SERVICE MANUAL

Diode laser

Classic 514

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Classic_514_SManual_V1.0_en

Contents

Classic_514_SManual_V1.0_en

1   Laser description

Figure 1: Classic 514

The "**Classic 514**" laser system is our new Classic variant as a diode laser which super-sedes the established KTP-laser "**Classic**".

The **Classic 514** has many benefits compared to the standard **Classic**. As a diode laser system it has less components which can cause problems and is easier to maintain and re-pair.

1.1   The device in general

The Classic Laser has to be adapted to a slit lamp. Be careful, the accessories of the variants differ, e.g. the power supply is mounted at the table or not.
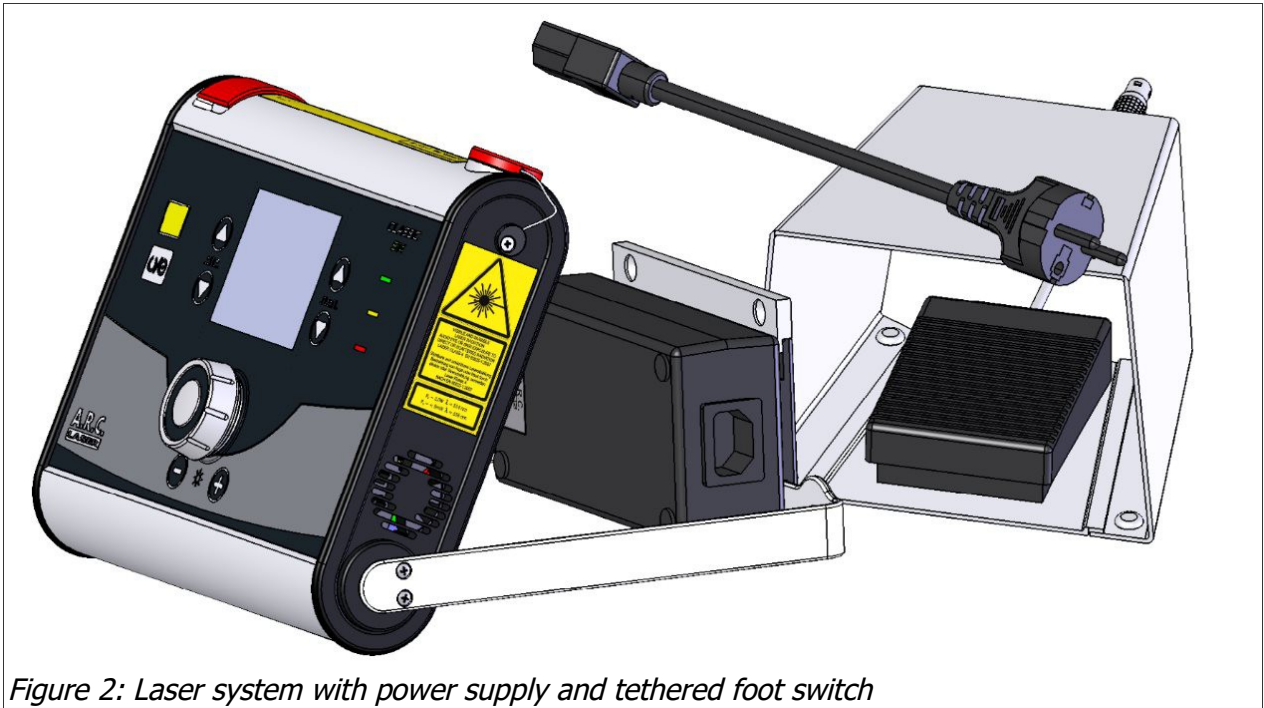
Figure 2: Laser system with power supply and tethered foot switch

Rear view of the device – connector block

Laser STOP knob
On-/Off-switch
Actually not in use
Connection port external warning light
Connection port eye protection filter
Connection port door-interlock
Connection port for foot switch or manual trigger
Connection port power supply:
PS01010

Figure 3: Rear sight of the laser – connector block
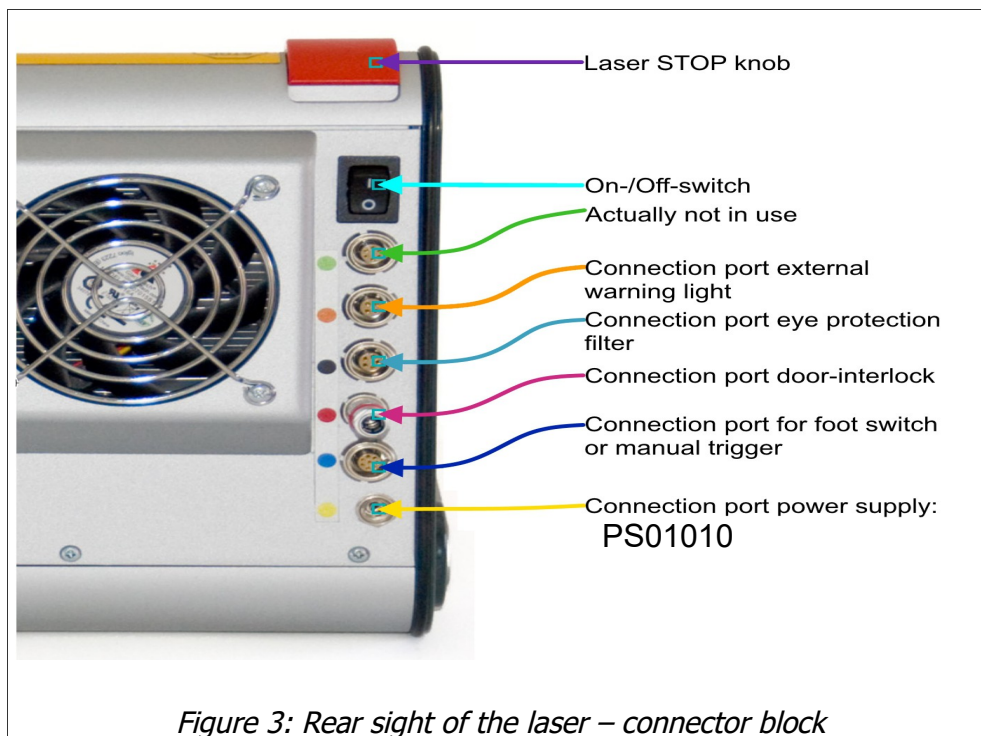
Port	Purpose / part to connect	Comment
green	Not in use	-
orange	Warning light	Potential-free output, max. 24 V, connect no line-operated device
black	Eye protection filter	Connect an electrical eye filter or a simulator adapter here
red	Door-Interlock	If no door interlock mechanism is used, the delivered interlock connector has to be plugged to close the interlock chain.
blue	Appropriate foot switch	The tethered foot switch is connected here
yellow / power supply	Port to connect the power supply PS01010	24 volt, DC
At the left side	Service port	Here you can connect the service-adapter to connect via RS232 the service interface

Labelling of the device

Figure 4: Label situation on the device

Figure 5: Type label and modification label
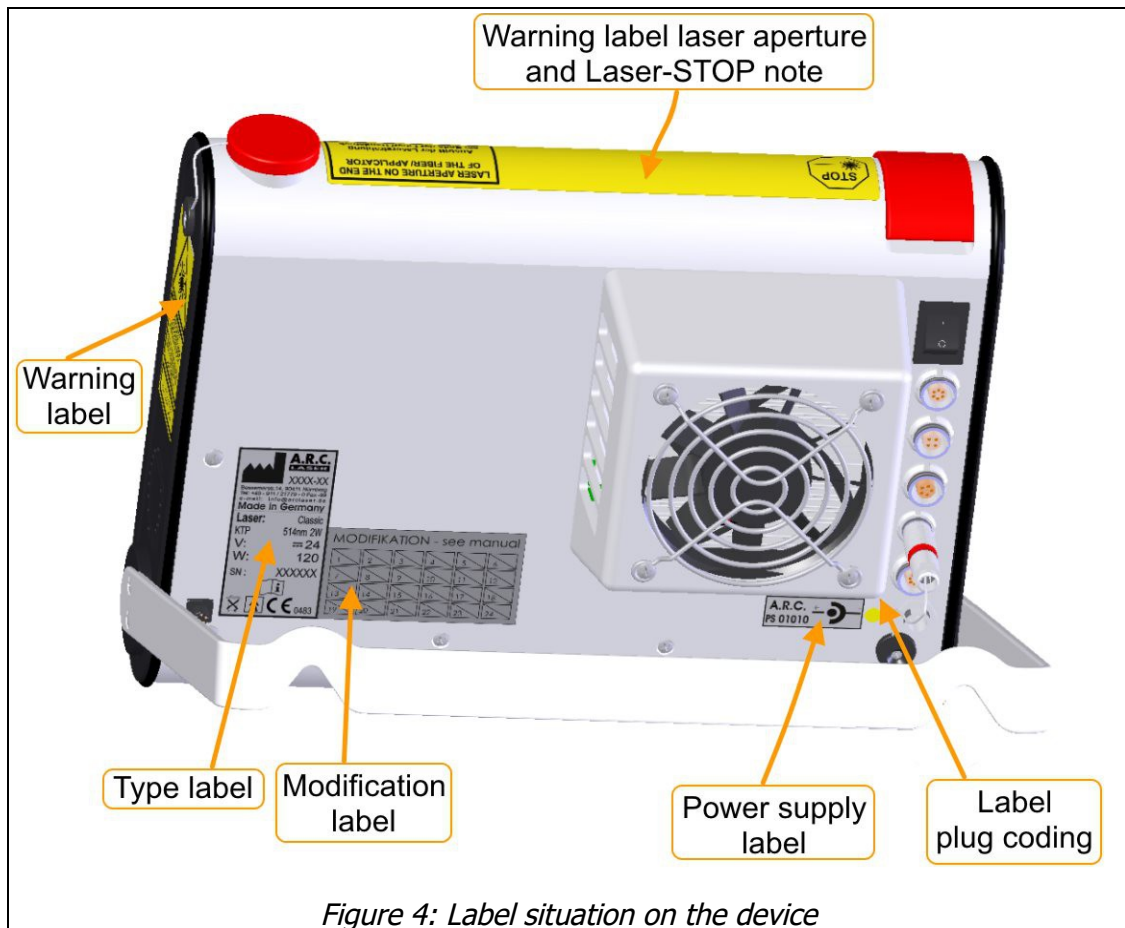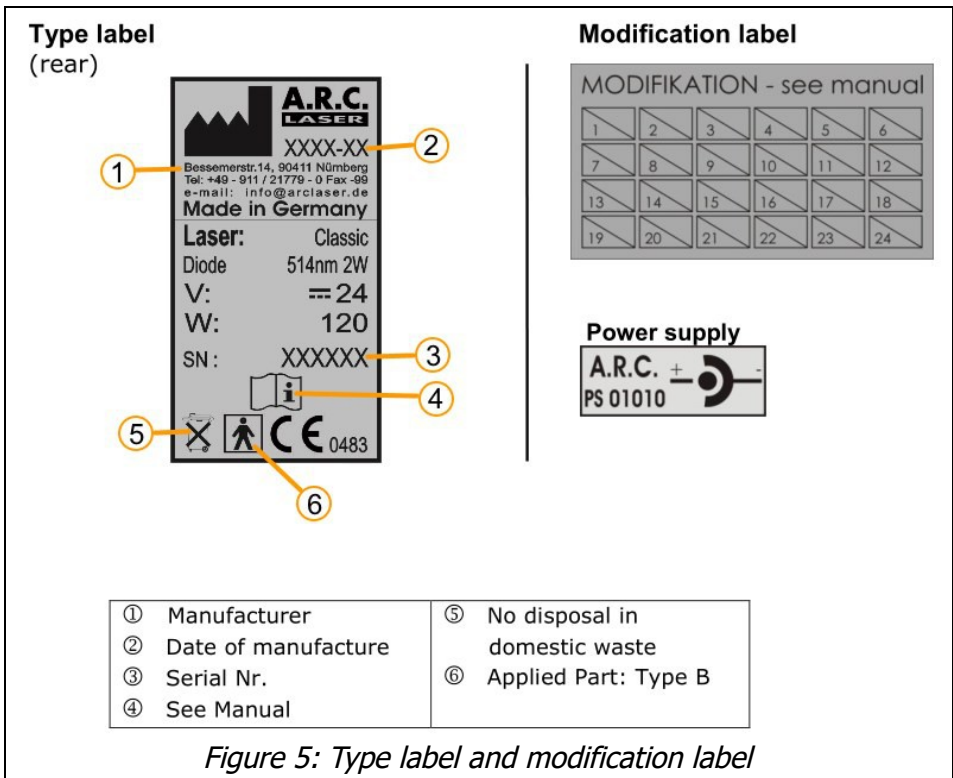
Packaging of Classic 514 for transport

