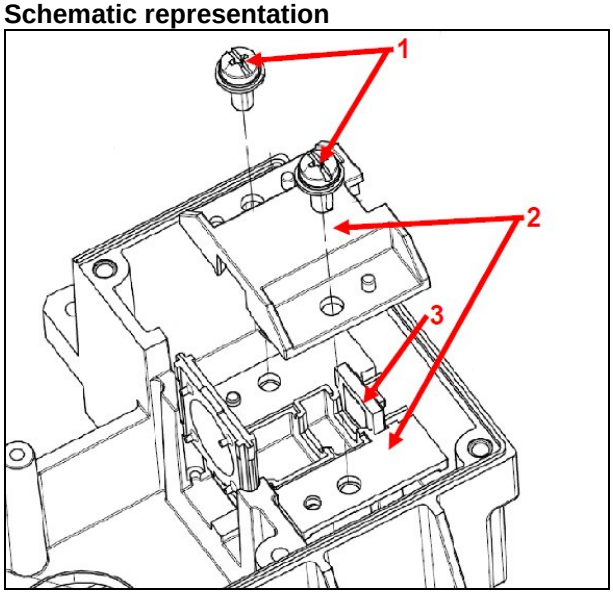
7. Remove the 4 screws (7).
8. The round cell compartment, together with the drive, can now be completely removed.
9. You can now dismantle the assembly according to the schematic diagram and replace individual components.

To assemble, follow points one to nine in reverse order.

4.7.13 Measurement sensor

CAUTION during cleaning and maintenance — please refer to section 6.2 How to handle and clean the optical components on page 89.

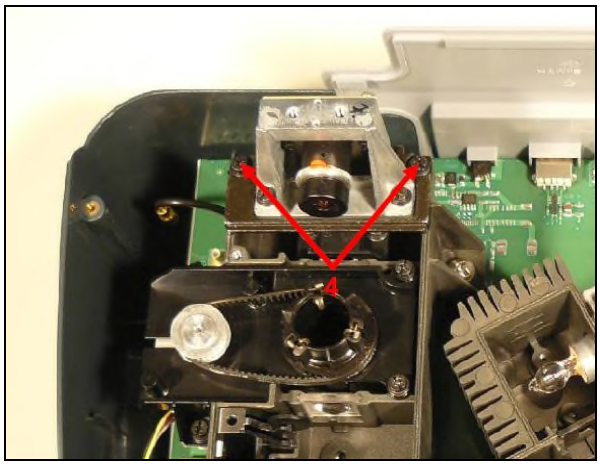
Schematic representation



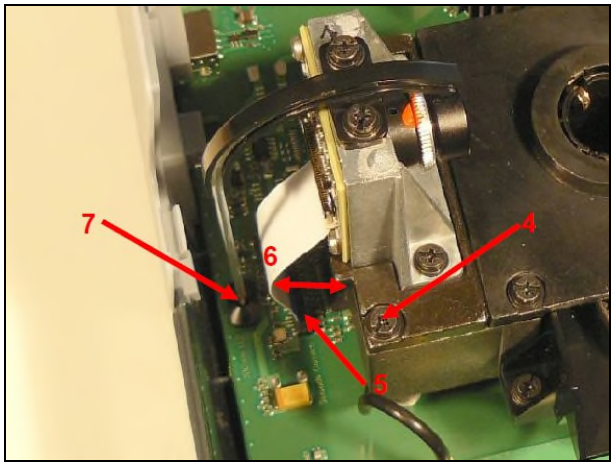
1 - Combi screw M3x8-Z1-3-8.8-R2R (included in LZV884)
2 - Scattered light trap
3 - Measurement sensor (LZV612)

CAUTION: Do not touch the optical surface with your fingers!

Remove the measurement sensor



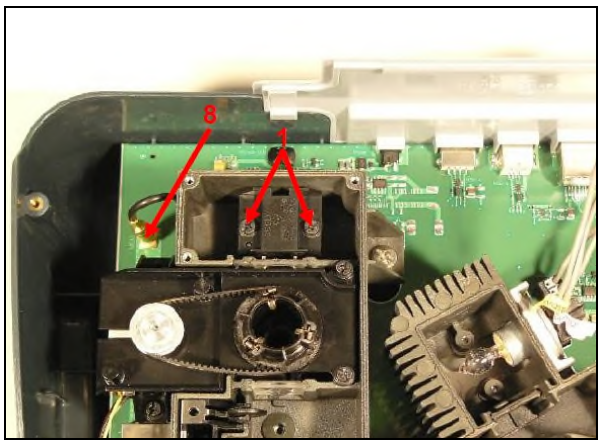
1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the cell compartment (refer to 50 mm cell compartment on page 69)
5. Open the beam path (Open the beam path on page 69)
6. Remove the 2 screws (4) from the camera bracket.



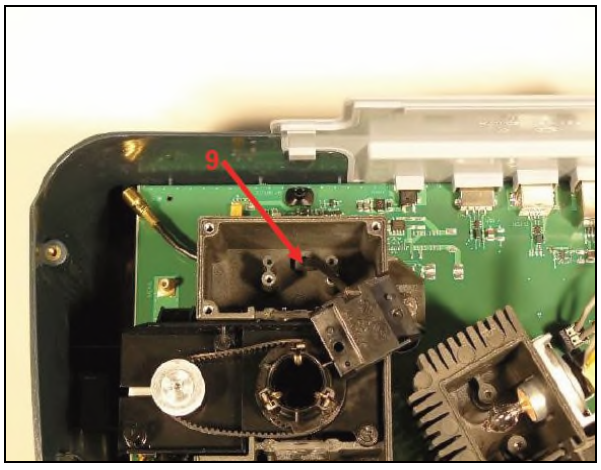
7. Remove the electrical contact (5) for the camera from the main board

During assembly, make sure that the curvature (6) that occurs in the camera connector points away from the beam path.
During assembly, make sure that the light guide is fed into the housing intended for the light guide (7) on the main board.

8. Remove the camera together with the camera bracket.



9. Remove the 2 screws (1).
10. Remove the plug (8) for the measurement sensor from the main board.
11. Remove the 2 screws (1).



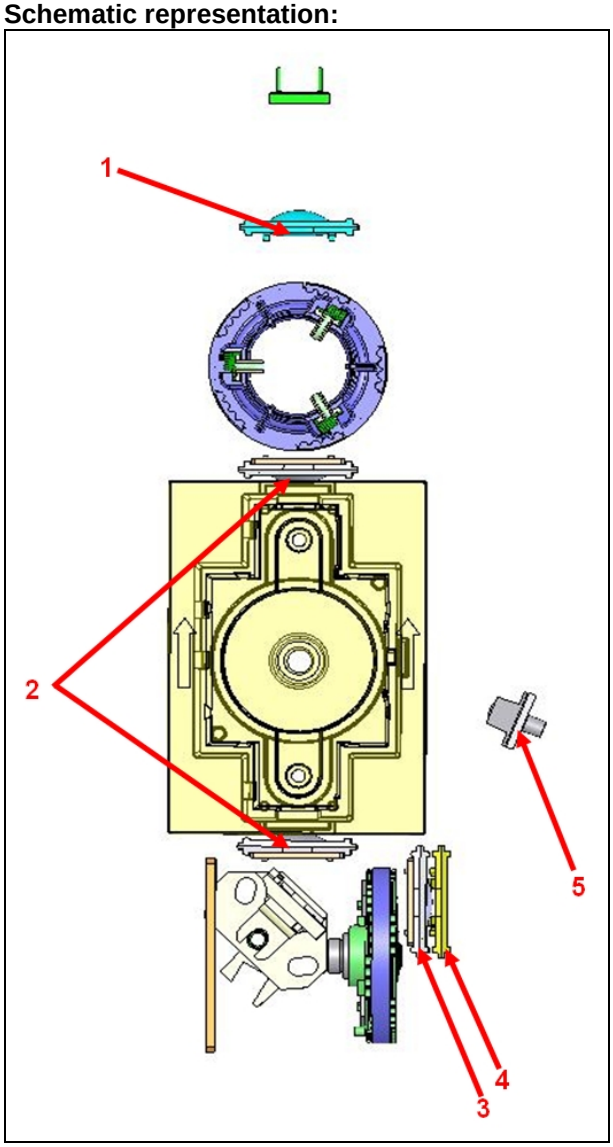
12. Pull the whole scattered light trap and the measurement sensor upwards and remove from the beam path chassis.
13. Remove the grommet (9) from the beam path chassis.
14. You can now dismantle and replace the assembly according to the schematic diagram.

To assemble, follow points one to fourteen in reverse order.

4.7.14 Lenses and zero order light guides

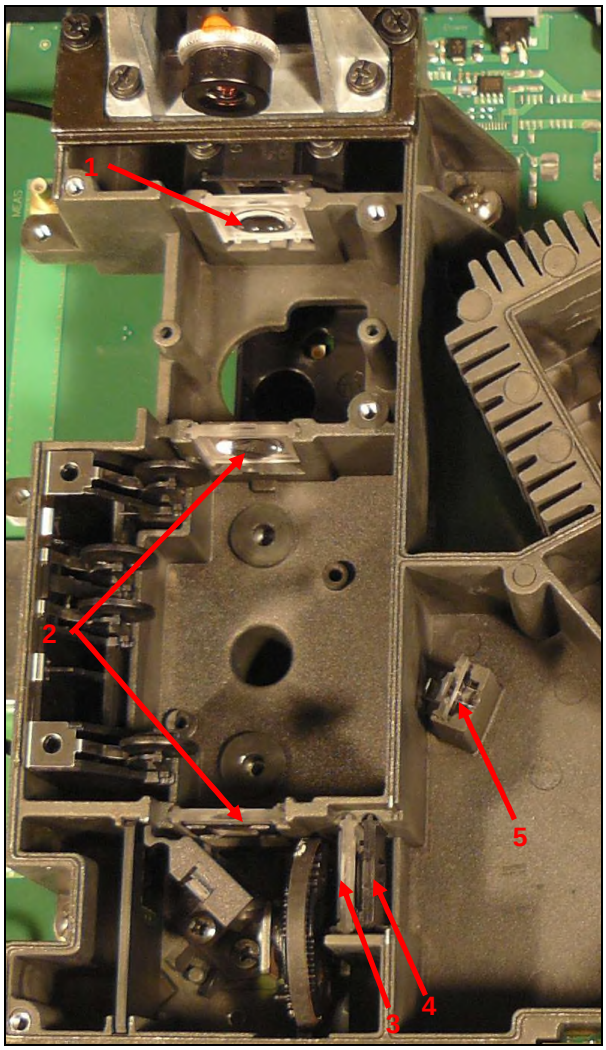
CAUTION during cleaning and maintenance — please refer to section 6.2 How to handle and clean the optical components on page 89.

Schematic representation:



1 - Lens C (included in LZV587)
2 - Lens A (included in LZV587)
3 - Lens B (included in LZV587)
4 - Exit slit
5 - Zero order light guide (LZV865)

Removal:



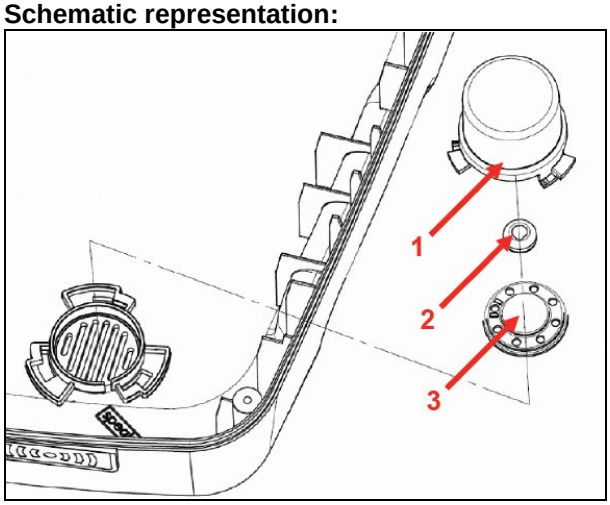
1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the cell compartment (refer to 50 mm cell compartment on page 69)
5. Open the beam path (refer to Open the beam path on page 69)
6. Remove the round cell compartment with drive (refer to Round cell compartment with drive and cuvette detection light guide on page 77)
7. The individual lenses and the zero order light guides can now be removed by lifting them upwards.

CAUTION: Do not touch the active optical surfaces with your fingers!

To assemble, follow points one to seven in reverse order.

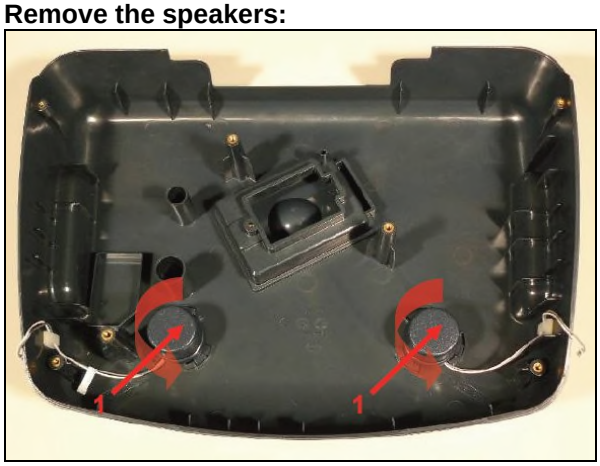
4.8 Speakers

Schematic representation:

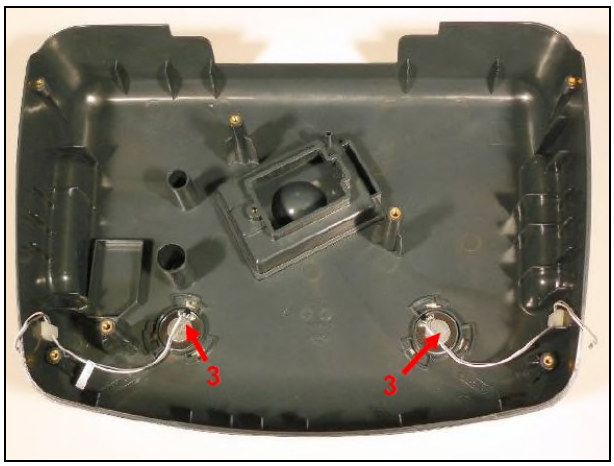


1 - Resonator
2 - Grommet, black
3 - Speaker (LZV869)

Remove the speakers:



1. Open the instrument (refer to Open the instrument on page 59).
2. Remove the display assembly (refer to Display assembly on page 61)
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the complete beam path from the lower part of the housing (refer to Removal of the beam path with main board on page 67).
5. Turn the resonators (1) for which the speakers (3) are to be replaced in an anti-clockwise direction and remove them.



6. The speakers (3) can now be replaced.

To assemble, follow points one to six in reverse order.

5 Adjust the beam path

5.1 General

This instrument contains plastic lenses that cannot be cleaned. If necessary, dust particles can be removed using oil-free compressed air or using the bellows. This instrument also has integrated light guides (LZV865 & LZV866 & LZV867), which must be handled with great care. Do not touch the active optical surfaces! (refer to section CAUTION during cleaning and maintenance — please refer to section 6.2 How to handle and clean the optical components on page 89.

For adjustment that complies with manufacturer's instructions, follow the steps in the order below. This guarantees that the beam path is optimally aligned.

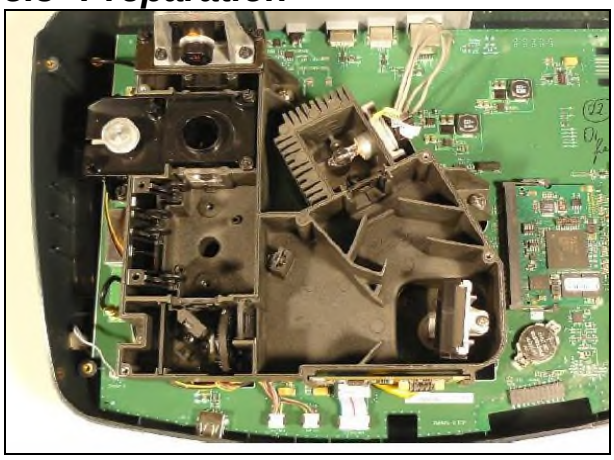
For service purposes, a quick adjustment option is available. If it is only ever single components that are removed or replaced, it is sufficient to adjust the replaced component only. To enable this, the beam position is correctly set on the optical component, which follows the element to be adjusted.