1.2 Service and maintenance

Safety-related check (SRC = German STK)

Required tools to service Classic 514

- Service-PC with HyperTerminal
- Classic service cable (please refer 6.1 Cable overview)
- RS232 cable (please refer 6.1 Cable overview)
- Laser Power meter
- Foot switch or manual trigger
- Safety goggles
- diverse Allen screwdrivers
- tweezers (curved), better when plastic
- very small screwdriver

Service interface

- At the rear side of the housing you find the service port
- Plug in the Classic service adapter cable KB04022 which converts the round plug of the Classic to standard RS232 connector in the dedicated port (shown in Figure 6).
- Via the A.R.C. service cable (KB01005, two RS232 plugs) you can connect the laser device to your PC (maybe you need a further adapter as RS232 to USB converter cable EL01368)

KB04022

Service port

Figure 6: Service interface
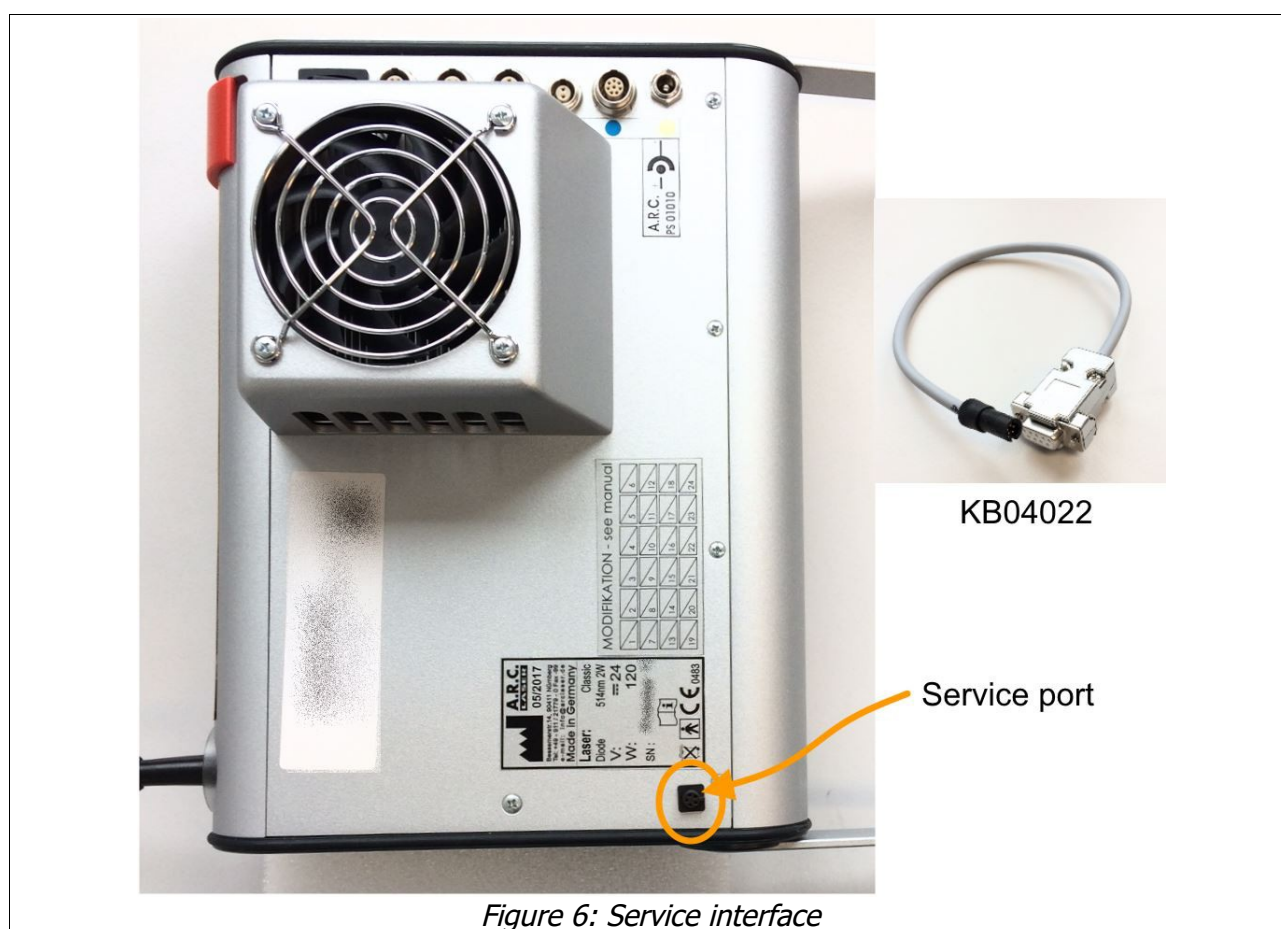
- For service menu you need a terminal program as HyperTerminal by Windows (serial interface).
- Adjust the HyperTerminal settings:
  - **COM**-Connection
  - **9600** Bits per second
  - **8** data bits
  - **no** parity
  - **1** stop bit
  - **no** flow control
  - Terminal keys
  - ANSI-Emulation
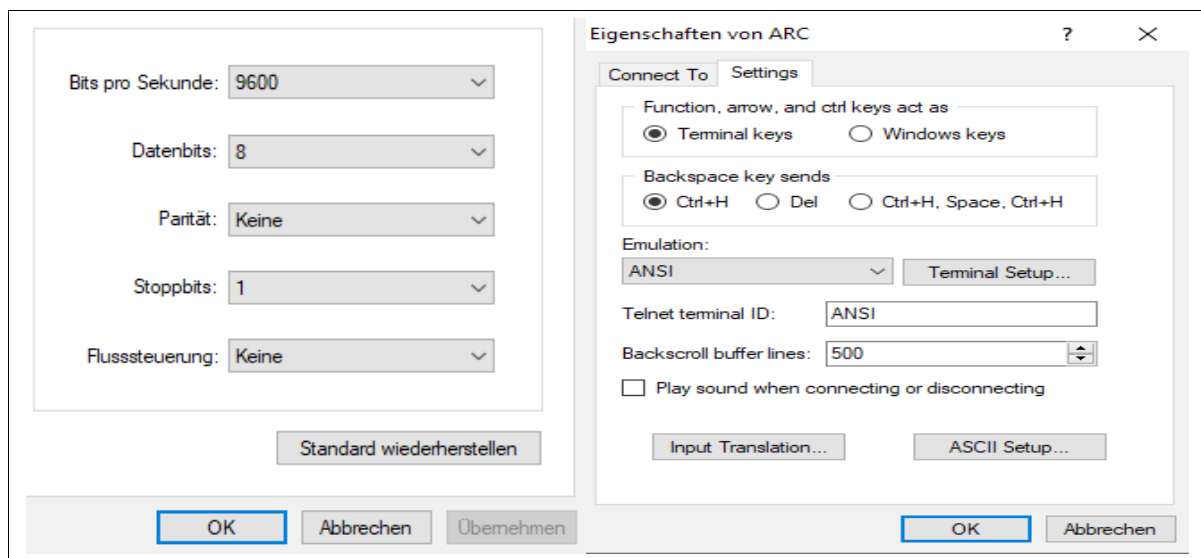
2 Software

2.1 General

The Classic 514 software is divided in four components. In the following the main functions of these SW-programs are described:

IC08407 "Main CPU Classic 514"

- Performance of System-Check
- Sensor control and monitoring (Diode temperature, voltage monitoring, temperature and humidity total device)
- Evaluation of the shot trigger signal
- Service mode control
- Check of chip-combination
- Administration of user settings
- Output of laser parameters for display

IC08402 " Safety CPU"

- Enabling laser driver
- Release of Interlock-chain
- Monitoring Safety-Shutter
- Monitoring eye protection filter

IC09801 "Temperature Control"

- Sensor control and monitoring of laser diode temperature (+10 to +45°C)
- Controlling and monitoring of fan function and heat sink (+25 to +35°C)
- Temperature control of laser diode (+15 to +35°C)
- Release the Interlock-chain

IC07704 " Display for Classic 514"

User Interface

- Graphical user interface (output of text, units, icons and animations)

Chip combination

The so called chip combination is the tested and released combination of the four SW-pro-grams (with version and date).