Tip: If all optical components are to be removed, the manufacturer recommends that these are processed step-by-step (remove, clean, install, adjust, next element, and so on) and one by one, starting with the lamp housing and working through to the measurement sensor.

5.2 Required materials

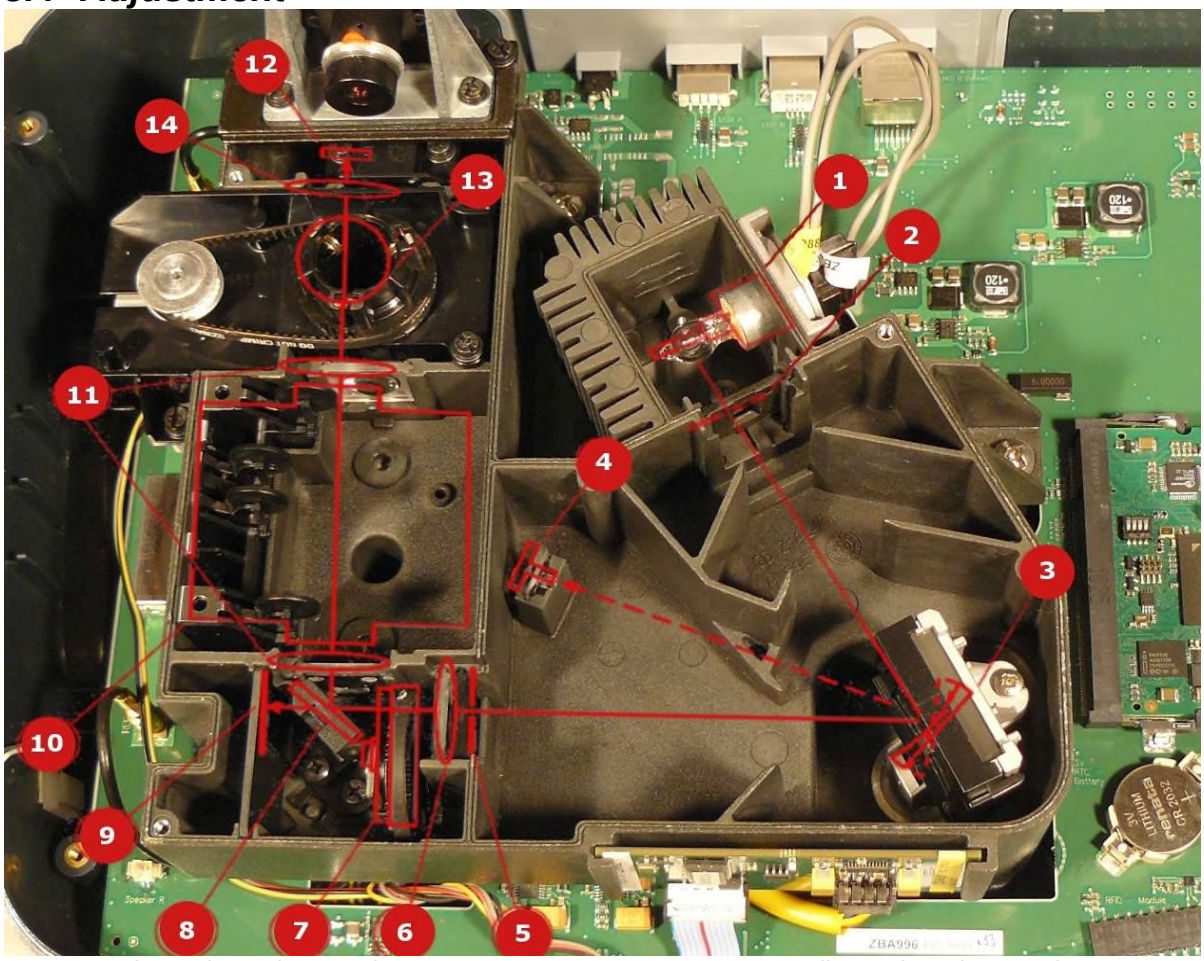
- VAA840 50 mm adjustment shield
- VAA608 USB stick with check program
- Narrow strips of paper

5.3 Preparation



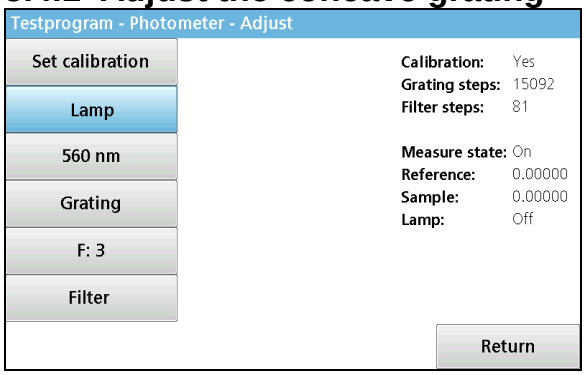
1. Open the instrument (refer to Open the instrument on page 59).
2. Tip the display assembly carefully to the right and place it on its side on the lower part of the housing (refer to Display assembly on page 61).
3. Remove the cross rail with the sample chamber slide (refer to Cross rail on page 62).
4. Remove the cell compartment (refer to 50 mm cell compartment on page 69)
5. Open the beam path (Open the beam path on page 69)
6. Switch on the instrument
7. Start the customer service menu (refer to Customer service menu on page 24).

5.4 Adjustment

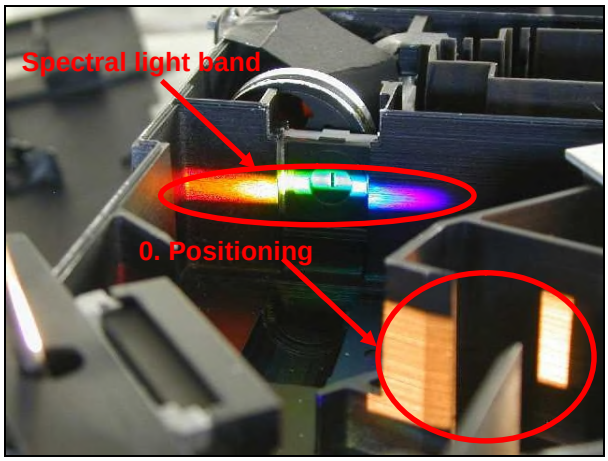


1 - Halogen lamp (LZV565)
2 - Entry slit
3 - Concave grating (LZV592)
4 - Zero order light guide (LZV865)
5 - Exit slit
6 - Lens B (included in LZV587)
7 - Filter wheel (LZV591)
8 - Beam splitter mirror (LZV755)
9 - Reference element (YAB083)
10 - Cell compartment (2) for rectangular cuvettes
11 - Lens A (included in LZV587)
12 - Measurement element (LZV612)
13 - Cell compartment (1) for round cuvettes
14 - Lens C (included in LZV587)

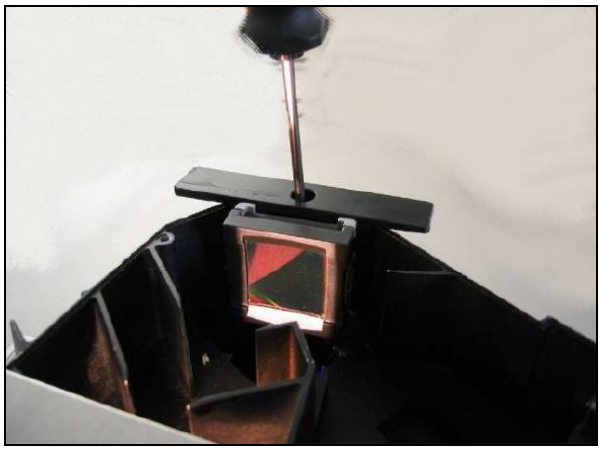
5.4.1 Adjust the concave grating



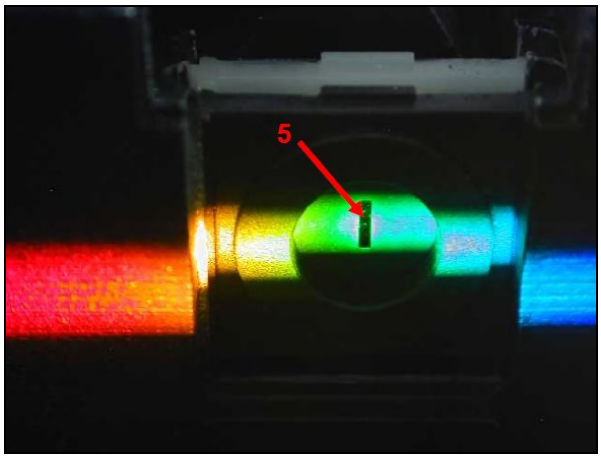
1. In the Testprogram, select the menu option Photometer→ Adjust
2. Select "Lamp" to switch on the lamp (refer to Adjust on page 42).



3. The grating (3) is set (Photometer → Adjust → Grating refer to Adjust on page 42, menu option "Grating"), so that the spectral light band falls with the green light on the exit slit (5).

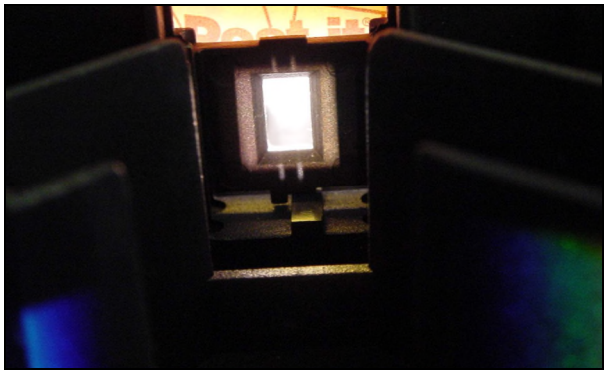


4. Now use a screwdriver to turn the adjustment screw.



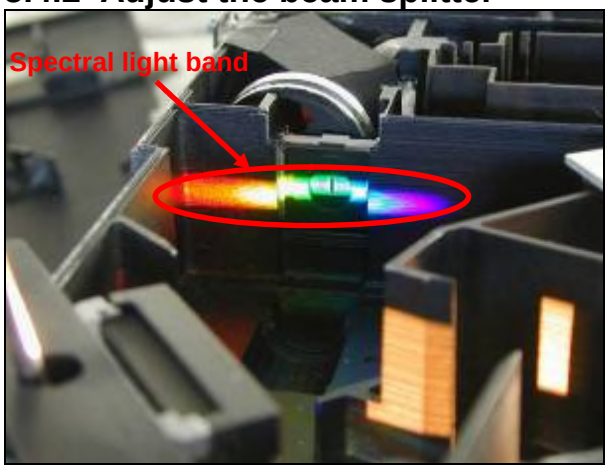
5. Initially, the spectral light band is below the exit slit (5). First rotate the spectral light band over the slit, and then rotate so that the beam shines on the exit slit (5) equally at the top and bottom.

Note: *The rotation stabilizes and releases the grating holder!*

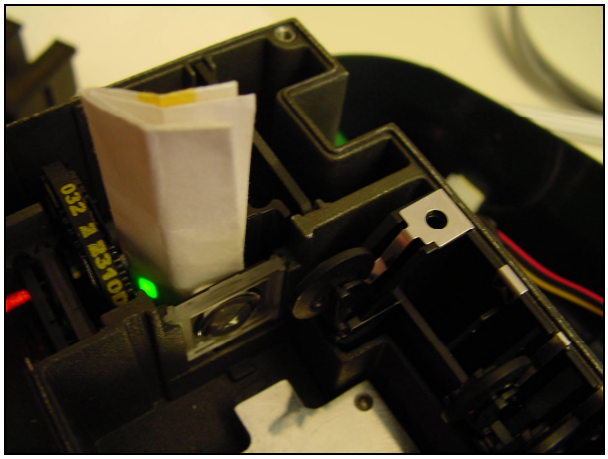


6. To check the adjustment, rotate the grating towards the lamp. The reflected light should meet the lamp at the same height again → The light should shine at a symmetrical height on the lamp aperture/entry slit (2). If the reflection does not shine on the aperture at the top and bottom, the height adjustment of the grating (VAA643) when it was installed was not successful and must be repeated (refer to Repairs →Concave grating, from on page 70).

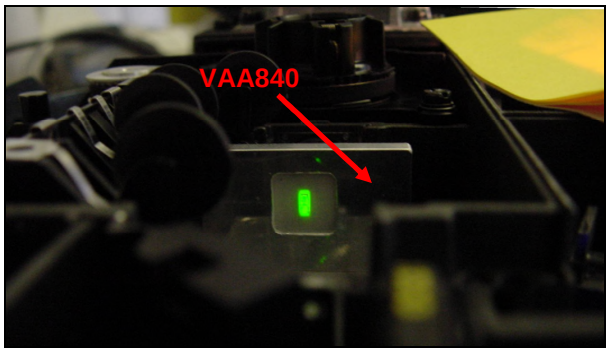
5.4.2 Adjust the beam splitter



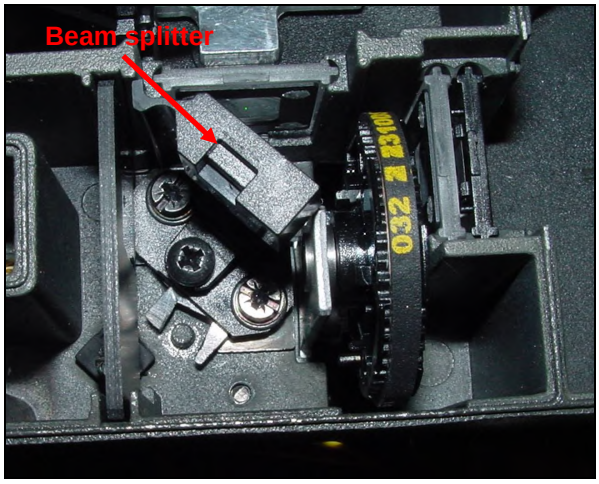
7. The grating is positioned so that from the spectral light band, the green light falls on the exit slit (Photometer → Adjust → Grating refer to Adjust on page 42, menu option "Grating").



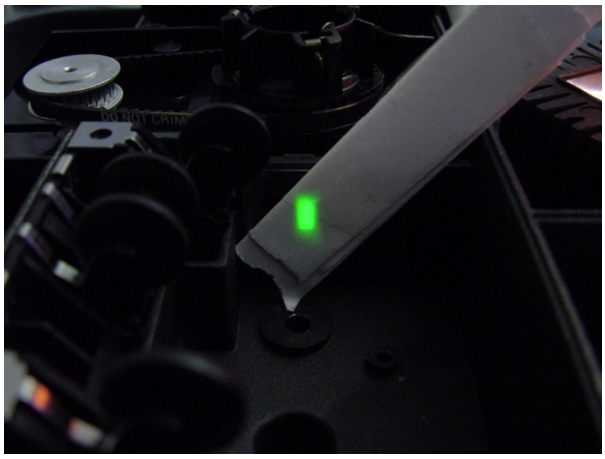
8. The filter wheel (7) is positioned so that the green light falls on the beam splitter (8) (Photometer → Adjust → Filter refer to Adjust on page 42, menu option "Filter"). The light must fall through the center of the filter and must not be cut off at the top or bottom. (The best way to test this is to use a piece of paper.)



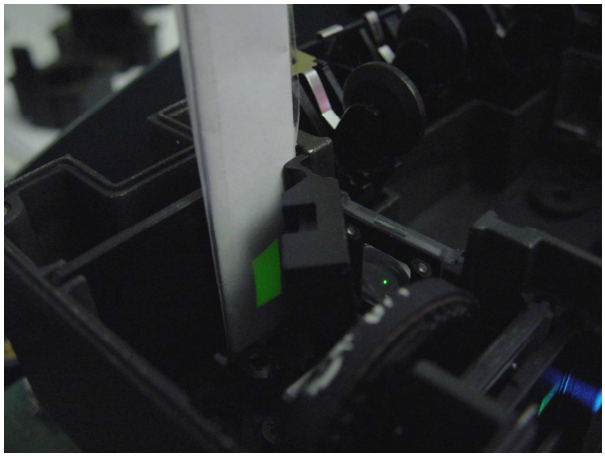
9. The adjustment shield VAA840 must be set to the position of the 50 mm cell compartment. The beam must hit the center of the raised marking.



10. To adjust the beam splitter, tip the beam splitter and turn it sideways:
11. To make sideways adjustments, both outside screws must be released. The beam splitter is rotated to the correct position and attached using both outside screws.
12. The single central screw is used for height adjustment.



13. If the beam is precisely aligned using the adjustment shield and the beam splitter is screwed into place, the central illumination of all lenses must be checked (using a piece of paper).



14. Finally, check the reference element to make sure that the beam hits the active surface sufficiently (using a piece of paper).

6 Inspection

6.1 Inspection process

An inspection interval of 12 months is recommended.

What?	How?
1. Check the housing for signs of damage and/or contamination.	Visual inspection
2. Update to the latest version of the user program	Check the user program version number: "System Check →Instrument information" (also refer to section 3.3 Instrument information on page 19) Execute the update (refer to section 3.6.8.2 Update on page 58)
3. Replace the following components:	
4. Lenses (LZV587)	Refer to section 4.7.14 Lenses and zero order light guides on page 80
5. Driving collar (A23757)	Refer to section 4.7.12 Round cell compartment with drive and cuvette detection light guide on page 77
6. Check for any contamination of the following components and, if necessary, clean according to instructions.	
a. Filter (in the filter wheel)	Visual inspection and, if necessary, clean according to instructions (refer to section 6.2 How to handle and clean the optical components on page 89)
b. Beam splitter mirror	Visual inspection and, if necessary, clean according to instructions (refer to section 6.2 How to handle and clean the optical components on page 89)
c. Receiver	Visual inspection and, if necessary, clean according to instructions (refer to section 6.2 How to handle and clean the optical components on page 89)
d. Grating	Visual inspection and, if necessary, clean according to instructions (refer to section 6.2 How to handle and clean the optical components on page 89)
7. Photometric test of the instrument.	Refer to section 6.4 Field Service Insp. on page 106
8. Start up the instrument in the UI. Enter the current date under "Last inspection" in the user program.	Refer to section 3.4 Service times on page 21
9. The archive file 'Logger_LPG440:xxxxxxx.tar.gz' was automatically copied to VAA608 after the field service inspection. Please send the complete archive file 'Logger_LPG440:xxxxxxx.tar.gz' to e-mail account: InstrumentLogger@hach-lange.de.	Refer to section 3.6.8.1Event logger on page 56

6.2 How to handle and clean the optical components

6.2.1 General

As a general rule, all optical components must be handled with the utmost care. Do not touch the components on the active optical surfaces. Direct contact with other parts must also be avoided. Use aids such as plastic forceps and gloves if necessary.

6.2.2 Required materials

- EZZ046 Plastic forceps
- EZZ043 Latex disposable gloves, size S (6–6.5)
- EZZ044 Latex disposable gloves, size M (7–7.5)
- EZZ045 Latex disposable gloves, size L (8–8.5)
- EZZ002 Disposable paper tissues precision wiping cloths
- Cotton swabs
- Glass cleaner

6.2.3 Clean

The method of cleaning the optical components varies according to the degree of contamination. First, always perform the recommended cleaning procedure. If this is not successful, use an alternative cleaning method.

Optical component	Recommended cleaning method	Alternative cleaning method
Zero order light guide (LZV865)	Clean with oil-free air	Cotton swabs and glass cleaner
Filter wheel (LZV591)	Clean with oil-free air	Cotton swabs and glass cleaner
Beam splitter mirror (LZV755)	Clean with oil-free air	Cotton swabs and glass cleaner
Camera illumination light guide (LZV867)	Clean with oil-free air	Cotton swabs and glass cleaner
Cuvette detection light guide (LZV866)	Clean with oil-free air	Cotton swabs and glass cleaner
Concave grating (LZV592)	Clean with oil-free air	
Reference and measurement element (YAB083/LZV612)	Clean with oil-free air	
Lenses A, B, C (LZV587)	Replace during the inspection	Clean with oil-free air

6.3 Hardware check (service)

6.3.1 General

WARNING, the manufacturer recommends that you perform a complete hardware check (service) following every component replacement.

The hardware check (service) is used to test the main functions of the hardware of the instrument. This is a menu-guided testprogram that performs a self-check of the DR 3900. The user is guided step-by-step through the program.

When you start the hardware check, optional tests can be deselected. These are indicated with [optional] in the description of the individual tests under 6.3.5 Tests performed on page 92. It is always recommended to perform the full hardware check.

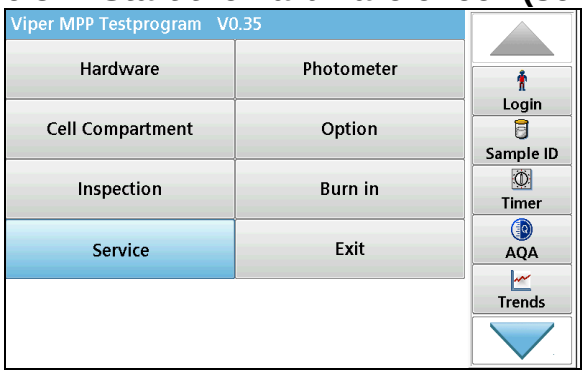
6.3.2 Required materials

- VAA608 USB stick with check programs
- VAA591 Verification kit
- VAA896 RFID operator TAG
- VAA880 Test cuvette with 2D code label (for Adjust 2D code camera system)
- VAA897 Adapter 13 mm/16 mm (for positioning the VAA880)
- LZX998 Ethernet cable, 2 m, crossover
- XLH926 USB — connection cable (host/device)
- PC/Notebook with Ethernet interface

6.3.3 Preparation

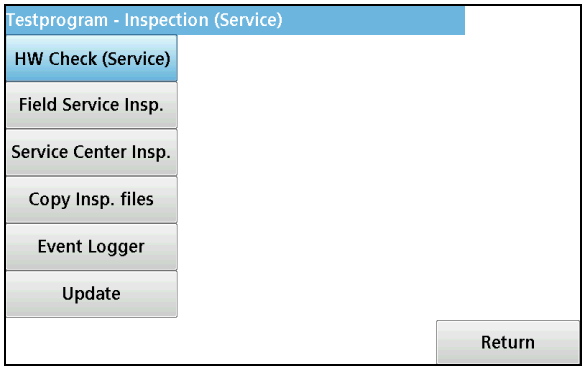
- Connect the USB connection cable to the two USB ports (host/device) at the rear.
- Connect the Ethernet cable between the PC/Notebook and the Ethernet port at the rear of the instrument.
- Connect the VAA608 (USB memory stick) to the front USB port (host).
- Connect the plug-in power supply (15 V/2.7 A) to the rear power socket.

6.3.4 Start the hardware check (service)



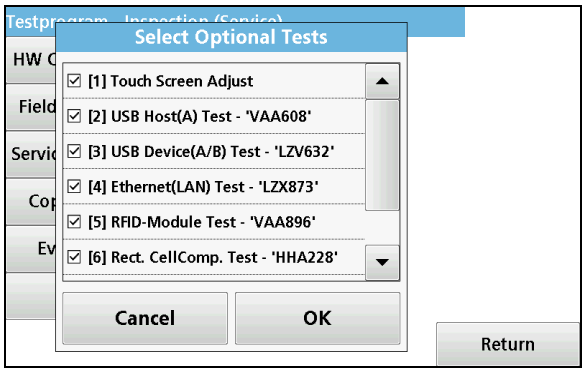
Start the testprogram (refer to 3.6.2 Start on page 24)

In the Testprogram main menu, press "Service".



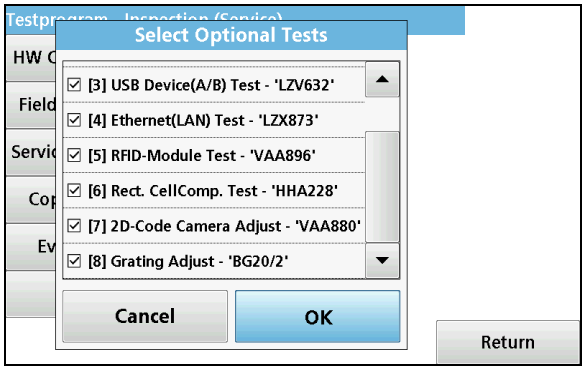
In the display, the menu "Testprogram — Inspection (Service)" is shown.

In the Testprogram — Inspection (Service) menu, press "HW Check (Service)"

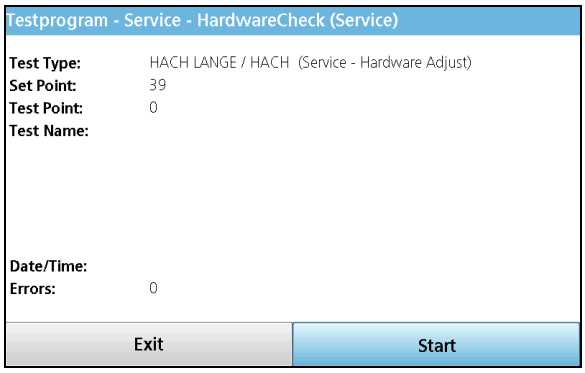


A selection list of optional tests is shown. The displayed tests can be individually deselected as required. These are indicated with [optional] in the description of the individual tests under 6.3.5 Tests performed on page 92.

It is always recommended to perform the full hardware check.



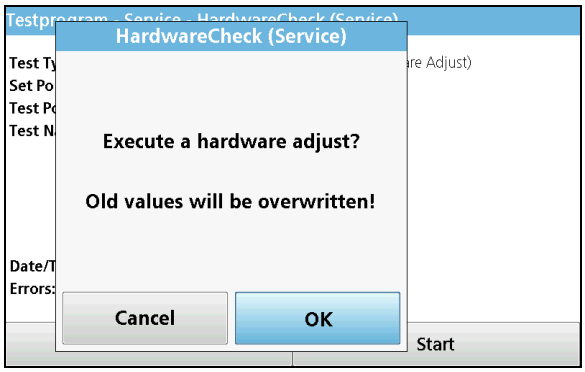
Press "OK"



The "Testprogram — Service — hardwareCheck (Service)" menu is shown in the display.

Press "Exit" to return to the "Testprogram — Inspection(Service)" menu.

Press "OK"



The message "Execute a hardware adjust? Old values will be overwritten!" is shown.

Press "Cancel" to return to the "Testprogram — Inspection(Service)" menu.

Press "OK" to start the hardware check. This is a menu-guided program. The user is guided step-by-step through the program. All tests under 6.3.5 Tests performed (that have not previously been deselected) are processed in sequence.

6.3.5 Tests performed

The following tests run automatically:

1. **Query the RFID configuration of the device (with/without RFID module) [optional]**

   This is where the hardware configuration is set. For the DR3900, there are device variants with and without a connected RFID module.

   (Also refer to section 3.6.7.2 Definitions on page 51 menu option "Configuration")

2. **Initialization: Resets all calibration values (to the default setting)**

   ***Note:** The photometric alignment data is not set to default values.*
   Only after changing the grating motor (ZDA500) will all data in the EEPROM be set to default values when starting the hardware check. After starting the hardware check, perform a complete (error-free) test run to ensure instrument function in all application cases.

3. **Touch Screen Adjust including Touch Screen Position Test** [optional]

   (Also refer to section 3.6.4.2 Touch on page 28 menu options Adjust and Touch Test)

4. **Set the RTC (Day/Month/Year — Hours/Minutes)**

   (Also refer to section 3.6.4.4 RTC (Real Time Clock) on page 29 menu option "Set time")

5. **DC/DC transformer (power supply)**

   - VCC (5.3 V) — General power supply to the periphery
   - AVCC (5.0 V) — Analog range positive power supply
   - AVEE (-0.65 V) — Analog range negative power supply
   - VM (18 V) — Motor driver ICs power supply

   (also refer to section 3.6.4.7 Option (Power) on page 31 Display window)

6. **Display Test (Pixel/Color/Brightness/Backlight On/Off)**

   (Also refer to section 3.6.4.1 Display on page 26 menu option "Display Check")

7. **StandBy test mode (Standby LED (yellow)/PowerOn LED (green))**

8. **Sound (Test tone 2 x left/3 x right)**

   (Also refer to section 3.6.4.3 Sound on page 28 menu option "Option (L/R Testsound)")

9. **I2C Bus Test**

10. **Temperature measurement @sensor main board (near the lamp housing)**

    - Check the ambient temperature (15 °C < temperature @sensor main board < 60 °C)

    (Also refer to section 3.6.5.1 AD on page 33 Display window: Lamp [°C])

11. **RTC battery test (Buffer battery voltage > 1.95 V)**

    (also refer to section 3.6.4.4 RTC (Real Time Clock) on page 29 Display window: Battery [V]:)

12. **USB host test (USB memory stick)** [optional]

    (also refer to section 3.6.4.5 USB on page 30)

13. **USB Device Test (USB connection cable between USB host and USB device port)** [optional]

    (also refer to section 3.6.4.5 USB on page 30)

14. **Ethernet Test (Ethernet cable between PC /Notebook and the Ethernet port)** [optional]

    (also refer to section 3.6.4.6 Ethernet on page 30)

15. **Test switch-on button ("Not pressed" status)**

    (Also refer to chapter 3.6.4.7 Option (Power) on page 31 Screen: Power switch:)

16. RFID module test @RFID module (YAB120) [optional]

Note: Not performed for devices that are configured without RFID.

(also refer to section 3.6.6.4 RFID on page 48 menu options)

Tests performed:

- Serial interface to module (Read version; read S/N).
- Initialize a TAG (read header).
- Read/write test for TAG (test bytes on VAA896 write and read back).

17. Test rectangular cuvette detection [optional]

(also refer to section 3.6.6.1 Cuvette detection on page 43)

Tests performed:

- Test empty cell compartment
- Insert cuvette adapter "A"

Note: The switches "10 mm cuvette" and "1 inch round cuvette" are tested later

18. Lid detection (Open status/Closed status)

(also refer to section 3.6.6.1 Cuvette detection on page 43 Display window: lid:)

19. Round cuvette detection (calibration) @round cuvette sensor [optional]

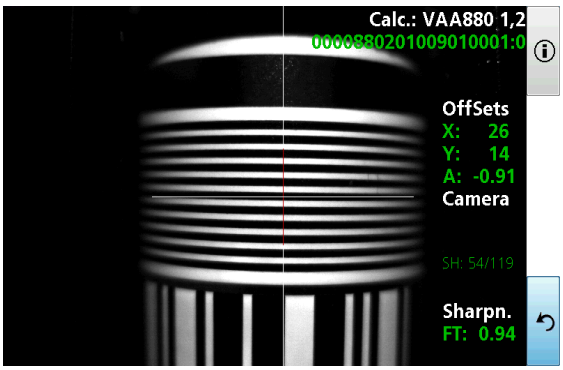
(also refer to section 3.6.6.1 Cuvette detection on page 43)

Tests performed:

- Test dark value (RK LED off : voltage @round cuvette sensor < 0.1 V)
- Check the light/dark difference
  (RK LED Off/On : 0.2 V < Difference @round cuvette sensor < 3.5 V)
- Check the ambient temperature (11 °C < temperature @sensor main board < 52 °C)
- Perform calibration (RK LED Off/On: Difference @round cuvette sensor — 20% ; Temperature @sensor main board)

20. 2D code camera calibration with VAA880 @camera module [optional]

(Also refer to section 3.6.6.3 Camera on page 45 menu option: Basic Functions →Adjust VAA880)



Please wait until the values have stabilized and are green.