At the moment of the creation of this service manual chip combination V1.0 was actual:

IC07704	V1.0	11.07.2017
IC08402	V1.0	27.02.2008
IC08407	V1.1	11.07.2017
IC09801	V1.6X	22.01.2010

2.2   Programming

Opening of the housing

- See chapter: **Disassembling of Classic 514 - Opening of the housing**

  (4. How to service Classic 514...; 4.2 Exchange; Disassembling of Classic 514 - Opening of the housing on page 37)

Hardware settings

- plug in USB-cable into USB debug adapter (1)
- connect the adapter to your computer (2)
- connect the adapter with the programming adapter (3)
- connect the service adapter with the correct micro match plug on PL11084 / PL11077 / PL11098 in the inside of the device (4)
- remove the door interlock connector
- ensure that all flat ribbon cables, which connect rear panel with the front, are plugged and turn the device on

<u>IC08407</u>

Use the specified adapter and connect your PC with the correct port on PL11084 (compare Figure 7 and Figure 8).

Figure 7: Connection line to PL11084

Figure 8: Connection port to program IC08407

IC08402

Use the specified adapter and connect your PC with the correct port on PL11084 (compare Figure 7 and Figure 9).

Figure 9: Connection port to program IC08402

IC07704

Use the specified adapter and connect your PC with the correct port on PL11077 (compare Figure 10 and Figure 11).

Figure 10: Connection line to PL11077

Figure 11: Connection port to program IC07704

IC09801

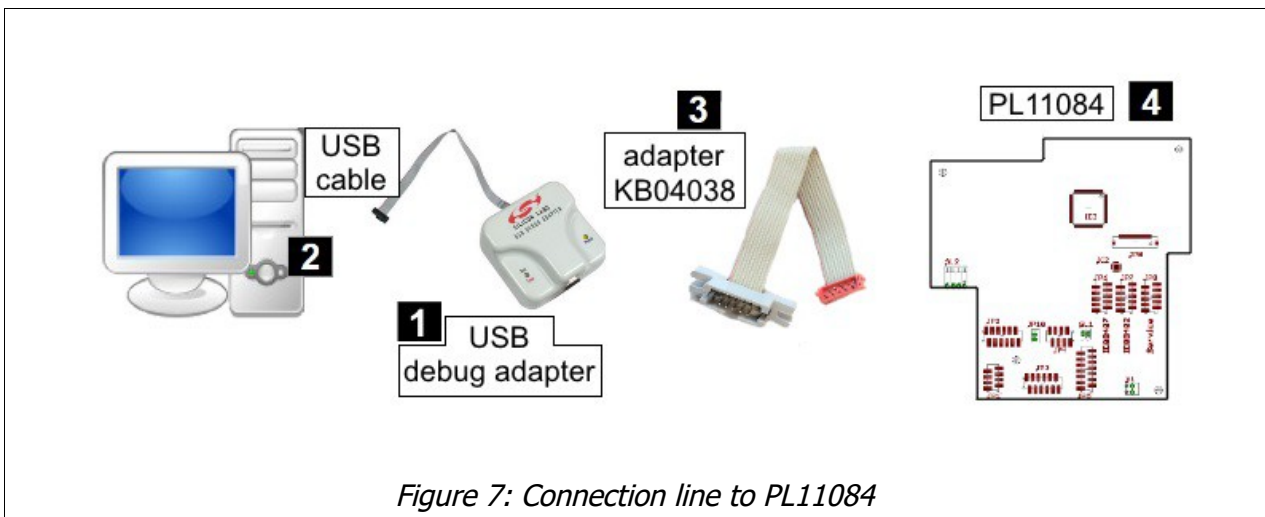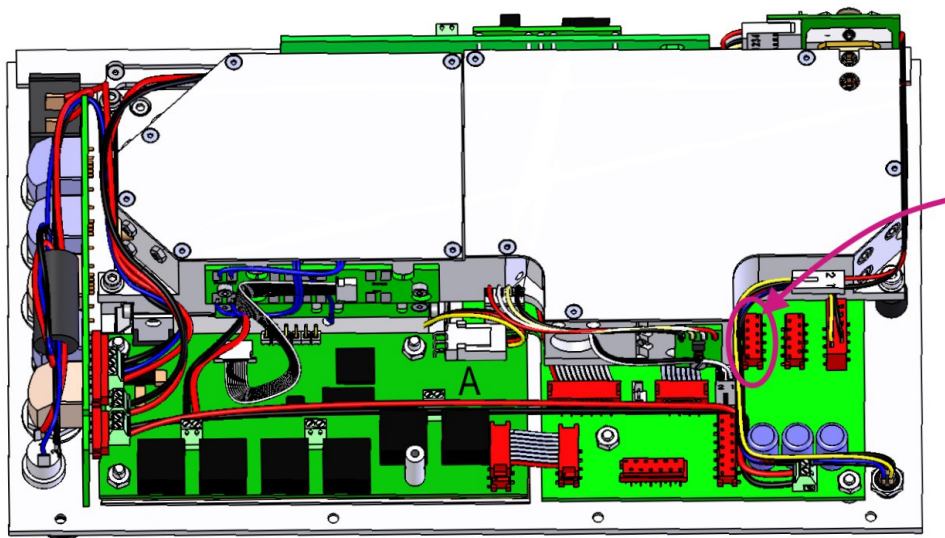Use the specified adapter and connect your PC with the correct port on PL11098 (compare Figure 12 and Figure 13).
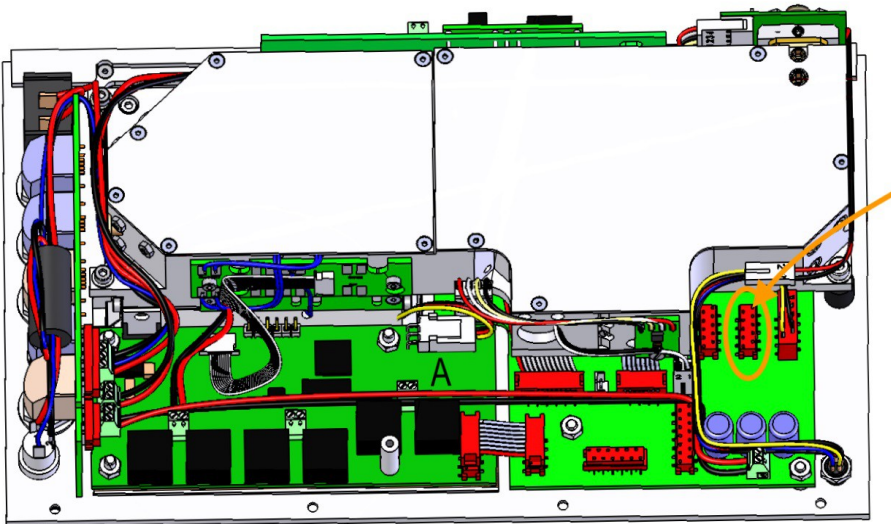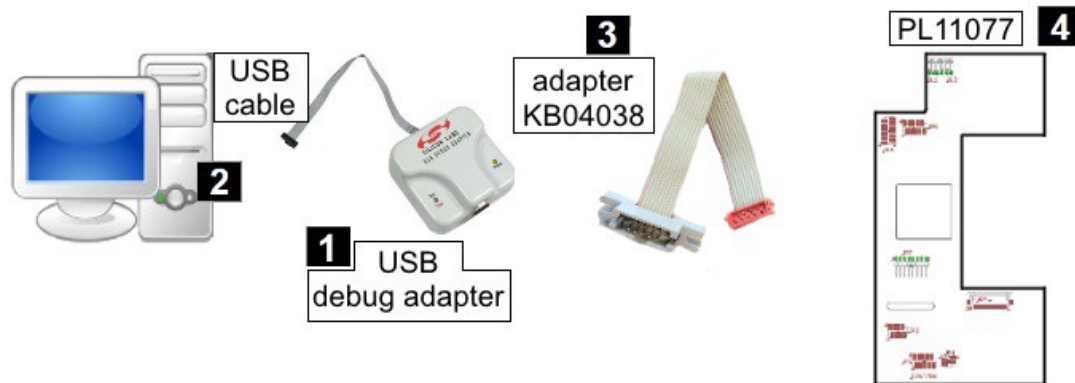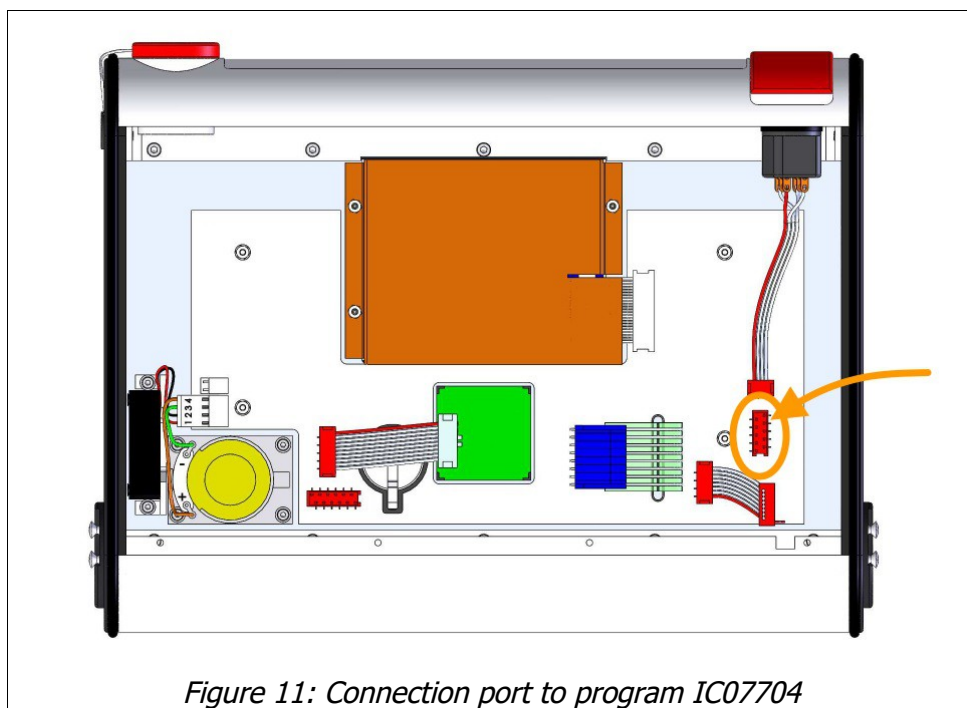