Then press the arrow at the bottom right of the screen.

Tests performed:

- Insert VAA880 (2D code adjust cuvette) plus VAA897 (adapter for 13 mm/16 mm cell compartment)
- Detect round cuvette
- Read 2D code marker with default values
  (Determine the angle of the marker in front of the camera)
- Decode the 2D code with default values (code: 0000880201009010001)
- Place the VAA880 in front of the bar code
- Perform the calibration/test (shutter/X-position/Y-position/sharpness)

21. 2D code camera calibration with VAA880 @camera module [optional]

(also refer to section 3.6.6.3 Camera on page 45)

Please press the arrow at the bottom right of the screen.

Tests performed:

- Read 2D code marker with adjust values (Determine the angle of the marker in front of the camera)
- Decode the 2D code with adjust values (code: 00008802010090100001)
- Display the 2D code (shutter/angle/correction attempts)

22. Initial calibration of the beam path with default values

Note: *The following description applies for all calibration processes of the beam path. The details are described below. The calibration is required to determine zero position of filter motor and grating motor. These preset positions are used to set the photometer (monochromator) to the selected wavelength together with the required blocking filter.*

Tests performed:

- Check light from halogen lamp @zero order sensor
  - Halogen lamp OFF: Voltage @zero order sensor < 1.0 V
    Logger [33,1]
  - Halogen lamp ON: Difference @zero order sensor > 0.15 V
    Logger [33,2]
- Set lamp voltage of halogen lamp to approximately 6.0 V; Halogen lamp ON
- Find zero order (white light) @zero order sensor ; grating motor is rotated by a maximum of 360°
  - Threshold value @ zero order sensor > 0.8V (Adjust value)
    Logger [33,4]
- Place the grating motor in front of the zero order (white light) @zero order sensor
- Scan center from zero order (white light) @zero order sensor
  Logger [33,4]
  - Slopes of peak signal shall be reduced at least to 10% of max value.
- Set first position grating to approximately 600 nm in front of the monochromator exit slit
  Logger [33,5]
- Find filter F3 on the filter wheel @reference sensor; filter wheel is rotated by a maximum of 360°
  Logger [33,6]
  - Threshold value @reference sensor signal change > 0.1V
  - Analyse scan signal regarding two peaks found? (for DR3900 filter F0 is open)
- Scan center of filter F3 @reference sensor
  Logger [33,7]
  - Slopes of peak signal shall be reduced at least to 10% of max value
- Save **zero stepmotor position for filter motor** (step marker for filter F0 position)
- Place filter motor for filter F2 behind exit slit (monochromator)
  Logger [33,8]
- Place grating motor zero order (white light) 50nm (150 steps) in front of exit slit (monochromator)
  Logger [33,9]
- Find zero order (white light) @reference sensor; grating motor is rotated by a maximum of 20°
  - Threshold value @reference sensor > 1.2V
    Logger *[33,11*]
- Scan center from zero order (white light) @reference sensor.
  - Slopes of peak signal shall be reduced at least to 10% of max value
    Logger *[33,11*]
- Save **zero stepmotor position for grating motor** (step marker for zero position grating)
- Set grating motor to 560 nm; position the filter wheel and potentiometer according to the wavelength

range (@lamp voltage; @reference sensor; @measurement sensor;)
Logger [33,12]

23. Dark values @reference sensor / @ measurement sensor

Tests performed:
- Halogen lamp OFF
- Set potentiometer @reference sensor to high amplification (poti value = 5)
- Check the dark value @reference sensor (voltage @reference sensor < 0.050 V)
- Set potentiometer @measurement sensor to high amplification (poti value = 5)
- Check the dark value @measurement sensor (voltage @measurement sensor < 0.050 V)

24. Function of potentiometer @reference sensor / @ measurement sensor

Tests performed:
- Halogen lamp ON / set 345 nm wavelength
- Set potentiometer @reference sensor to low amplification (poti value = 99)
- Check the light value (V1) @reference sensor (0.01 V < voltage @reference sensor < 2.5 V)
- Set potentiometer @reference sensor to medium amplification (poti value = 49)
- Check light value @reference sensor ((V1 * 1.7) < voltage @reference sensor < (V1 * 2.3))

Note: The above test is repeated with the same specification for @measurement sensor…

25. Grating Adjust with monochromator angle measurement [optional]

Tests performed:
- Detection of BG20/2 test cuvette (10 mm rectangular cuvette switch)
- Absorbance-Scan BG20/2 test cuvette (peak target: 807 nm ; scan range: 801 nm … 814 nm)
- Calculate new grating angle (check whether the grating value is plausible: 60° < grating angle < 63°)

26. Filter wheel mechanism test

Tests performed:
- Halogen lamp ON; set wavelength/filter to x
- Filter-Fast-Test @360 nm; 445 nm; 580 nm; 810 nm
- 20 full revolutions of the filter wheel (160 steps)
- Check the position of the filter wheel (@Filter3: +/- 2 steps)

27. Potentiometer Adjust @reference sensor; @measurement sensor; @lamp voltage

(Also refer to section 3.6.5.1 AD on page 33 menu option "Adjust Pot.")

Tests performed:
- Detection of 'Light Shield' was set
- Set the calibration wavelength (grating motor and filter wheel) calibration point 'x'
- Adjust potentiometer @lamp voltage to default 'x' (+/- 0.15 V)
- Adjust potentiometer @reference sensor to default 'x' (+/- 0.4 V)
- Adjust potentiometer @measurement sensor to default 'x' (+/- 0.4 V)

Note: the potentiometer alignment is performed for all alignment wavelengths (filter ranges): refer to table for default values…

Default wavelength	Filter number	Wavelength range	@Measurement sensor	@Reference sensor	@Lamp voltage
339	R0 (virtual)	320 nm … 339 nm	1.4 V	1.8 V	6.5 V
360	F1	340 nm … 374 nm	1.2 V	1.5 V	6.5 V
445	F2	375 nm … 479 nm	2.7 V	3.3 V	6.0 V
580	F3	480 nm … 699 nm	3.0 V	3.8 V	5.0 V
794	F4	700 nm … 794 nm	3.0 V	3.8 V	4.7 V
810	R5 (virtual)	795 nm … 1049 nm	2.7 V	3.4 V	4.7 V
1050	R6 (virtual)	1050 nm … 1100 nm	2.5 V	3.0 V	6.0 V

28. Test AD converter (24-bit ADC)

Tests performed:
- Adjust halogen lamp ON / set 445 nm wavelength
- Measure voltage @measurement sensor via 16-bit AD converter (V_16bit)
- Measure voltage @measurement sensor via 24-bit AD converter (V_24bit)
- Check values ((V_16bit * 0.9) < V_24bit < (V_16bit * 1.1))

29. Adjustment of level zero order (white light) @reference sensor

(Refer to section 3.6.5.3 Grating on page 38 menu option "Adjust Pot.")

Tests performed:
- Halogen lamp ON; put @lamp voltage to approximately 6.0 V
- Adjust 0 nm wavelength / set filter 2 behind exit slit
- Adjust potentiometer @reference sensor to voltage @reference sensor = 4.0 V (+/- 0.3 V)

30. Adjustment of level zero order (white light) @zero order sensor

(Refer to section 3.6.5.3 Grating on page 38 menu option "Adjust Pot.")

Tests performed:
- Halogen lamp ON; put @lamp voltage to approximately 6.0 V
- Search for zero order (white light) @zero order sensor; grating motor turns max 360°
- Put grating to center of zero order (white light) @zero order sensor
- Put @lamp voltage to approximately 5.0 V
- Measure voltage @zero order sensor
- Calculate detection threshold for @zero order sensor (approximately 1.0 V; minimum 0.4 V maximum 4.0 V)

31. Stray light slit test

(Refer to section 3.6.5.3 Grating on page 38 menu option "Adjust Pot.")

Tests performed:
- Halogen lamp ON; put @lamp voltage to approximately 6.0 V
- Scan zero order (white light) @reference sensor; range -50 nm … +50 nm
- Calculate width of zero order (white light) signal at 30% of threshold value
- Ok if calculated width < 20 nm (approximately 60 steps)

32. Second calibration of light lengths with the newly determined threshold values

Note: Calibration is done in same order as the first calibration. The newly determined threshold values for the @zero order sensor; use @reference sensor. Please refer to point 22 for a detailed description of individual steps during calibration.

33. Adjust factor/offset (ratio between 16-bit and 24-bit converter)

Tests performed:
- Halogen lamp ON; 560 nm set wavelength
- Measure voltage @measurement sensor via 16-bit ADC (V1_16bit) and via 24-bit ADC (V1_24bit)
- Set 340 nm wavelength; put potentiometer @measurement sensor on minimum amplification
- Measure voltage @measurement sensor via 16-bit ADC (V2_16bit) and via 24-bit ADC (V2_24bit)
- Calculate factor and offset (factor approximately 2.05 / offset approximately 1.97)

34. Test lamp monitoring signal level @zero order sensor

Tests performed:
- Halogen lamp OFF; set potentiometer @zero order sensor to maximum amplification
- Measure voltage @zero order sensor (darkness value < 1.0 V)
- Halogen lamp ON; put @lamp voltage to approximately 6.0 V
- Scan grating 360°; measure voltage @zero order sensor (brightness value – darkness value > 0.1 V)

35. Measurement of air values (320 nm – 900 nm)

Tests performed:

- Halogen lamp OFF
  Logger [39,11];[39;12];[39;1];[39;2]
- The darkness value (@reference sensor;@measurement sensor) is determined for all filter ranges.
- Halogen lamp ON
  Logger [39,10];[39;3];[39;4]
- Scan over the wavelength range 320 nm – 900 nm (@reference sensor;@measurement sensor). Each calculated ABS value is saved as the zero value. The ABS value must be over the entire wavelength range <= 0.350 ABS (marked in the storage file as ok).

36. Air value check (criteria for error codes)

Tests performed:

a) General

- Assessing the signals; halogen lamp OFF (@ref sensor< 0.050 V;@measurement sensor < 0.050 V)
- ADC24 / ADC16 must measure without error (brightness and darkness measurements)!
- The calculated ABS value must be over the entire wavelength range <= 0.350 ABS (marked in the storage file as ok)

b) Scan check

Logger [39;10];[39,11];[39;12];[39;1];[39;2];[39,3];[39;4];[39;5];[39;6]

- An additional scan is performed from 340 to 360 nm. This is necessary to reject vibrating gratings. The ABS value from the scan from point 35 must be achieved with an accuracy of ± 5.4 mABS.

c) Individual value check

Logger [39,15] ; [39;16]

- After recording the air values (zero values) the wavelengths 350 nm, 360 nm, 380 nm, 445 nm, 580 nm, and 810 nm are approached again and a measurement is made there. The air values measured now must match the stored air values from point 35 with a tolerance of ± 3.4 mABS. This corresponds to the customer application!

6.3.6 Error messages during the hardware checks

3. Touch Screen Adjust — error
   - 'Wrong Position!' / 'Touch Adjust Failure'

   - Perform an alignment again with exact positioning of the markers
   - Check if the touch panel has any mechanical damage.
   - Check whether or not the glue frame of the membrane keyboard contact with the active area
   - Check plug contact to touch panel on mainboard (YAB119)

4. Set RTC — error
   - The date / time shown is not correct after being set.

   - Check mainboard (YAB119) contact to computer module (contained on YAB119) (P1) and replace as necessary

5. DC/DC converter — error
   - 'Voltage < x.xxV / Voltage > x.xxV!'

   - Check mainboard (YAB119) in area of DC/DC converter and replace as necessary

6. Display test — error
   - Individual display pixels not ok:

   - Check display and replace as necessary

   - Display color / background illumination not ok:

   - Check connection cable and plug on mainboard (YAB119) and on display
   - Check display and replace as necessary
   - Test mainboard (YAB119) in area of display plug and replace as necessary

7. Standby test mode — error
   - Green / yellow LED does not light up:

   - Check membrane keyboard and replace as necessary
   - Check plug contact on mainboard (YAB119); replace mainboard as necessary

   - Back light is not dimmed:

   - Check display and replace as necessary
   - Check plug contact on mainboard (YAB119) and on display
   - Test mainboard (YAB119) in area of display plug and replace as necessary

8. Sound test — error
   - Sound cannot be heard:

   - Check speaker contact (left/right)
   - Check mainboard (YAB119) and replace as necessary

9. I2C bus test — error
   - 'I2C Bus failure'

   - Replace mainboard (YAB119).

10. Temperature measurement — error
    - 'Temperature < 10 °C or > 60 °C'

    - Replace mainboard (YAB119).

11. RTC battery test — error
    - ' 'Battery voltage < 1.95 V'

- Replace RTC buffer battery (3.0 V).
- Check mainboard (YAB119) and replace as necessary

12. USB host test — error

➢ 'No detection of USB memory stick'

- Check USB port (A) on mainboard (YAB119) and replace mainboard as necessary

13. USB device test — error

➢ 'No detection of USB device '

- Check USB port(A) and USB port (B) on mainboard (YAB119) and replace mainboard as necessary
- Check mainboard (YAB119) contact to computer module (contained on YAB119) (P1) and replace as necessary

14. Ethernet test — error

➢ 'No detection of Ethernet interface'

- Check Ethernet port on mainboard (YAB119) and replace mainboard as necessary

15. Test switch on button — error

➢ 'Power switch is pressed'

- Check membrane keyboard and replace as necessary
- Check mainboard (YAB119) in area of power flip-flop and replace mainboard as necessary

16. RFID module test @RFID module (ZBA975) — error

➢ 'No RFID Modules detected'

- Check if RFID module is detected and is correctly in contact with the YAB119 mainboard.
- Check RFID module and replace as necessary.
- Check mainboard (YAB119) and replace as necessary

➢ 'No TAG found'

- Keep TAG (VAA896) at the correct position in front of the RFID module
- Check RFID module and replace as necessary.

➢ 'Multiple TAGs found'

- Only keep one TAG (VAA896) at the correct position in front of the RFID module
- Check RFID module (position/seated firmly …) and replace as necessary.

➢ 'RFID Read/Write test failure'

- Keep TAG (VAA896) at the correct position in front of the RFID module
- Check RFID module and replace as necessary.

17. Test rectangular cuvette detection — error

➢ 'Adapter A is detected' / 'Light Shield is detected'

- Check rectangular cell compartment
- Are all magnets still in their holders on the spring levers?
- Do the levers in the rectangular cell compartments stick?
- Check mainboard (YAB119) and replace as necessary.

➢ 'No Adapter A detected'

- Check rectangular cell compartment
- Are all magnets still in their holders on the spring levers?
- Do the levers in the rectangular cell compartments stick?
- Check mainboard (YAB119) and replace as necessary.

18. Lid detection (open status / closed status) — error

- 'Lid closed'/ 'Lid open'

- Check if the magnet is still stuck in the lid for the cell compartment?
- Check whether contact of the membrane keyboard on the mainboard YAB119 is O.K., and replace as necessary.
- Check mainboard (YAB119) and replace as necessary.

19. Round cuvette detection (alignment) @round cuvette sensor — error

- 'LED cuvette dark signal > 0.1 V'

- Check if there is ambient light protection between chassis and LP and is positioned correctly.
- Check ambient light. Cover cell compartment to test.
- Check mainboard (YAB119) round cuvette detector and replace as necessary

- 'Ambient temperature too low' / 'Ambient temperature too high'

- Do not adjust at temperatures < 11 °C or > 52 °C.
- Check mainboard (YAB119) temperature measurement and replace as necessary

- 'LED cuvette signal out of tolerance' / 'Round cuvette adjust failure'

- Check round cell compartment/light guide are present and in correct position
- Check mainboard (YAB119) red LED for round cuvette detection and replace as necessary
- Check mainboard (YAB119) round cuvette detector and replace as necessary

20. 2D Code Camera Alignment with VAA880 @camera module (BVQ964 / ZBA977) — error

- 'No Camera detected'

- Check if camera connection cable is correctly connected to the mainboard
- Check camera module and replace as necessary
- Check mainboard (YAB119) contact of camera interface
- Check mainboard (YAB119) contact to computer module (contained on YAB119) (P1) and replace as necessary.