Figure 12: Connection line to PL11098

Figure 13: Connection port to program IC09801
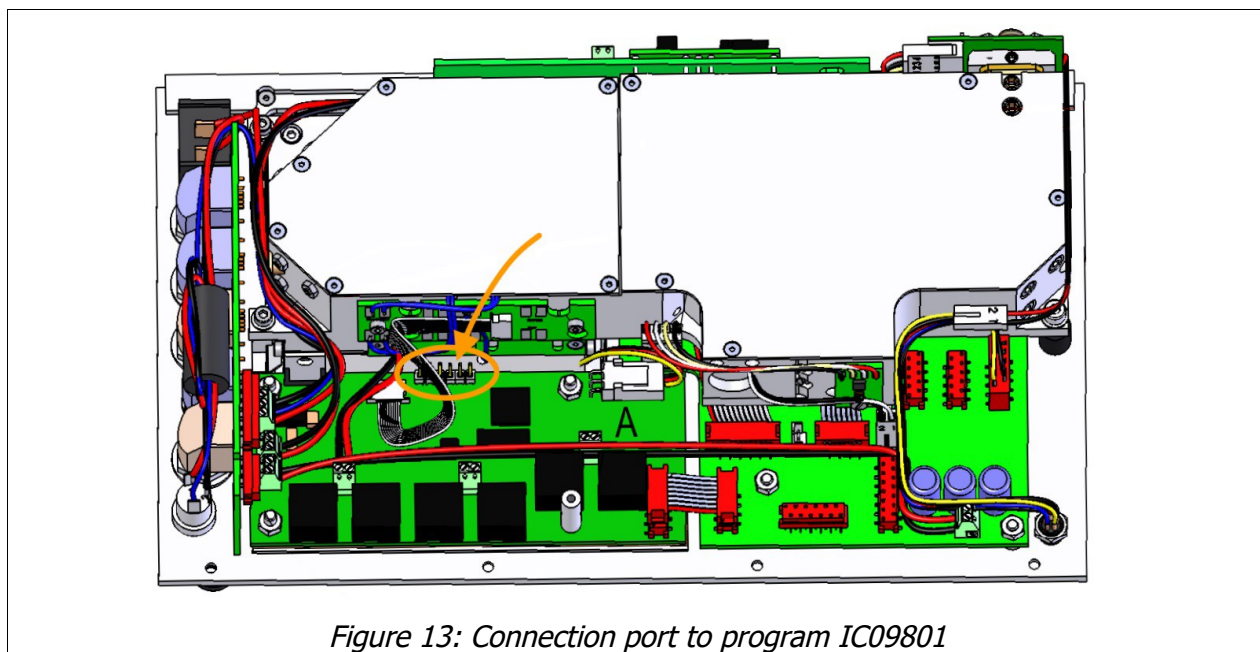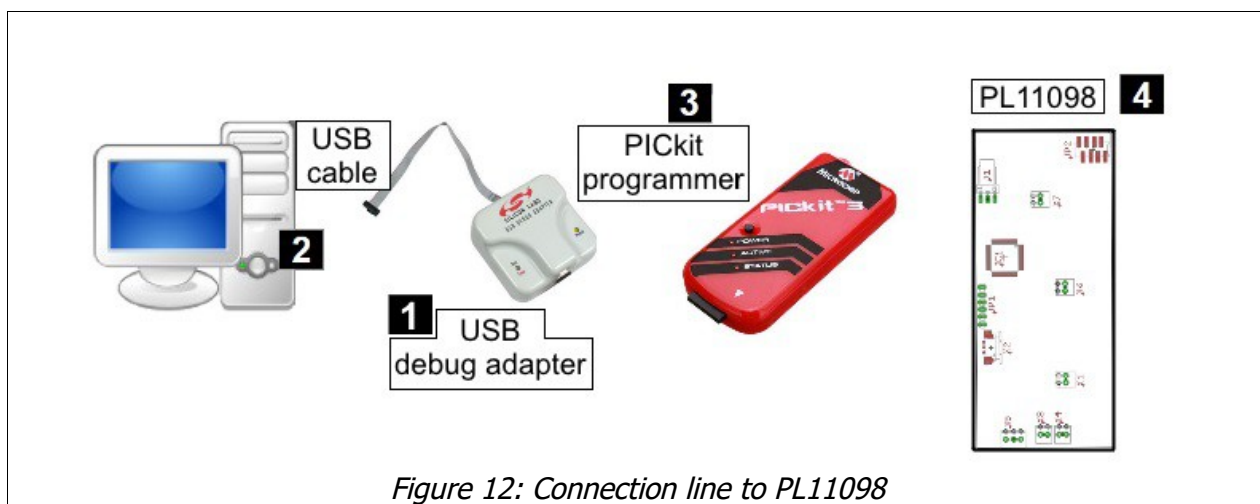
PC settings – How to install new software version of IC08407

If not done before download the software: *flash programming utility* silicon labs from the website *www.silabs.com.*
Link: *http://www.silabs.com/products/mcu/Pages/8-bit-microcontroller-software.aspx*

Main program – data transfer:
- At PC open the program „FLASH Programming Utility"
- Start the laser (green operation LED starts blinking, after some time the display lights up)
- Switch to the tab "**Connect/Disconnect**"
- Adjust the debug interface on "**JTAG**"
- Then switch to tab "**Flash Erase**" and
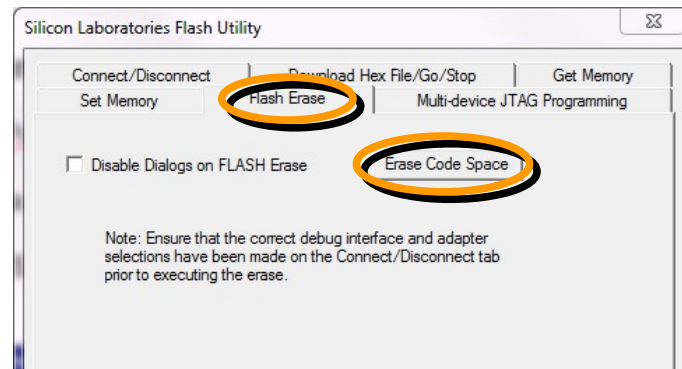
- Press "**Erase Code Space**" - maybe an error message appears, please retry to erase the code (a second try is often necessary and normal) → you will be informed about the success
  - If it doesn't function please check the complete connection (compare Figure 8) and if the device is on
  - Note: After switching on the laser you should await the light up of the display to start the programming

- Switch to tab „**Connect/Disconnect**"
- Check if „**JTAG**" is adjusted
- It should be chosen "**USB Debug Adapter**"
- Connect via pressing the appropriate button: "**Connect**"

Classic_514_SManual_V1.0_en
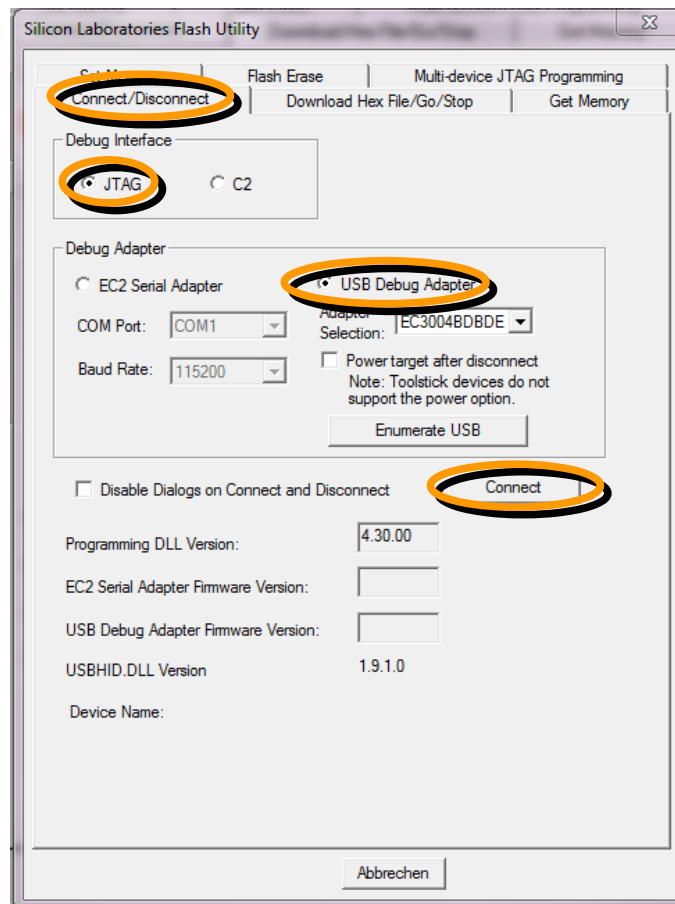
- Switch to tab "**Download Hex File/Go/Stop**"
- Via the "**Browse**"-button load the appropriate file:

Classic 514
IC08407

- Please check to browse the actual data from the actual chip version
- Check also if the other SW-programs of Classic 514 have also to be updated → otherwise a chip combination error maybe occur (F49)
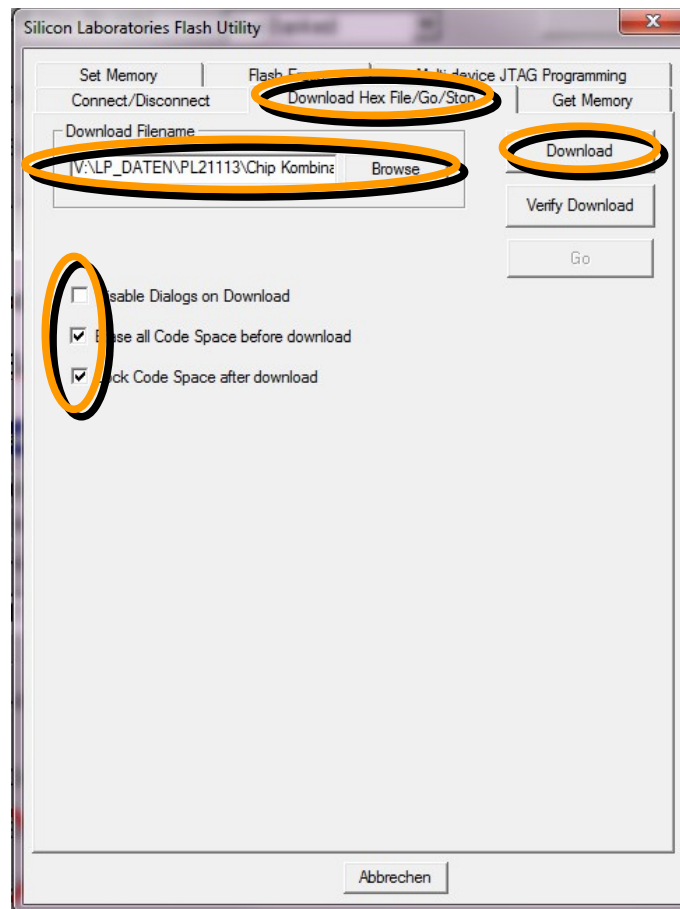
- Place a tick at "**Erase all Code Space before download**" and "**Lock Code Space after download**"
- Now start the download by pressing the button "**Download**"
- After ended process a message therefore appears which can be confirmed

- **Switch again to tab "Connect/Disconnect"**

- Disconnect via the button **"Disconnect"**

Finish the programming and document it:
- If you have the device documents in physically form by hand you have to note your done software update in the appropriate documents
  - testing protocol board PL11084 (protocol 055)
  - if the update is part of a modification and everything is done:
    - modification form
    - mark the modification label

Classic_514_SManual_V1.0_en

- Fill out the service documents

PC settings – How to install new software version of IC08402

If not done before download the software: *flash programming utility* silicon labs from the website *www.silabs.com.*
**Link:** *http://www.silabs.com/products/mcu/Pages/8-bit-microcontroller-software.aspx*

Safety program – data transfer:
- Be sure your debug adapter is plugged at the correct position!
- At PC open the program „FLASH Programming Utility"
- Start the laser (green operation LED starts blinking, after some time the display lights up)
- **You can follow the update instructions of IC08407 but you have to adjust "C2" at the tab "Connect/Disconnect"!**
- At browsing the software be sure to load **IC08402**
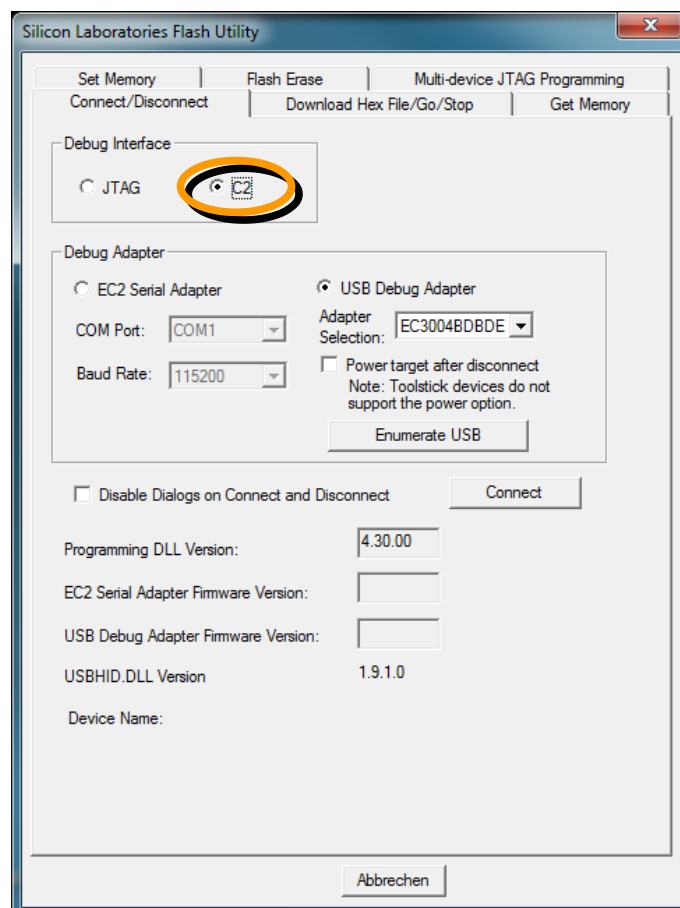
PC settings - How to install new software version of IC07704

If not done before download the software: **iLCD Manager XE** of the company demmel products from the website *www.demmel.com.*
Link: *http://www.demmel.com/de/service/downloads.html*

Display interface program – data transfer:

- At PC open the program "iLCD Manager XE" → Program opens see picture at the right
- Start the laser (green operation LED starts blinking, after some time the display lights up)
- Then open the software via
  - File
  - Open
  - appropriate storage location
  - IC07704_V1.0.lcdp-flash
- Then the file is loaded and all of the different segments of the software are shown (compare figure below)

Classic_514_SManual_V1.0_en
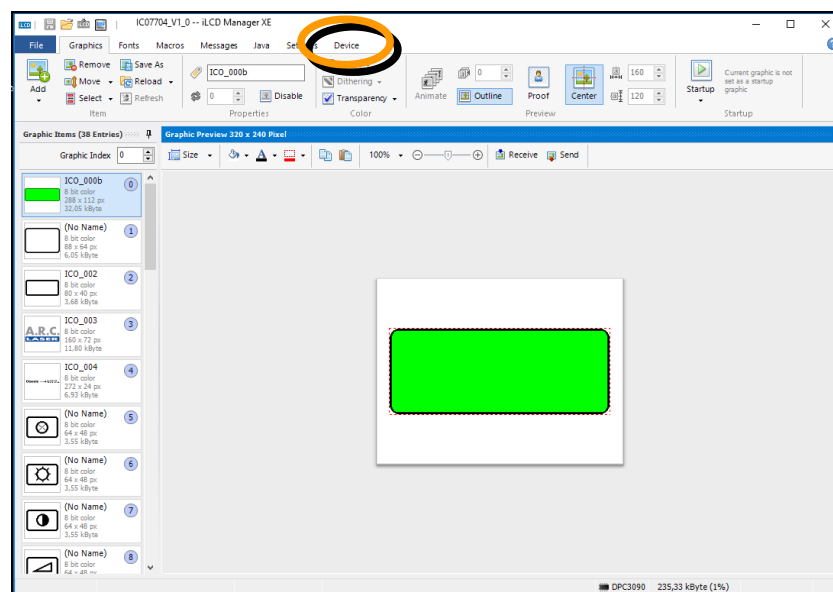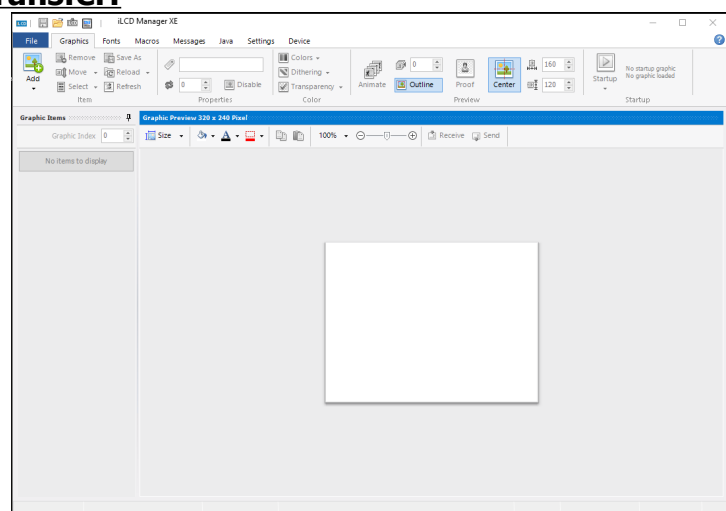
- Switch to "Device"

Finish the programming and document it:

- If you have the device documents in physically form by hand you have to note your done software update in the appropriate documents
  - testing protocol board PL11077
  - if the update is part of a modification and everything is done:
    - modification form
   - mark the modification label
- Fill out the service documents

PC settings - How to install new software version of IC09801

To program IC09801 you need the Microchip PICkit 3 and its programming software.

- Connect the PICkit via JP1 of PL11098 and start the laser
- Open the PICkit programmer
- The micro processor should be detected automatically (Device, User Ids Checksum should get filled out)
- Then open the software via
  - File
  - Open
  - appropriate storage location
  - V1.6.hex
  - confirm via "open"
- The successful import is shown via text message
- After that start the programming via the button "Write"
- The running process is shown via loading
- It is finished after the message "Programming Successful"
- Close the program, disconnect the PICkit and restart the laser when it starts with the new software you're finished

Finish the programming and document it:
- If you have the device documents in physically form by hand you have to note your done software update in the appropriate documents
  - testing protocol board PL11098
  - if the update is part of a modification and everything is done:
    - modification form
    - mark the modification label
    - Fill out the service documents

Classic_514_SManual_V1.0_en

2.3   *Service mode with HyperTerminal*
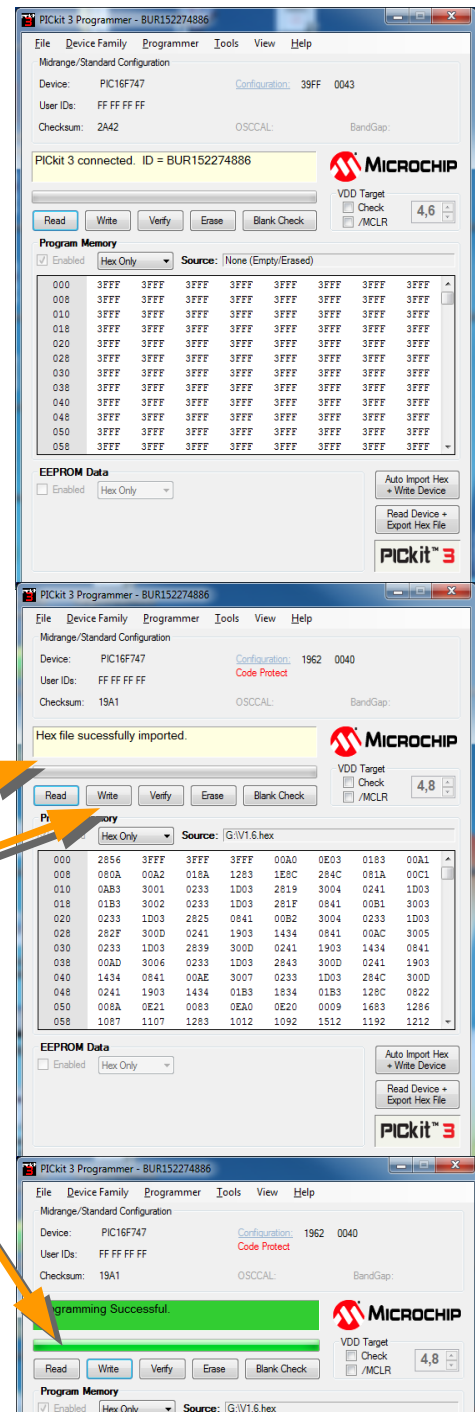
The laser is equipped with a special service program. It allows to check a variety of electronic functions of the laser and to align the device. For the communication, you need a terminal program, like HyperTerminal from Microsoft or similar free ones you can find in the internet. Computer is needed as monitor and keyboard.