- 'Round cuvette detected, Please insert VAA880'

- Check if there is a round cell compartment / light guide and if they are in correct position
- Check mainboard (YAB119) red LED for round cuvette detection and replace as necessary
- Check mainboard (YAB119) round cuvette detector and replace as necessary

- 'Failure VAA880 Adjust' 'No 2D-Code found' / read process lasts longer than 20 seconds

- Check camera: image is transferred?
- Check cuvette motor: round cuvette is being rotated?
- Check green LED (camera) and light guide: round cell compartment is illuminated?
- Check VAA880: 2D code label is free of scratches and cuvette is positioned with adapter VAA897
- Check mainboard (YAB119) and replace as necessary
- Check mainboard (YAB119) contact to computer module (contained on YAB119) (P1) and replace as necessary

- Adjust values are not displayed as 'ok' (green) after a long period of time / X position and Y position remain at value '0' .

- Check VAA880: 2D code label is free of scratches and cuvette is positioned with adapter VAA897
- Check ambient light; possibly cover area around cell compartment.
- Possibly move VAA880 briefly so that the adjustment process can be started again.

21. Read 2D Code with VAA880 @camera module (LZV862) — error

- 'Timeout VAA880 Check': read process lasts longer than 5 seconds. / 'Error VAA 880 Check'

- Check camera module / objective: Contamination? Focus set correctly?
- Check cuvette motor: round cuvette is being rotated correctly?
- Check VAA880: 2D code label is free of scratches and cuvette is positioned with adapter VAA897
- Check mainboard (YAB119) and replace as necessary
- Check mainboard (YAB119) contact to computer module (contained on YAB119) (P1) and replace as necessary

22. Initial calibration of the beam path with default values — error
'Calibration failure. Check mainboard / optical beam path'

- ,Halogen-Lamp level failure @sensor zero order – Lamp not Off? ***Logger [33,1]***

- Check if light guide for zero order is present and was used in the correct position
- Check if there is ambient light protection between chassis and mainboard, and whether it is positioned correctly.
- Check mainboard (YAB119) in area of zero order sensor and replace mainboard as necessary

- ,Halogen-Lamp level failure @sensor zero order – Lamp not On? ***Logger [33,2]***

- Check if halogen lamp lights up (possibility of a defective lamp?)
- Check if halogen lamp is used and lamp connection leads have good contact.
- Check if light guide for zero order is present and was used in the correct position
- Check mainboard (YAB119) in area of lamp activation and replace mainboard as necessary
- Check mainboard (YAB119) in area of zero order sensor and replace mainboard as necessary

- ' Find grating zero order failure @sensor zero order' ***Logger [33,4]***

- Check if grating motor assembly is attached correctly and if grating motor card is connected correctly to the mainboard.
- Check if the grating moves freely and is moved by the grating motor.
- Check if the light guide for zero order was used in the correct position.
- Check if there is ambient light protection between chassis and mainboard, and whether it is positioned correctly.

- 'Set grating to 600 nm failure — step calibrate filter' ***Logger [33,5]***

- Check if grating motor assembly is attached correctly and if grating motor card is connected correctly to the mainboard.
- Correctly press plug used for contact with the grating motor card to the mainboard. Switch off instrument and start again.

- '360 degree scan filter motor for filter 3 @reference sensor' ***Logger [33,6]***

- Check beam path. Check height of the first position at the outlet slit.
- Check filter wheel assembly to see if filter wheel turns, replace as necessary
- Check contact of filter wheel motor on mainboard (YAB119).
- Check beam path. Is the beam splitter mirror used incorrectly and does it hide the reference element?
- Check reference element, check contact to mainboard and replace reference element as necessary.
- Check mainboard (YAB119) in area of detector operation amplifier (under the shield cap), replace as necessary.

- 'Scan filter 3 max peak failure @reference sensor' ***Logger [33,7]***

- Check filter wheel assembly to see if filter wheel turns correctly, replace as necessary
- Check filter wheel assembly if optical filters are correctly glued in. (Is filter 3 present?)
- Check reference element, check contact to mainboard and replace reference element as necessary.

- 'Set filter motor to filter F2 failure' ***Logger [33,8]***

- Check mainboard (YAB119) in area of filter motor activation, replace as necessary

- ‚Set grating to 50 nm failure – step calibrate grating' ***Logger [33,9]***

- Check if grating motor assembly is attached correctly and if grating motor card is connected correctly to the mainboard.
- Correctly press plug used for contact with the grating motor card to the mainboard. Switch off instrument and start again.
- Replace grating motor card as necessary.

- ' Find grating zero order failure @reference sensor' ***Logger [33,11]***

- Check beam path. Is there stray light at outlet slit?
- Check beam path. Lamp house cover; frame/cover on grating
- Check lamp (correct seat in lamp house)
- Check lamp voltage at mainboard (lamp is approx. 6.0 V?)

- 'Scan grating zero order max peak failure @reference sensor' ***Logger [33,11]***

- Check grating assembly to see if grating motor rotates correctly and replace as necessary
- Check beam path. Is there stray light at outlet slit?
- Check beam path. Lamp house cover; frame/cover on grating.

- , Set photometer to 560nm failure' ***Logger [33,12]***
- ' Set grating motor to 560 nm failure' ***Logger [33,12]***

- Check if grating motor assembly is attached correctly and if grating motor card is connected correctly to the mainboard.
- Correctly press plug used for contact with the grating motor card to the mainboard. Replace grating motor card as necessary.

- ' Set filter motor to F3 failure, step lambda to 560nm' ***Logger [33,12]***

- Check mainboard (YAB119) and replace as necessary

23. Darkness values @reference sensor / @ measurement sensor — error
- 'Dark reference signal? Value > 0.050 V' / 'Dark sample signal? Value > 0.050 V'

- Check ambient light / is there direct irradiation in the cell compartment?
- Check upper housing section / lower housing section for possible mechanical damage. Does light shine into the instrument?
- Check beam path chassis. Is the chassis cover screwed on correctly?
- Check reference element and measurement element and replace as necessary.
- Check mainboard (YAB119) in area of detector operation amplifier measurement (under the shield cap) and replace as necessary

24. Function of potentiometer @reference sensor / @ measurement sensor — error
- 'Reference sensor no signal.' / 'Sample sensor no signal.'

- Check reference element (sensor) or measurement element (sensor) and replace as necessary.
- Check beam path. (Does the cell compartment hide the measurement element?)
- Check mainboard (YAB119) and replace as necessary

- 'Reference Poti? No signal change.' / 'Sample Poti? No signal change.'

- Check mainboard (YAB119) in area of operation amplifier potentiometer (under the shield cap) and replace as necessary

25. Adjust grating with monochromator angle measurement — error
- 'Grating Adjust failure'

- Check if BG20/2 cuvette was set correctly
- Check beam path from beam splitter mirror up to measurement element (lenses/ cell compartment …)
- Check beam path alignment (height of first position at exit slit)
- Check optical grating / grating motor assembly

26. Filter wheel mechanics test — error
➢ 'Filter mechanical test failure'

- Check filter wheel assembly (strap/filter wheel/filter wheel motor…) and replace as necessary
- Check contact of filter wheel motor on mainboard (YAB119)

27. Potentiometer adjust @reference sensor; @measurement sensor; @lamp voltage — error
➢ 'Reference sensor signal Nom: x.xxx Act: x.xxx' / 'Sample sensor signal Nom: x.xxx Act: x.xxx' / 'Failure poti adjust'

- Check halogen lamp (seat in lamp house; glass body is clear and without deposits, connection cable contacts correctly …) and replace as necessary
- Check beam path alignment (height of first position at exit slit)
- Check beam path to reference element (beam splitter mirror/beam splitter mirror holder…)
- Check filter wheel assembly: filters are glued in the correct order?
- Check beam path from beam splitter mirror to measurement element (lenses / cell compartment …)
- Check mainboard (YAB119) and replace as necessary

➢ ' Lamp voltage signal Nom: x.xxx Act: x.xxx' / 'Failure poti adjust'

- Check mainboard (YAB119) in the area of halogen lamp activation and replace as necessary

28. Test AD converter (24-bit ADC) — error
➢ 'Read ADC24 sample signal'

- Check mainboard (YAB119) in area of 24-bit AD converter (under the shield cap) and replace as necessary

29. Adjustment of level zero order (white light) @reference sensor — error
➢ 'Adjust ref level zero order failure. Photometer system F2 error' / 'Poti is set to 0 or 99'

- Check beam path. Too much light / too little light at reference element?
- Check filter wheel assembly. (Is filter F2 glued correctly and does not have a stray light slit?)
- Check reference element (seat in chassis; contamination on optical surfaces? …)
- Check mainboard (YAB119) in area of reference element input (under the shield cap) and replace as necessary

30. Adjustment of level zero order (white light) @zero order sensor] - error
➢ 'Sensor zero order Adjust [V]: Nom:x.xx Act:x.xx'

- Check zero order light guide (seat in chassis; contamination on optical surfaces? …)
- Check if there is ambient light protection between chassis and mainboard, and whether it is positioned correctly.
- Check mainboard (YAB119) in range of zero order sensor and replace as necessary

31. Stray light slit test — error
➢ 'Slit width is > 20 nm. Minor slit detected'

- Check lamp house (seat of cover on lamp house …)
- Check cover on grating (seat and size of cover)
- Check beam path on exit slit. Can a stray light slit be seen?
- Check filter wheel assembly: Is filter 2 correctly glued in? Can a stray light slit be seen?

32. Second calibration of light lengths with the newly determined threshold values — error
➢ Error is treated the same as under point 5.23.

33. Adjust factor/offset (ratio between 16-bit and 24-bit converter) — error
- 'Factor 16bit ->24bit Nom:2.0 Act: x.xx' / 'Offset 16bit ->24bit Nom:2.0 Act: x.xx'

- Check mainboard (YAB119) and replace as necessary

34. Test lamp monitoring signal level @zero order sensor — error
- 'Lamp level 360° scan failure. Lamp dark level > 1.0 V'

- Check ambient light (beam path chassis…)
- Check if there is ambient light protection between chassis and mainboard, and whether it is positioned correctly.
- Check mainboard (YAB119) in range of zero order sensor and replace as necessary

- 'Lamp level 360° scan failure. Lamp On/Off difference level < 0.1 V'

- Check beam path chassis
- Check light guide for zero order sensor (seat in chassis; contamination on optical surfaces?)
- Check mainboard (YAB119) in range of zero order sensor and replace as necessary

35. Measurement of air values (320 nm – 900 nm) — error
- 'Zero scan failure'
- ‚Dark Sample signal [V] Nom:x.xxx Act: x.xxx' ***Logger [39,11]***
- ‚Dark Reference signal [V] Nom:x.xxx Act: x.xxx' ***Logger [39,12]***

Reference/Sample Dark signal > 0.050 V

- Check ambient light / is there direct irradiation in the cell compartment?
- Check upper housing section / lower housing section for possible mechanical damage.
- Check beam path chassis. Is the chassis cover screwed on correctly?
- Check mainboard (YAB119) and replace as necessary

- ‘Zero scan failure’
- ‘Lambda[nm]: xxx Absorbance to high: Nom:x.xxx Act: x.xxx’ ***Logger [39,10]***

340nm…900nm: Absorbance > 0.350;

320nm…339nm: Absorbance > 0.750;

- Check potentiometer adjust for wavelength 'xxx'. Are the measurement/reference voltage values correct for this wavelength range/filter?
- Check beam path alignment (height of first position at exit slit)
- Check beam path to reference element (beam splitter mirror/beam splitter mirror holder…)
- Check filter wheel assembly: (no stray light slit on the filters 1 -4)
- Check beam path from beam splitter mirror to measurement element (lenses / cell compartment … replace as necessary)
- Check mainboard (YAB119) and replace as necessary

36. Air value check — error
- , Lambda[nm]: xxx Difference Absorbance [mAbs]: Nom:x.xxx Act: x.xxx'

Logger [39,15] / [39,16]

- 'Check zero scan failure… Grating motor movement?'

340…900 [nm]: Difference (act <-> stored value) > 4.4 mAbs ***Logger [39,15]***

320…339 [nm]: Difference (act <-> stored value) > 45 mAbs ***Logger [39,15]***

350/360/380/445/580/810 [nm] Difference (act <-> stored value) > 3.4 mAbs

Logger [39,16]

- Check beam path alignment (height of first position at exit slit)
- Check beam path to reference element (beam splitter mirror/ beam splitter mirror holder seats firmly?…)

- Check grating / grating motor assembly: Can grating rotate freely? Grating holder seated firmly on grating motor axle
- Check filter wheel assembly: (filter is positioned precisely?)
- Check beam path from beam splitter mirror to measurement element (lenses/cell compartment seat firmly?)
- Check mainboard (YAB119) in area of analog measurements under the shield cap, replace as necessary

- ‚Dark Sample signal [V] Nom:x.xxx Act: x.xxx' ***Logger [39,11]***
- ‚Dark Reference signal [V] Nom:x.xxx Act: x.xxx' ***Logger [39,12]***
- 'Check zero scan failure… Grating motor movement?'

  Reference/Sample Dark signal > 0.050 V

- Check ambient light / is there direct irradiation in the cell compartment?
- Check upper housing section / lower housing section for possible mechanical damage.
- Check beam path chassis. Is the chassis cover screwed on correctly?
- Check mainboard (YAB119) and replace as necessary

- Sample signal [V] Nom:x.xxx Act: x.xxx' ***Logger [39,5]***
- Reference signal [V] Nom:x.xxx Act: x.xxx' ***Logger [39,6]***

  Reference/Sample signal < stored 'Reference/Sample signal' Value * 0.85.

- Check beam path chassis. Is the chassis cover screwed on correctly?
- / somthing is been losened? (lenses; beam path splitter; cell compartment; sensores…)
- Check lamp / (lamp assembly within lamp housing; glas buld of lamp ok? …)
- Check sensors (reference sensor/ sample sensor …)
- Check mainboard (YAB119) and replace as necessary

- 'Lambda[nm]: xxx Absorbance to high: Nom:x.xxx Act: x.xxx' ***Logger [39,10]***

340nm…900nm: Absorbance > 0.350;

320nm…339nm: Absorbance > 0.750;

- Check potentiometer adjust for wavelength 'xxx'. Are the measurement/reference voltage values correct for this wavelength range/filter?
- Check beam path alignment (height of first position at exit slit)
- Check beam path to reference element (beam splitter mirror/beam splitter mirror holder…)
- Check filter wheel assembly: (no stray light slit on the filters 1 -4)
- Check beam path from beam splitter mirror to measurement element (lenses / cell compartment … replace as necessary)
- Check mainboard (YAB119) and replace as necessary

6.4 Field Service Insp.

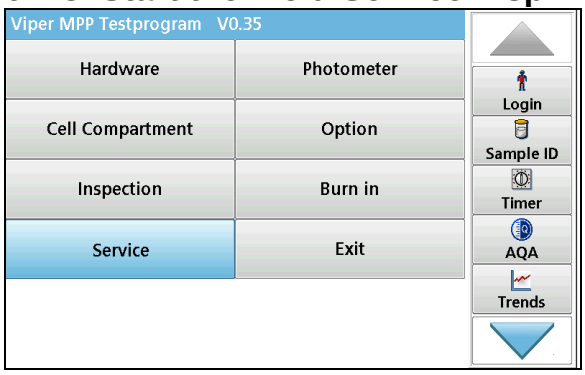
6.4.1 General

The Field Service Insp. is a photometric inspection of the instrument with test filters. This is a testprogram run using menus. The user is guided step by step through the program. The values required in the inspection protocol are shown during the Field Service Inspection and can be adopted accordingly.