Attention:
All changes of any settings in the electronic can influence the function of the laser. Write down all changes (old and new settings with date of change) to be able to recover old settings in case of problems.

Required tools:
– computer with serial port
– or computer with available USB
  (only with USB adapter cable art. no. KB01180)
– terminal program on the computer. DOS programs as well as HyperTerminal (standard in most windows computers) are accepted.
– A.R.C. Laser RS232 cable (KB01005)
– service adapter cable (KB04022)

Connection

1. Connect the service adapter cable and set up HyperTerminal as described in 1 Laser description, 1.2 Service and maintenance, Service interface on page 12.

When all settings are correct and laser device and PC are connected the system-check of the device will be shown in HyperTerminal when it is started (see Figure 14).

```
  ** System-Check **

00) Internel Bus-System OK
    External Bus-System OK
    Init Display OK
01) EEProm Write AAH OK
    EEProm Read  AAH OK
    EEProm Write 55H OK
    EEProm Read  55H OK
    WDT Status >08H< = FFH OK
    EEProm User  OK
02) Input Voltage (> 18V) = 24.46V OK
    +5V  (+-0.15V) = 4.99V OK
    +12V (+-0.50V) = 12.11V OK
    Temperature (>= 10 and <= 40) = 27.3° OK
    Air Humidity (< 75%) = 38% OK
    Not-Aus OK
    External IL-Loop OK
    Safety CPU: IC08402 V1.0 27.02.08
    Safety CPU Loop OK
03) Ready Key OK
    Poti Key OK
    Keyboard OK
04) Checksum Test OK
05) Footswitch first and second conn. OK
Footswitch first conn. OK
    Footswitch second conn. OK
06) Test Safety Shutter
    -Shutter-Open   OK
    -Shutter-Close  OK
    -Shutter-Open   OK
    -Shutter-Close  OK
    -Shutter-Open   OK
    -Shutter-Close  OK
    -Shutter-Open   OK
    -Shutter-Close  OK
07) DAC0/DAC1 < 50mV = 0.005V OK
    DAC0+1 to 3V+- 0.2V = 0.302V OK
08) Driver Enable OFF  < 3.0V = 00.03V OK
    Driver Enable  ON 10V +-1,5V = 09.99V OK
    Safety CPU OFF
    Driver Voltage  < 3.0V = 00.86V OK
    Safety CPU  ON
```

```
    Driver Voltage 10V +-1,5V = 09.98V OK
    Laser Enable OFF / Diode Voltage  < 1.0V = 0.024V OK
    Laser Enable ON / Diode Voltage  3.3V +0.1V/-0.2V= 3.256V OK
    Diode Current < 500mA = 0.004A OK
    Diode Voltage OFF < 1.0V = 0.139V OK
09) Test Peltier1/2/3:
    P1 24,89/26,40/C00   P2 24,79/24,56/H35   P3 24,54/24,68/H35 OK
10) Test Laserpower
    P1 value =  0.630A +01.70%  OK
    P2 value =  0.951A +00.42%  OK
    P3 value =  1.613A +02.49%  OK
11) Lasertype = 00
12) Test Slitlamp Eyefilter
    -Shutter-Close  OK
    -Shutter-Open   OK
    -Shutter-Close  OK
    -Shutter-Open   OK
    -Shutter-Close  OK
    -Shutter-Open   OK
    -Shutter-Close  OK
    -Shutter-Open   OK

** System-Ready **
_
```

Figure 14: Screen System-Start in HyperTerminal

During the system-check many basic functions and device states are checked by the laser itself → reading out the messages in system-check when an error occurs helps you to find the cause!

Note: After position 0 of the system-check "Init Display OK" is shown and the display lights up. This is normal!

General about the handling

In the different submenus big letters symbolize displayed parameters which can't directly changed in Hyper Terminal, small letters symbolize parameters which can be adjusted. In the upper part of the screen the explanation of the different letters is given and in the lower part are, in a row, the different values of these parameters.

After selecting a parameter (with a small letter) you will see a star beside its value. Now you can change it with the buttons <+> and <->.

- – Back to previous menu without saving: <Esc>
- – Show help with: <z>
- – Save changes with: <x>
- – Change step value inside parameter with: <1> to <4> (1:1; 2:10; 3:100; 4:250) (step values may differ)

Overview of the submenus

```
A.R.C Laser GmbH Classic 514nm Lasersystem
  (IC08407 / V1.0 / 11.07.2017)

Function submenues:

1) Safety functions
2) Control functions
3) IO functions
4) LH functions
5) Laser power
a) System
b) Calculate checksum
c) Restart Laser
d) Stop Laser System
```

Figure 15: Overview service menu: main menu
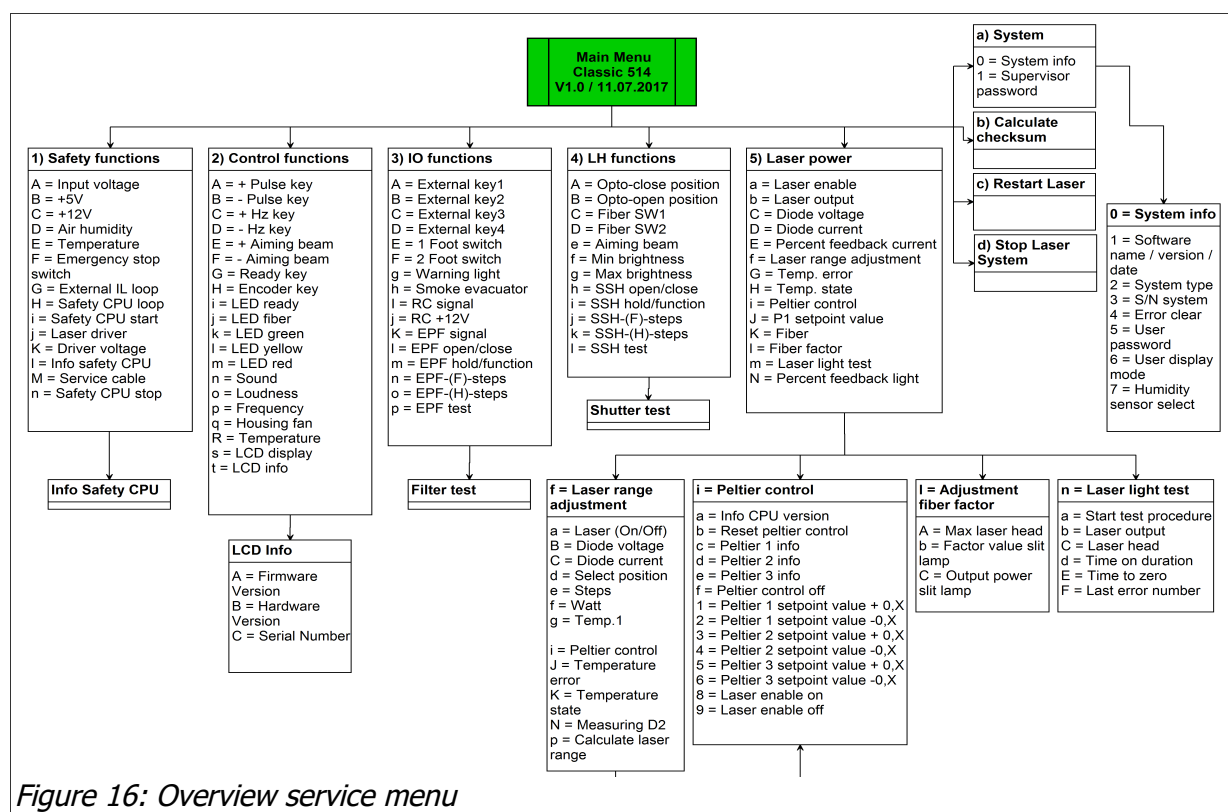
Figure 16: Overview service menu

A.R.C. Error Code

The probably most important tool of this manual is the error list. For reasons of a fast access it is attached at the end of the document, but it is not less important.

In this list the error numbers (error code) are assigned to the particular error source, a short explanation and suggestions of possible activities to troubleshoot. Some of them are further described below.