6.4.2 Required materials

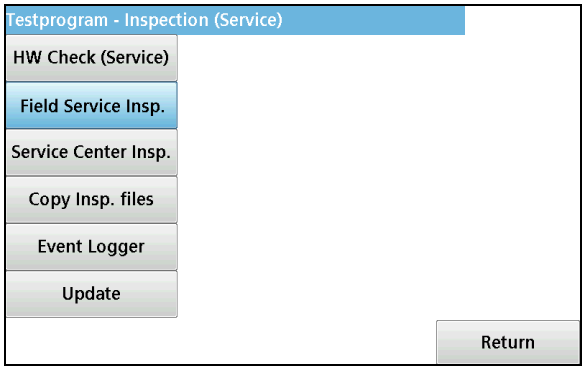
- VAA608 USB stick with check program
- VAA591 Verification kit

6.4.3 Start the Field Service Insp.



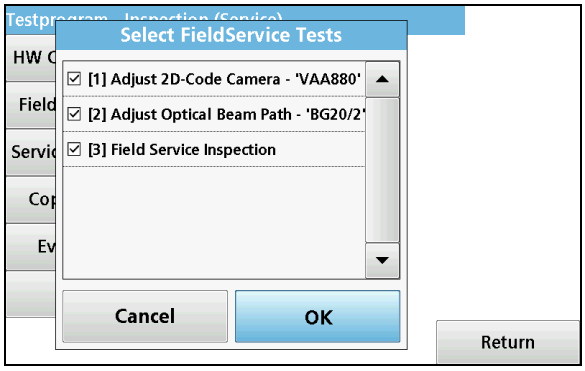
Start the testprogram (refer to 3.6.2 Start on page 24)

In the Testprogram main menu, press "Service".



In the display, the menu "Testprogram — Inspection (Service)" is shown.

In the Testprogram — Inspection (Service) menu, press "Field Service Insp."



A selection of optional tests is shown. The tests shown can be deselected individually. The first two points:

[1] Adjust 2D Code Camera — "VAA880"
[2] Adjust Optical Beam Path — "BG20/2"

…are components of the hardware check. After the hardware check has been successfully completed, they are not absolutely necessary.

They are marked in the description of the individual tests under 6.4.4 Tests performed on page 107 as [optional].

Start the selected tests using the "OK" button. This is a program performed using menus. The user is guided step by step through the program. All tests described under 6.4.4 Tests performed on page 107 (and not previously deselected) are worked through.

6.4.4 Tests performed

6.4.4.1 Components of the hardware check:

For details about individual points, refer to 6.3.5 Tests performed as of on page 92 at the corresponding test point.

1. DC/DC transformer (power supply)[optional]
2. I2C Bus Test [optional]
3. Temperature measurement @sensor main board (near the lamp housing) [optional]
4. RTC battery test (Buffer battery voltage > 1.95 V) [optional]
5. Round cuvette detection (calibration) @round cuvette sensor **[optional]**
6. 2D code camera calibration with VAA880 @camera module **[optional]**
7. 2D code camera calibration with VAA880 @camera module **[optional]**
8. Initial calibration of the beam path with default values **[optional]**
9. Dark values @reference sensor / @ measurement sensor **[optional]**
10. Function of potentiometer @reference sensor / @ measurement sensor **[optional]**
11. Grating Adjust with monochromator angle measurement **[optional]**
12. Potentiometer Adjust @reference sensor; @measurement sensor; @lamp voltage **[optional]**
13. Test AD converter (24-bit ADC) **[optional]**
14. Adjustment of level zero order (white light) @reference sensor **[optional]**
15. Adjustment of level zero order (white light) @zero order sensor **[optional]**
16. Second calibration of light lengths with the newly determined threshold values **[optional]**
17. Test lamp monitoring signal level @zero order sensor **[optional]**
18. Measurement of air values (320 nm – 900 nm) **[optional]**
19. Air value check (criteria for error codes) **[optional]**

6.4.4.2 Field Service Inspection:

20. Calibration of the beam path
21. Zero point calibration (546 nm)
22. VAA591 measurement — NG11/2 (546 nm)
23. VAA591 measurement — NG5/2 (546 nm)
24. VAA591 measurement — NG9/1 (546 nm)
25. Zero point calibration (340 nm)
26. VAA591 measurement — KV450/3 (340 nm)
27. Zero point calibration (803 nm – 813 nm) (with closed lid)
28. VAA591 measurement — BG20/2 (803 nm – 813 nm) (with closed lid)
29. Copying the archive file “Logger_LPG440_serialnumber.tar.gz” to VAA608. The current archive file contains the event logger file (Logger_LPG440_xxxxxxxx.txt).

7 Spare parts

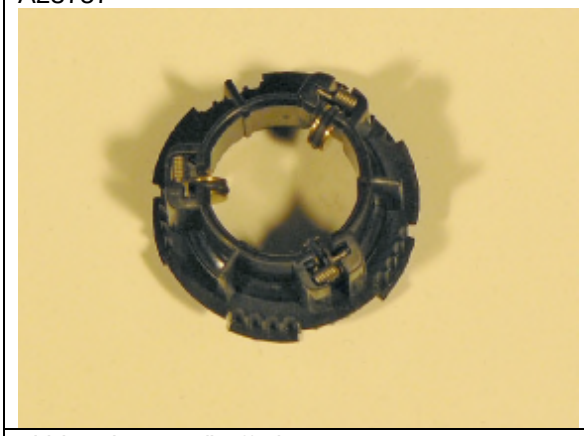
7.1 Overview

Order-No.	Spare part name, german	Spare part name, english
A23757	Mitnehmerring 16/13 mm	Drive ring round cuvette 16/13 mm
LZV850	Schrittmotor - Barcode	Stepping drive for barcode
LZV851	Lithium Knopfzelle CR2032	Lithium battery (buffer)
LZV400	Gehäusefüsse (4 St.)	Enclosure feets (4 pieces)
LZV565	Halogen-Lichtwurflampe	Halogen lamp
LZV587	Linsen Set	Set of lenses
LZV852	Gehäuseoberteil	Housing top
LZV853	Gehäuseunterteil	Housing bottom
LZV854	Frontabdeckung	Front cover
LZV855	Rückwand	Rear cover
LZV872	Geräteschild Logo Set	Badge Logo Set
LZV856	Probenraumschieber	Sample chamber slide
LZV857	Lampendeckel vollständig	Lamp cover
LZV858	Traverse Hach Lange	Hach Lange cross rail
LZV859	Traverse Hach	Hach cross rail
LZV755	Teilerspiegel montiert	Beam splitter mirror, mounted
LZV860	Filterrad mit Filtern	Filter wheel with optical filters
LZV592	Konkavgitter	Concave grating
LZV593	Zahnriemen - Filterwechsler	Tooth belt for filter changer
LZV594	Zahnriemen - Barcode	Tooth belt for barcode unit
LZV861	Küvettenschacht rund	Cell compartment, round
LZV848	Küvettenschacht 50 mm	Cell compartment, rectangular, 50 mm
LZV612	Messempfänger	Measurement sensor
LZV614	Schrittmotor - Filterwechsler	Stepping drive for filter changer
LZV862	Kamera, justiert	Camera, preadjusted
YAB118	Gittermotor mit Platine	Grating motor with PCB
LZV754	Lampenstecker (Redesign)	Lamp connector (Redesign)
LZV849	Lichtschutz	Light shield
LZV846	Küvettenadapter A (10 mm und 1 inch rund)	Cell adapter A (10 mm and 1 inch round)
LZV847	Küvettenadapter B (30 mm)	Cell adapter B (30 mm)
LZV863	Gitterhalter mit Schrauben	Grating holder with screws
YAB119	Rechnerplatte mit Prozessor Board DR 3900	Main board PCB with processor DR 3900
YAB083	Referenzplatte	Reference PCB
LZV864	Display mit Touch	Display with touch
LZV865	Lichtleiter 0. Ordnung	Zero order light guide
LZV866	Lichtleiter Küvettenerkennung	Cuvette detection light guide
LZV867	Lichtleiter Beleuchtung Kamera	Camera illumination light guide
LZV868	Rechteckküvettenerkennung	Rectangular cuvette detection
LZV869	Lautsprecher	Speaker
YAB120	RFID Modul	RFID Module
LZV871	Aufkleber Set	Label set
LZV870	Kabelsatz Kamera, Display, Gittermotor	Cable set camera, display, grating motor
LZV884	Schraubenset DR 3900	Screw set DR 3900
LZV844	Tisch-Netzgerät 100-240 V - 15 V DC	Power supply, desktop type 100-240 V 15 V DC
YAA080	Netzkabel EU	EU power cord
XLH051	Netzkabel CH	CH power cord
XLH055	Netzkabel US	US power cord

Order-No.	Spare part name, german	Spare part name, english
XLH057	Netzkabel UK	UK power cord
XLH069	Netzkabel CN	CN power cord
LZV881	Abdeckkappe für USB-Anschluß	Cover lid for USB connection

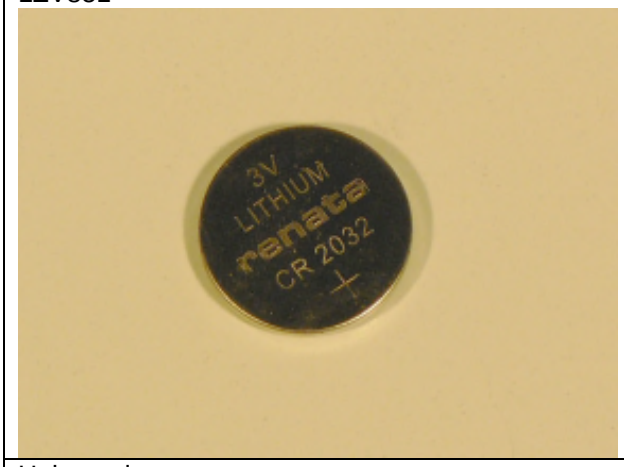
7.2 Images of spare parts

Drive ring round cuvette 16/13 mm
A23757



Stepping drive for barcode
LZV850

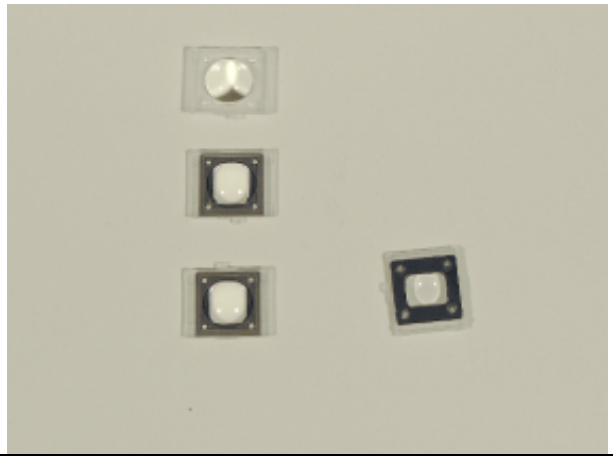
Lithium battery (buffer) CR2032
LZV851

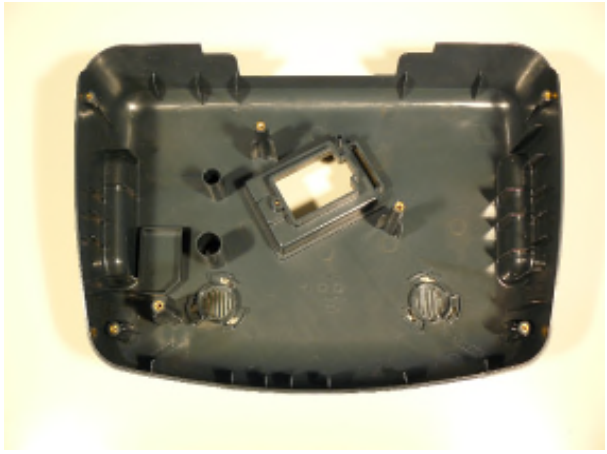
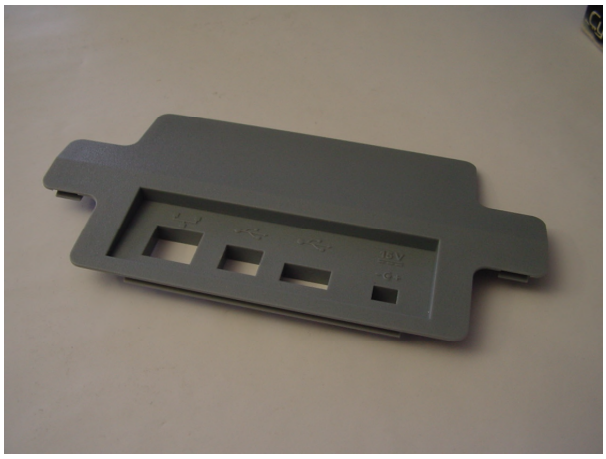
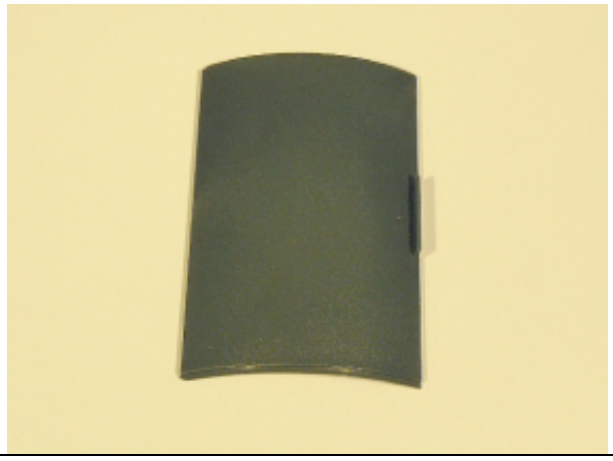