3   Inner parts of Classic 514

3.1   *Built-in circuit boards*
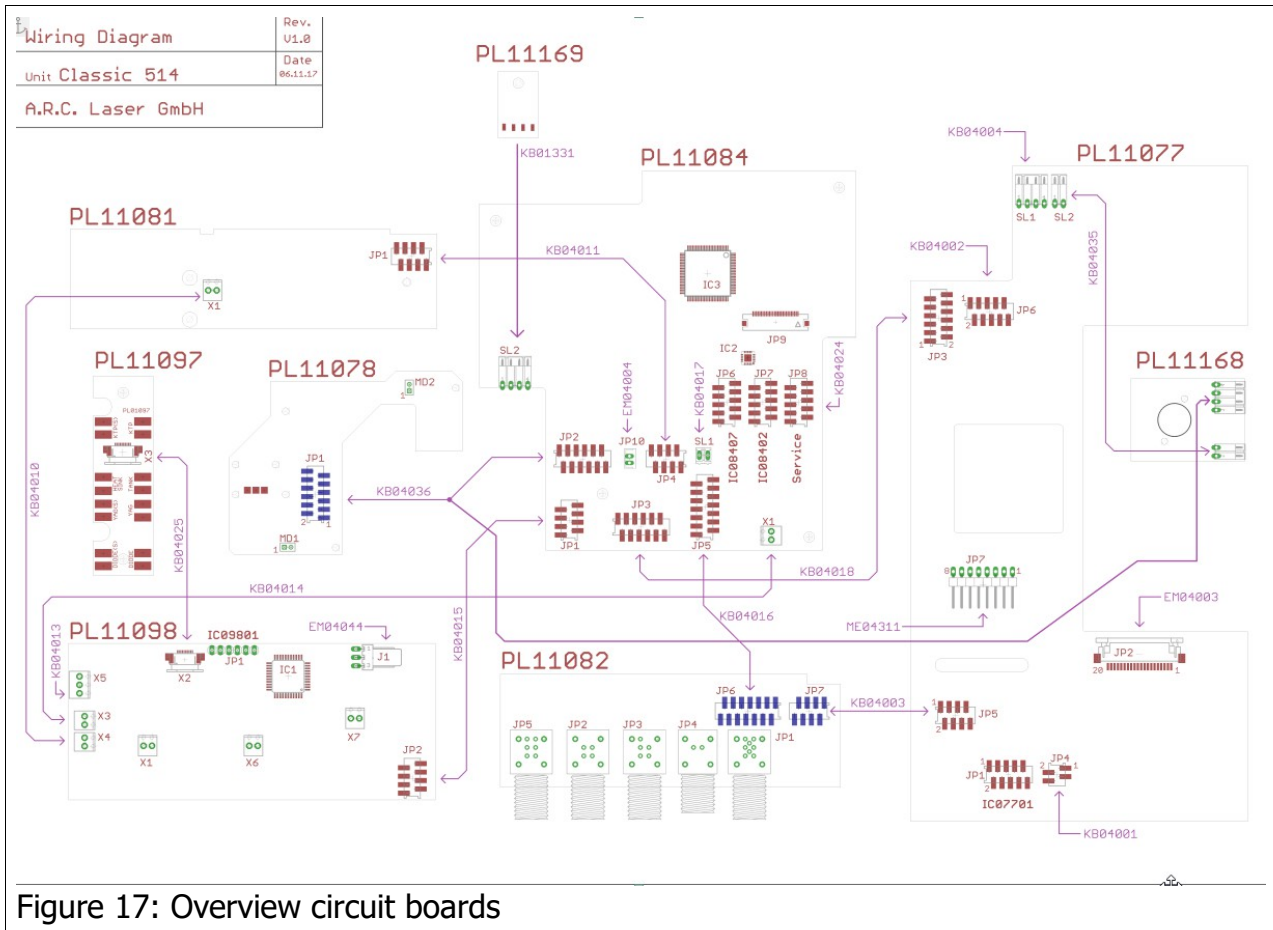
Figure 17: Overview circuit boards

Inside the Classic 514 you'll find nine circuit boards:
- PL11077: Front board
- PL11078: Laser head board
- PL11081 as Z1: Classic driver
- PL11082: Classic IO-board
- PL11084 as Z1: Classic CPU-board
- PL11097 as Z1: Classic NTC adapter board
- PL11098: Classic peltier control board
- PL11168: Classic fiber switch and LED board

Classic_514_SManual_V1.0_en

- PL11169: Humidity and temperature sensor

3.2 Overview main assemblies

Figure 18: Laser device dismount in the two main assemblies front and back panel

Classic_514_SManual_V1.0_en
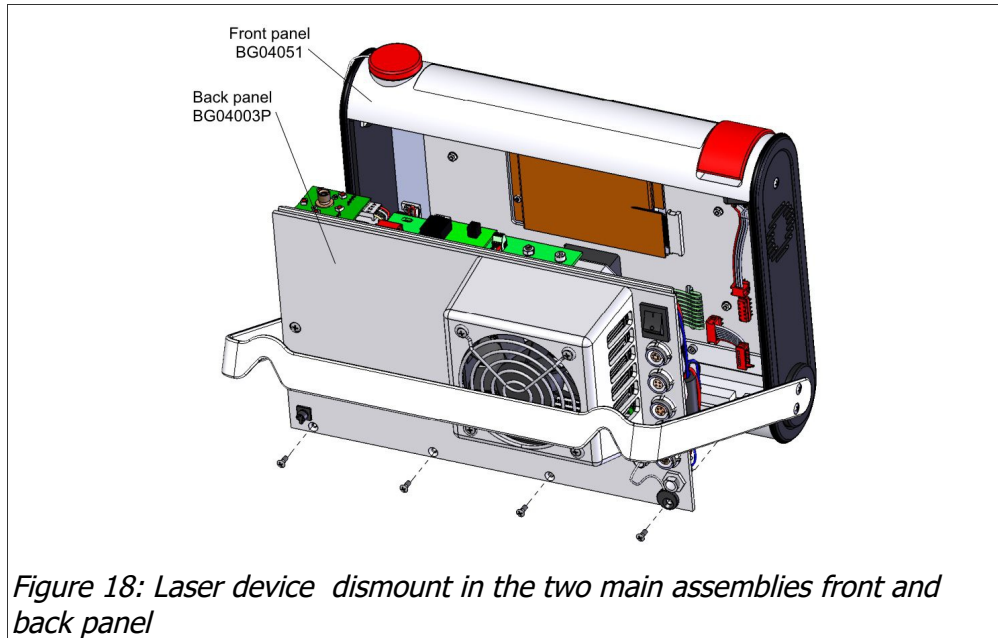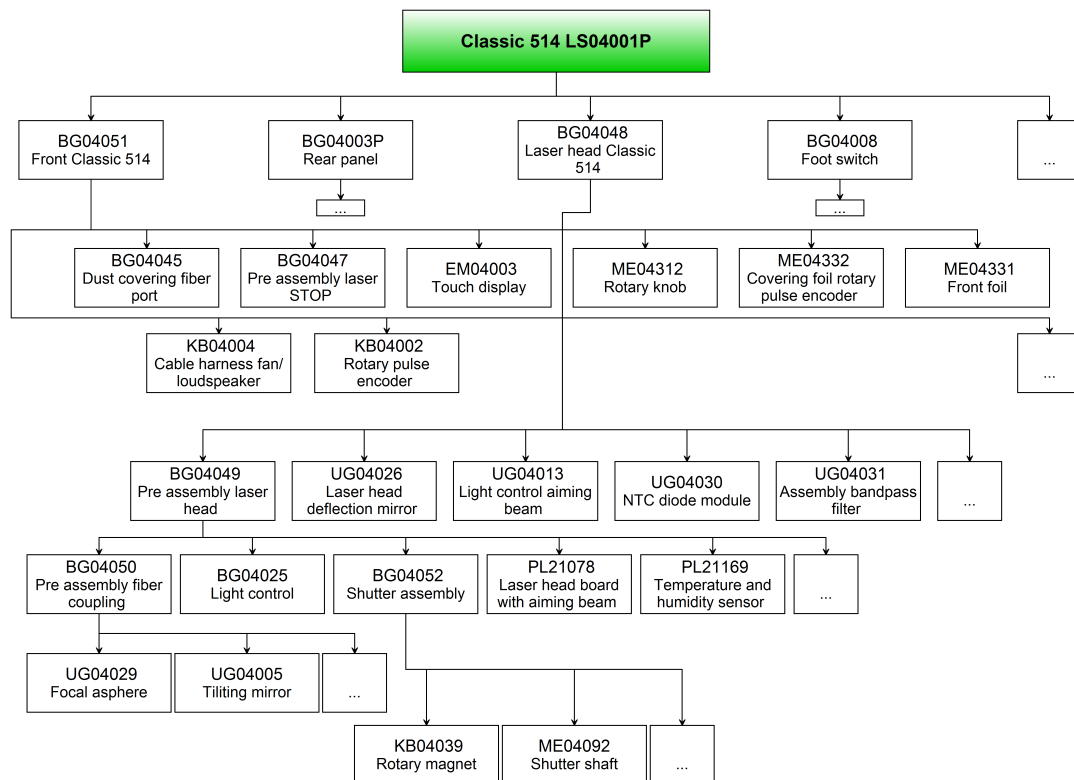
Figure 19: Tree diagram of several Classic 514 components

4   How to service Classic 514...

4.1   *During normal operation*

Check software version during normal operation

In normal operation mode of the Classic 514 you can check the actual installed SW-version in the settings:

• Start the device and enter user-PW

• Switch from main menu to the settings display (compare Figure 20) via pressing the two aiming beam buttons simultaneously (functions only in STANDBY-mode)

• Navigate via the aiming beam buttons to the info icon and confirm (pressing rotary knob)

• No you can read out the installed SW-versions (compare Figure 21)
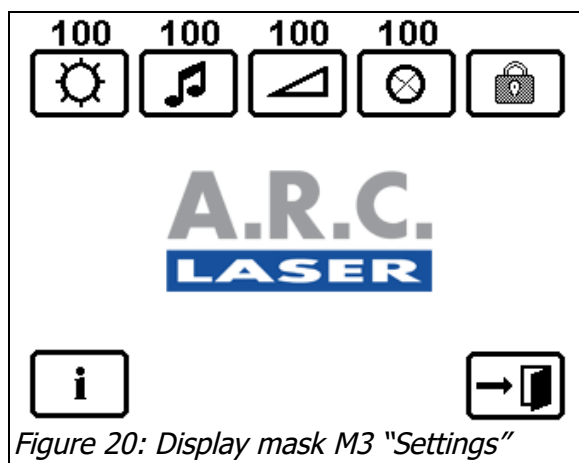
Figure 20: Display mask M3 "Settings"
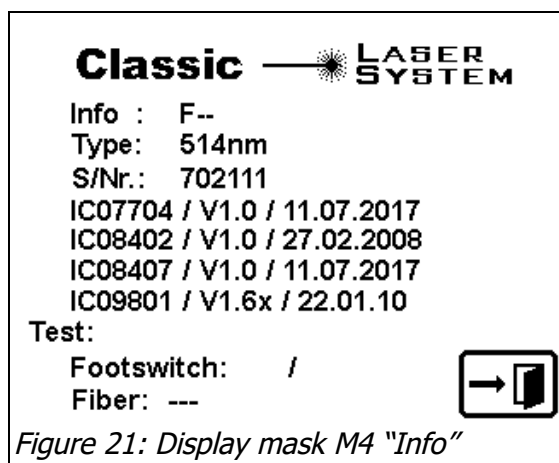
Figure 21: Display mask M4 "Info"

- At the position "Info" the last occurred error is listed
- In this menu you can read out the installed software versions
- Under the point "Test" you can test the function of foot switch and fiber detection
  - Foot switch: press the switch you will see FS1/FS2 on the display
  - Fiber: the fiber monitoring is not active, because the fiber is not removable by the end user

Change user password

If the user has forgotten his entry password it is necessary to change it. For this you will need the Master-Password.