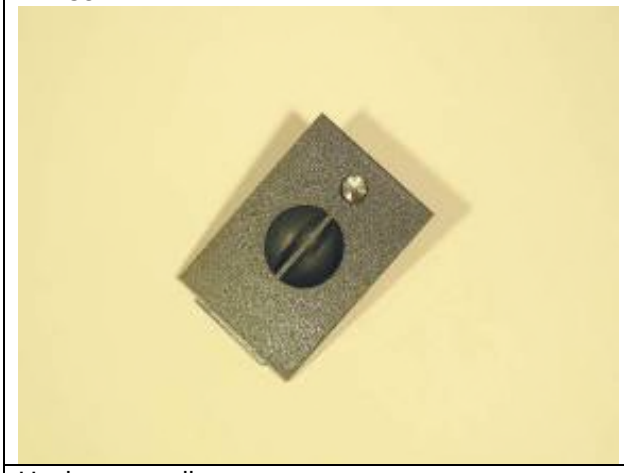
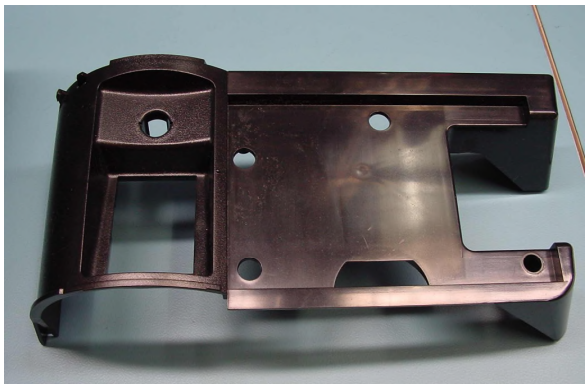
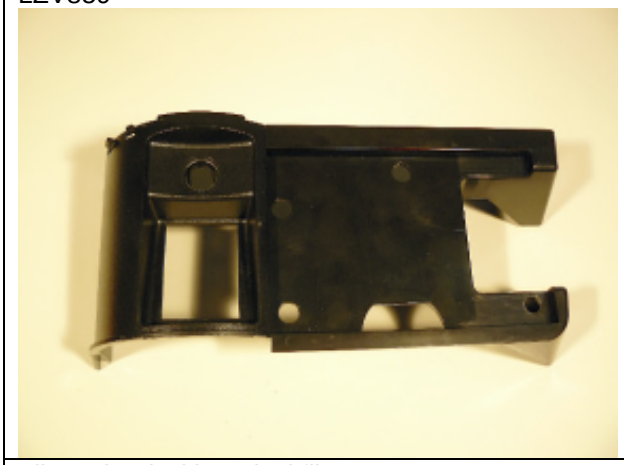
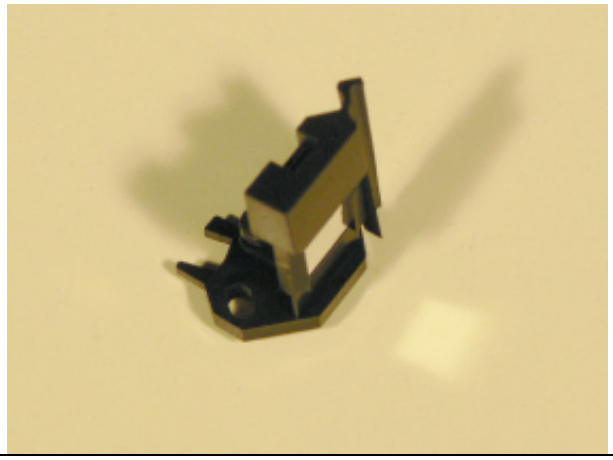
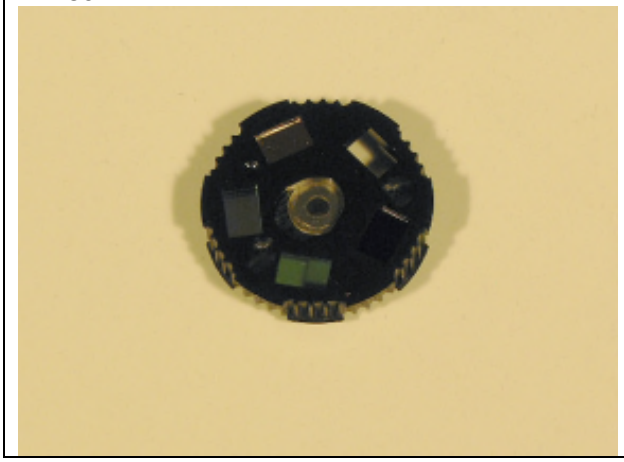
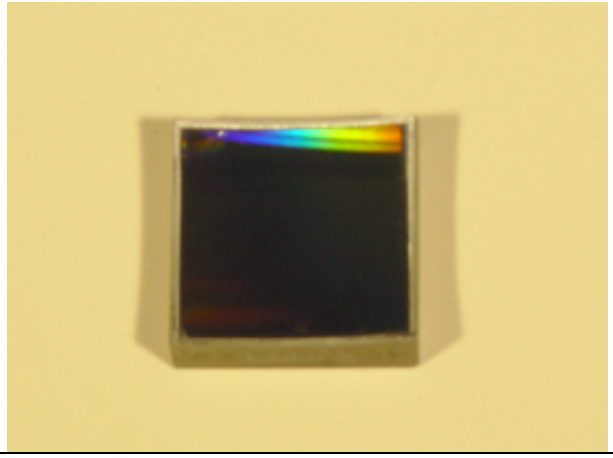
Enclosure feet (4 pieces)
LZV400

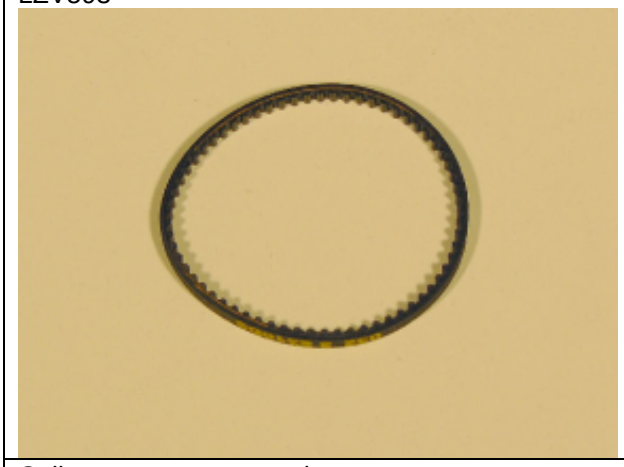
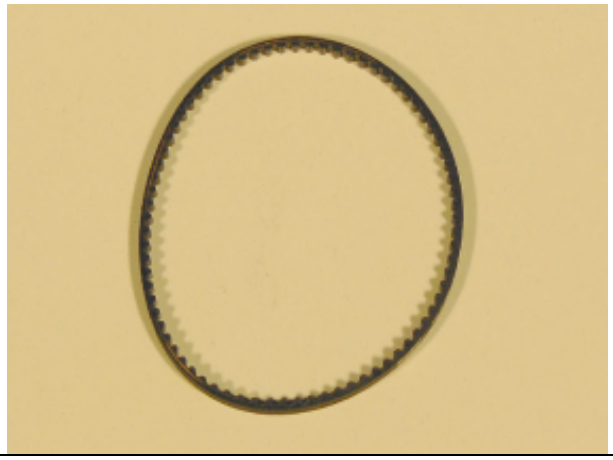
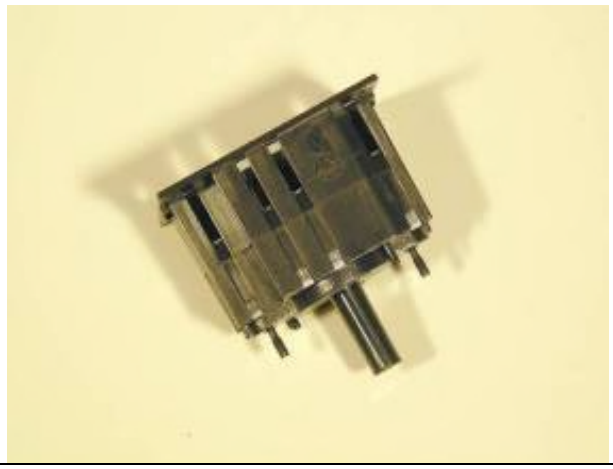
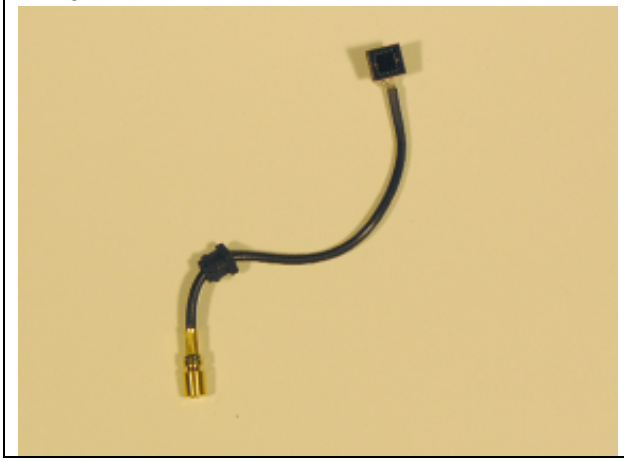
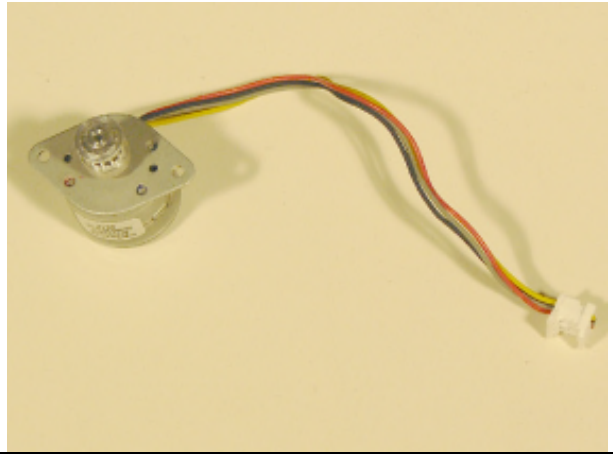
Halogen lamp
LZV565

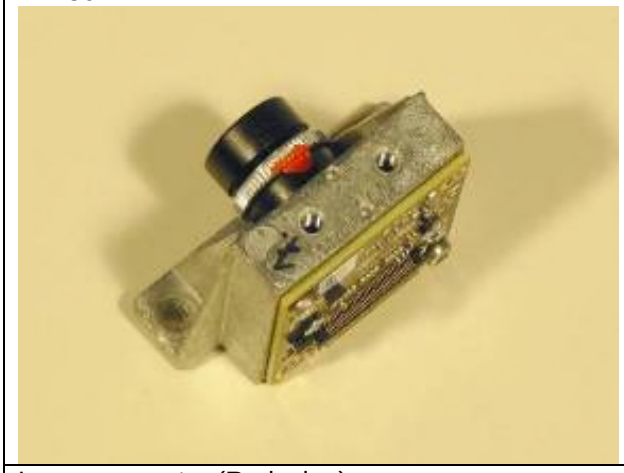
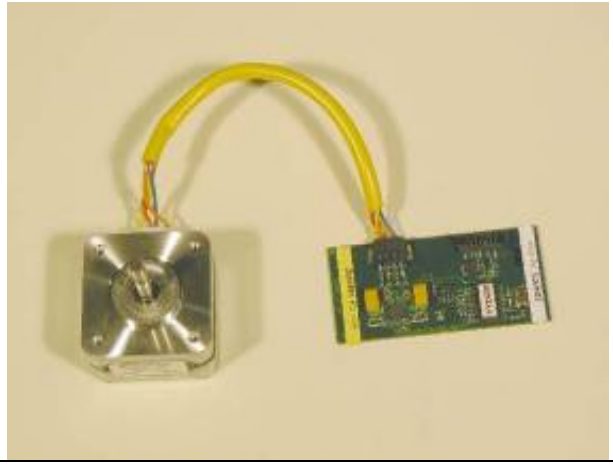
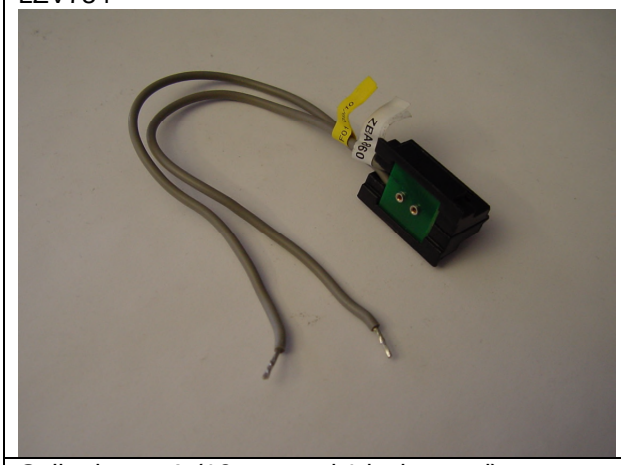
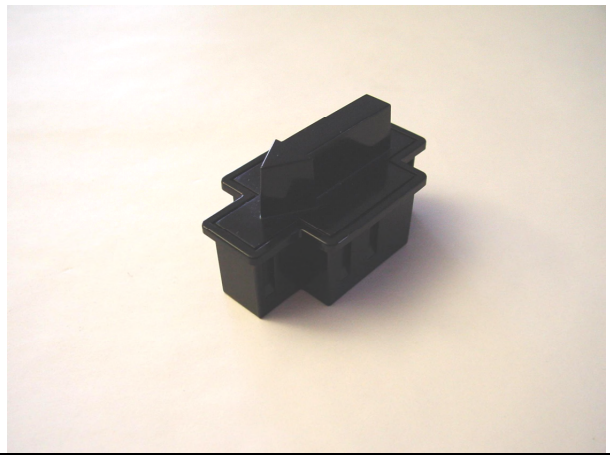
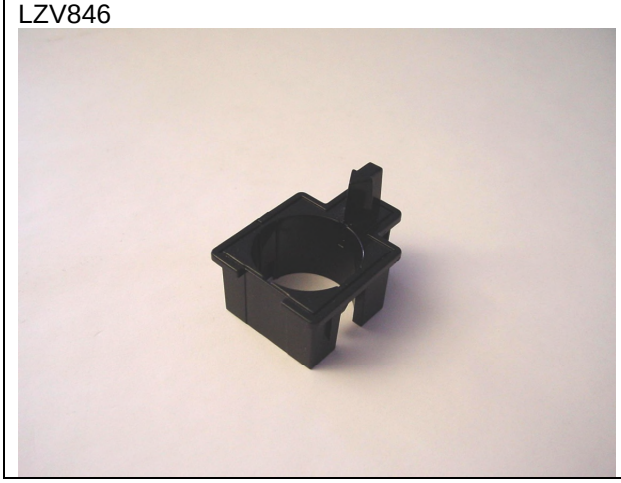
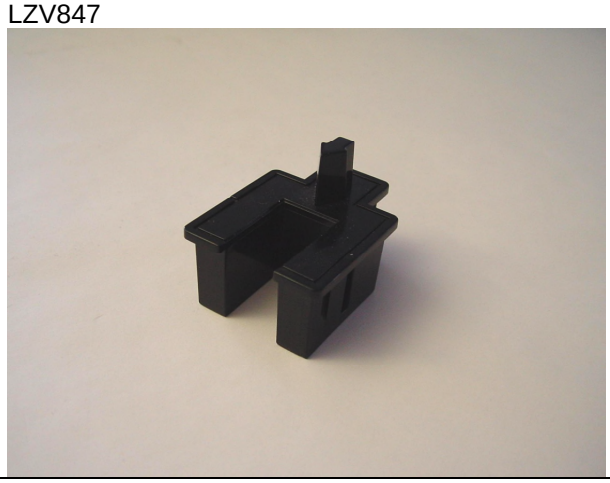
Set of lenses
LZV587

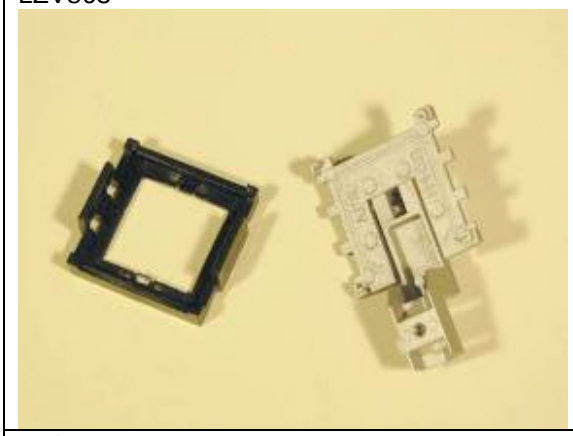
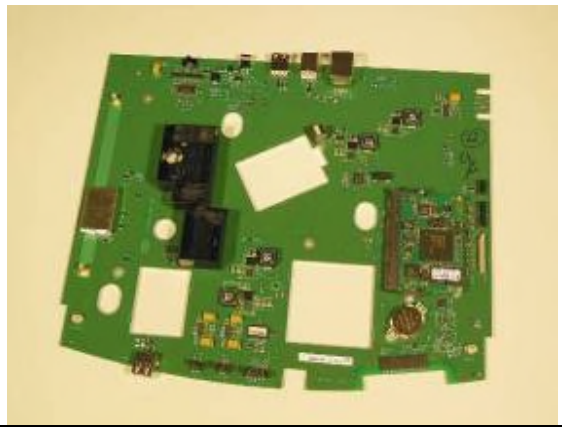
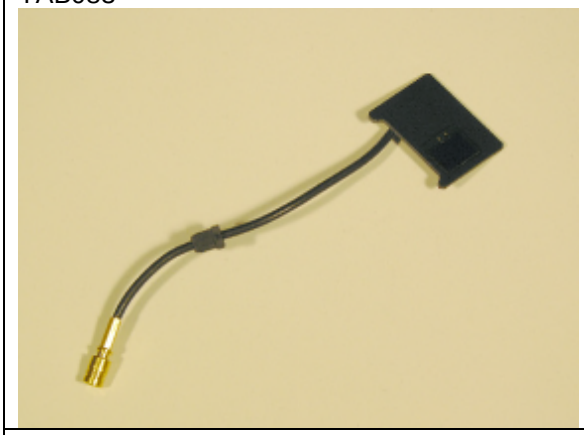
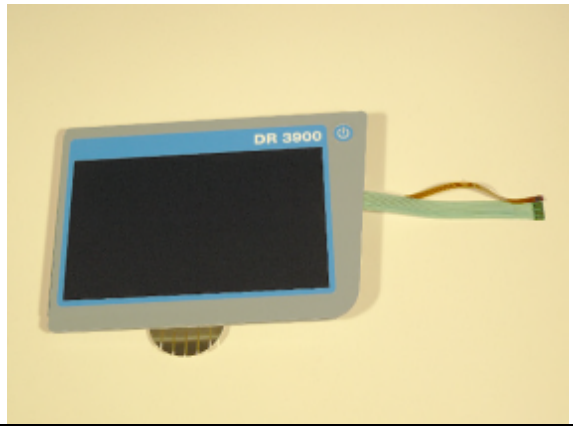
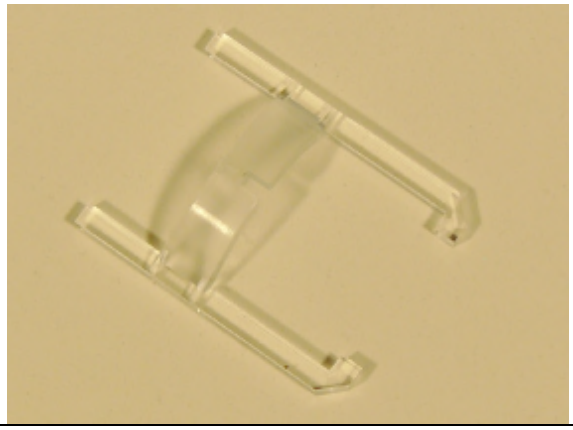


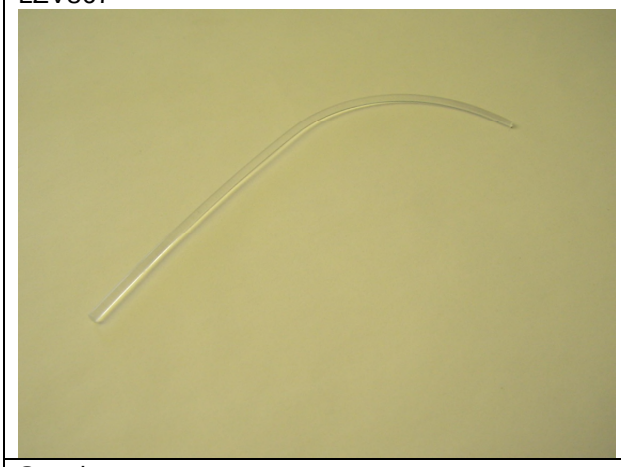
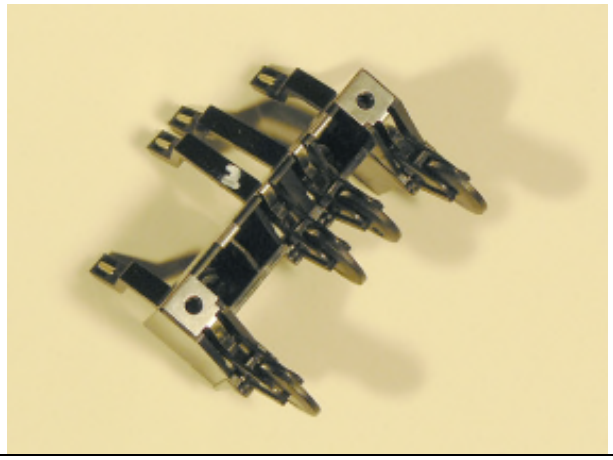
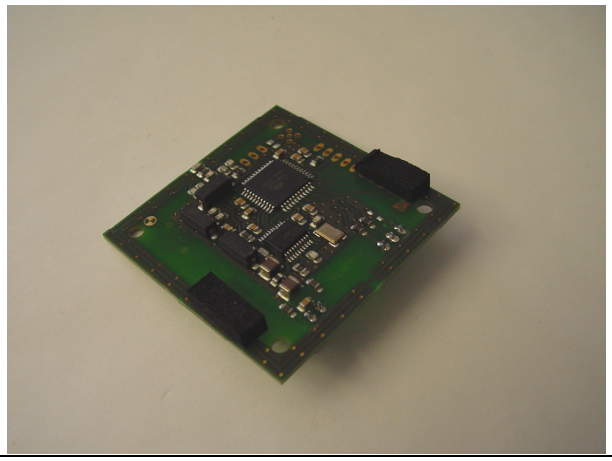
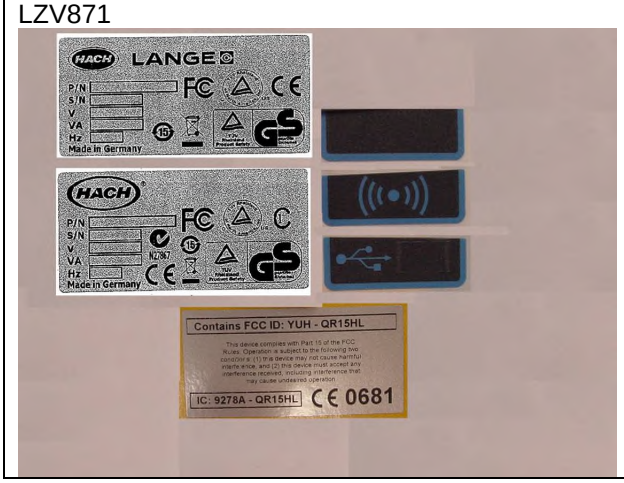
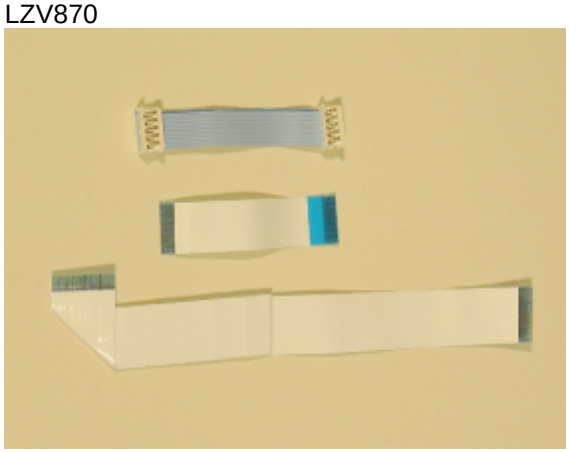
Housing top LZV852 	Housing bottom LZV853 
Front cover. LZV854 	Rear cover LZV855 
Badge Logo Set LZV872 	Sample chamber slide LZV856 

Lamp cover LZV857 	Hach Lange cross rail LZV858 
Hach cross rail LZV859 	Beam splitter mirror, mounted LZV755 
Filter wheel with optical filters LZV591 	Concave grating LZV592 

Tooth belt for filter changer LZV593 	Tooth belt for barcode unit LZV594 
Cell compartment, round LZV861 	Cell compartment, rectangular, 50 mm LZV848 
Measurement sensor LZV612 	Stepping drive for filter changer LZV614 

Camera, preadjusted LZV862 	Grating motor with PCB YAB118 
Lamp connector (Redesign) LZV754 	Light shield LZV849 
Cell adapter A (10 mm and 1 inch round) LZV846 	Cell adapter B (30 mm) LZV847 

Grating holder with screws LZV863 	Main board PCB with processor DR 3900 YAB119 
Reference PCB YAB083 	Display with touch LZV864 
Zero order light guide LZV865 	Cuvette detection light guide LZV866 

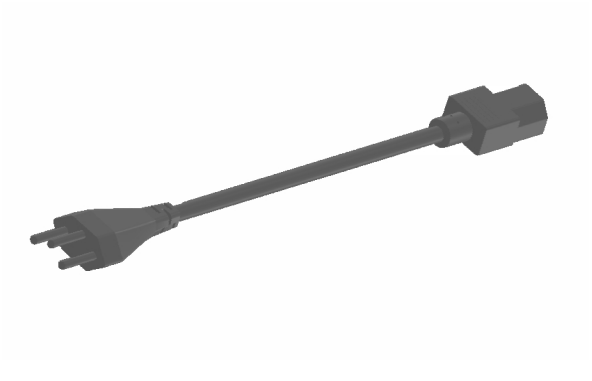
Camera illumination light guide LZV867 	Rectangular cuvette detection LZV868 
Speaker LZV869 	RFID Module YAB120 
Label set LZV871 	Cable set camera, display, grating motor LZV870 

Screw set(DR 3900)
LZV884

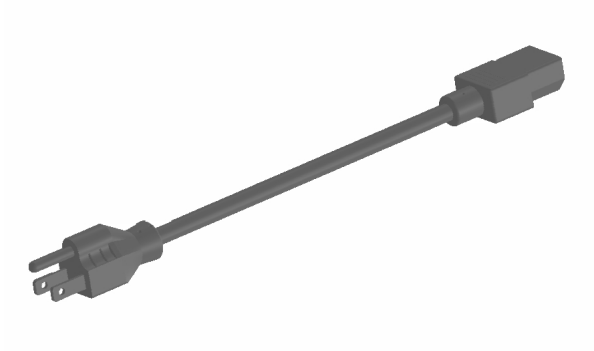
Power supply, desktop type 100-240 V – 15 V DC
LZV844

EU power cord
YAA080

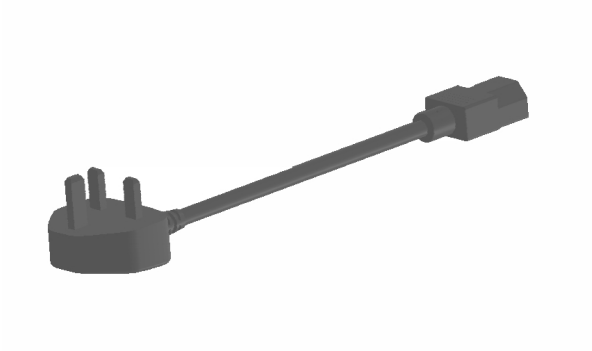
CH power cord
XLH051



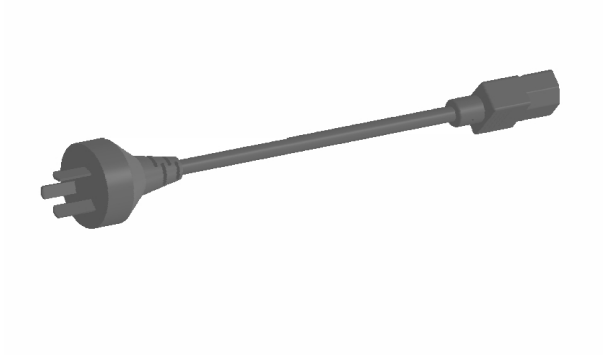
US power cord
XLH055



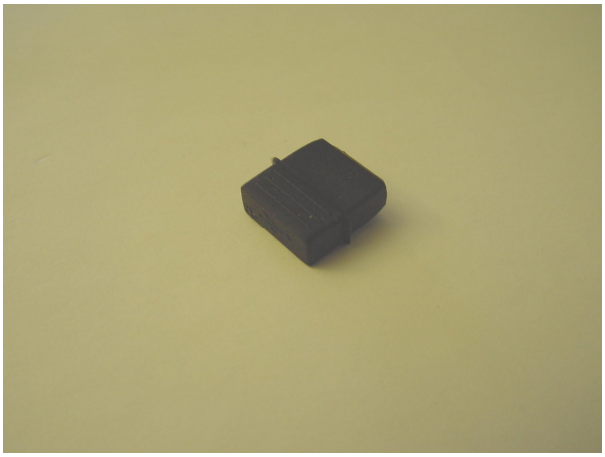
UK power cord
XLH057



CN power cord
XLH069



Cover lid for USB connection
LZV881



8 Test equipment and verification devices

8.1 Overview

Bestell-No. Order No.	Part name, German Part name, German	Part name, English Part name, English
VAA591	Prüffiltersatz	Verification Kit
VAA608	USB-Stick mit Prüfprogramm	USB memory stick with check program
VAA896	Operator Tag	Operator tag
VAA643	Abstandslehre Gitter	Distance tool grating
VAA840	Justageschirm 50mm	Adjustment shield
LZX998	Ethernetkabel 2m crossover	Ethernet cable 2 m crossover
VAA880	Kamera Testküvette	Camera test cell
VAA897	Adapter 13/16 für VAA880	Adapter 13/16 for VAA880
LZV882	Lumberg AZ30	Lumberg AZ30
XLH926	USB Computer-Schnittstellenkabel	USB PC interface cable

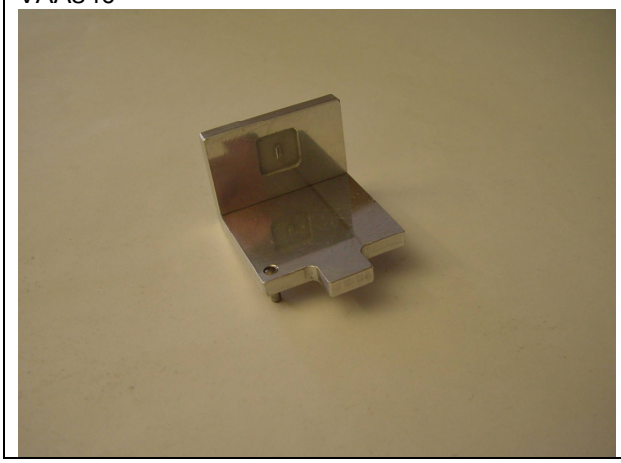
Verification kit
VAA591

USB stick with check program
VAA608

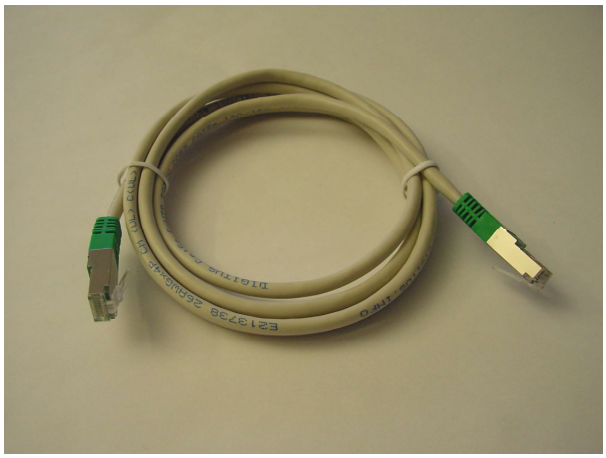
Operator tag
VAA896

Distance tool grating
VAA643

50 mm adjustment shield
VAA840



Ethernet cable 2 m crossover
LZX998



Test cuvette camera
VAA880

13/16 adapter for VAA880
VAA897

Lumberg AZ30
LZV882

USB computer interface cable
XLH926

9 Accessories

9.1 Locator

9.1.1 Test equipment

- PC with USB interface
- USB cable B mini 5 LZQ065
- Operator tag VAA896
- Hach Lange instrument software YYX710
- Hach instrument software YYX711

9.1.2 Function test

Switch on / Switch off:
Switch on locator with the center button. The Start screen is shown after 2 seconds.

Cause for error:
A. Check battery pack charging. A minimum of 1.2 V should be applied at each cuvette.
B. The fuse is defective. Please replace the instrument.

RFID check
Keep the VAA896 operator tag approximately 3 cm in front of the back of the locator. Then press the left button. The operator tag should be detected.

Cause for error:
A. The operator tag is not formatted. Please initialize with DR 3900.
B. Does not detect the operator tag. It is possible that operator detection is not switched on in the configuration.
C. Instrument malfunction. Please replace instrument.

USB connection
Connect the locator to the USB interface of the PC.
Open Explorer and an RFID is shown: .

Cause for error
A. USB cable is defective. Use a new USB cable.
B. Please replace the instrument.

9.1.3 Update software

- Connect locator to PC using the USB. A drive is shown called 'RFID'.
- Rename the file YYX710 or YYX711 in RFIDApp.bin and copy in the directory.
- Disconnect the USB cable and switch off the locator.
- Switch on the locator and check the version.