- Start the device
- Enter the Master-PW: 1950
- Switch from main menu to the settings display (compare Figure 20) via pressing the two aiming beam buttons simultaneously (functions only in STANDBY-mode)
- Navigate via the aiming beam buttons to the lock icon and confirm (pressing rotary knob)
- You will be redirected to a new mask on which the old user password has to be entered – Master Password is also valid
- Then enter a new password (user should memorize it)

Figure 22: Display mask "Change password"
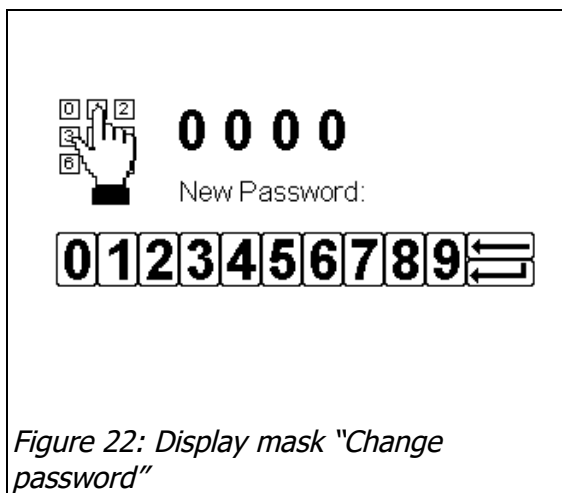
4.2 Exchange

Disassembling of Classic 514 - Opening of the housing

Be sure, that it is really necessary to open the housing and/or to remove the fiber. Removing the fiber entails a new optical and electrical alignment!

Note: The service interface can be also used with a closed device.

- Remove all plugged connectors (trigger plug, eye protection filter, power supply etc.)
- Place the Classic 514 on a clean and even surface – use something with a spare for for the rotary knob so it's not pressed during it lays on the front (e.g. cut out foam). Protect the display and the device front against scratches.
- Remove the screws with a cross-tip screwdriver (compare Figure 23)

Figure 23: Opening of the housing – Screws to remove
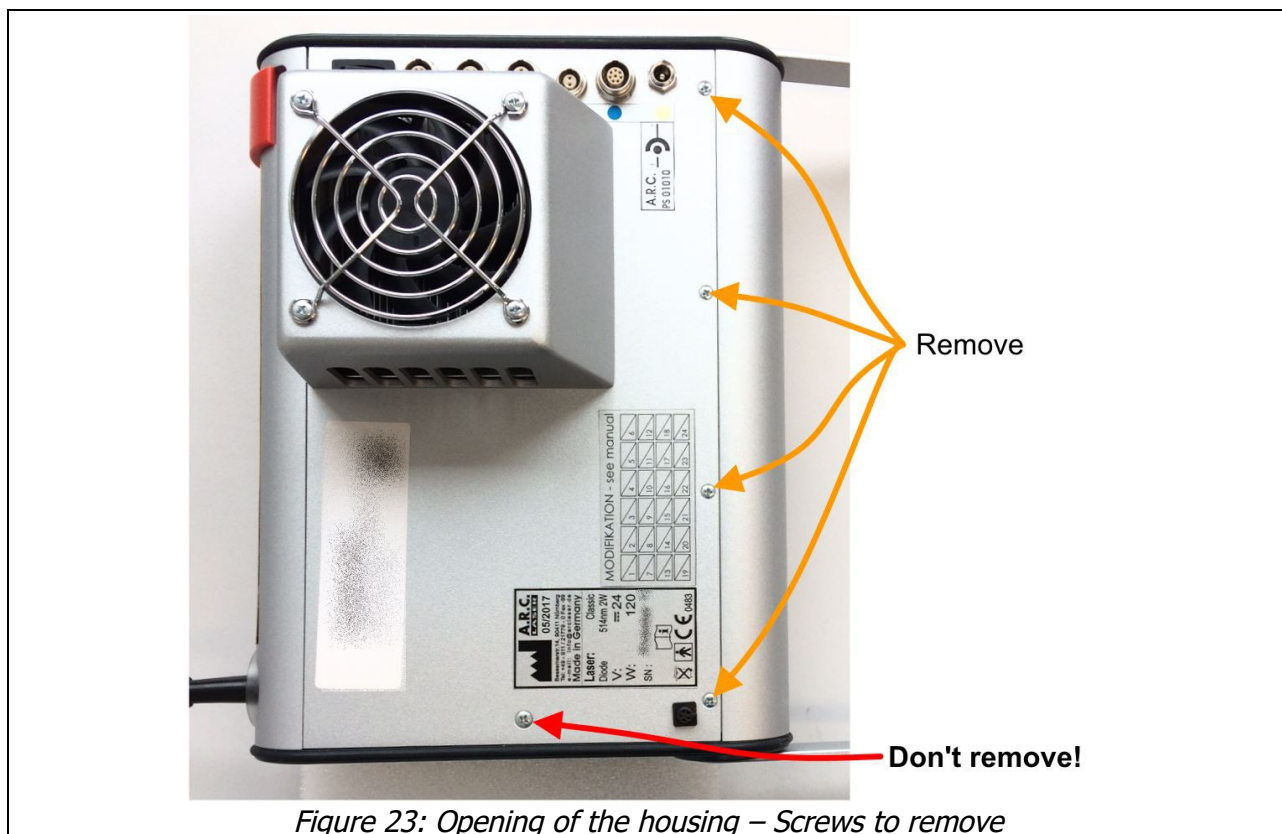
- Don't just lift the back panel! At first lift the lower side, then you can move it sideways to remove.
- Lift the back panel slowly as there are some cables connected and the space inside is tight
- **Be aware not to kink the fiber!**
- Remove the 2-pin fiber sensor cable (see picture). All other cables remain connected.
- Place the laser head on the table as shown in the picture below. Most adjustment work can be carried out in this position.
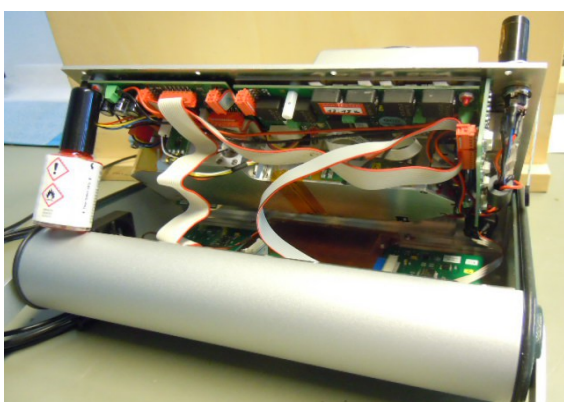
Step 1
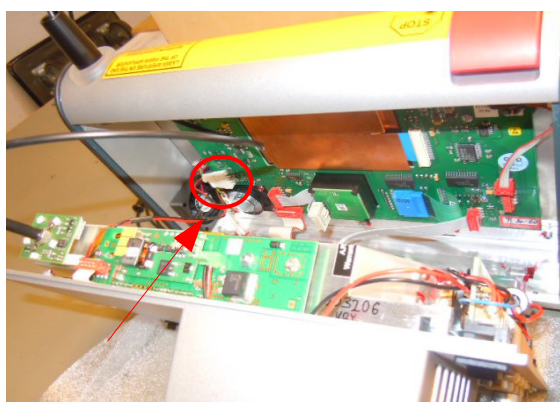
Step 2 remove the sensor cable
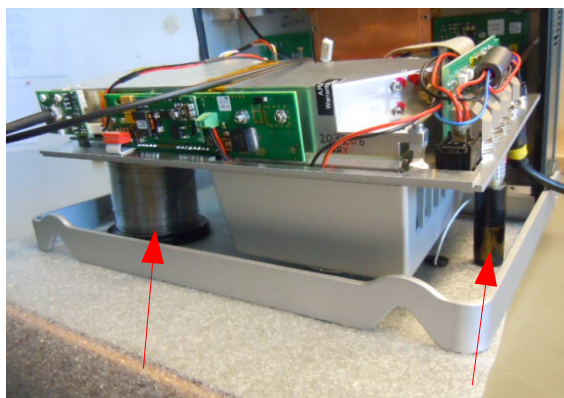
Step 3 place 2 spacers under the laser head
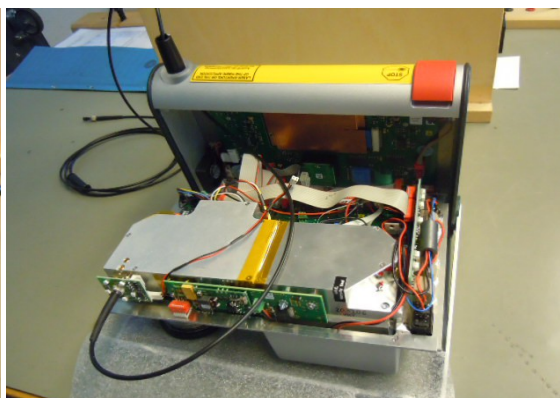
Figure 24 Opening of the housing - Service position

Closing of the housing

Proceed in reversed order:
1. Mount the rear housing in the front panel and pull the fiber through the fiber port simultaneously
2. Connect the 2-pin fiber sensor cable (see picture Figure 24 Opening of the housing - Service position step 2)
3. Put the top of the back panel in the front panel
4. Place the cables in the device, so that they are **not** under the laser head (see picture Figure 24 Opening of the housing - Service position step 1)
5. Built in the four screws and fasten them
6. Plug in door interlock connector
7. Make a full check up of the system

Aiming beam

The aiming beam is part of the circuit board PL11078 (PL21078, if you want to order). When the aiming beam is defect you have to exchange the PL11078. Please be sure before exchanging that the aiming beam is broken and not the electronic alignment set to zero.
1. Open device according to Disassembling of Classic 514 - Opening of the housing on page 37
2. Remove the bigger lid (ME04031) and its five screws (compare Figure 25)Unplug shutter cable, take one screw for shutter out and remove the shutter (compare *Shutter* on page 55)
3. Then unplug the light measuring cube (illustrated in blue in Figure 26)
4. Remove the two screws which fix the light measuring cube at the side and disassemble it
5. Then you can remove the five screws which fix the circuit board (illustrated in green)
6. The circuit board can be changed now
7. Reconstruct all the parts in the laser head and don't forget to check the optical and electronic alignment. For the optical alignment use the Aiming beam adjustment screws (see Figure 26: Exchange PL11078 highlighted in red).
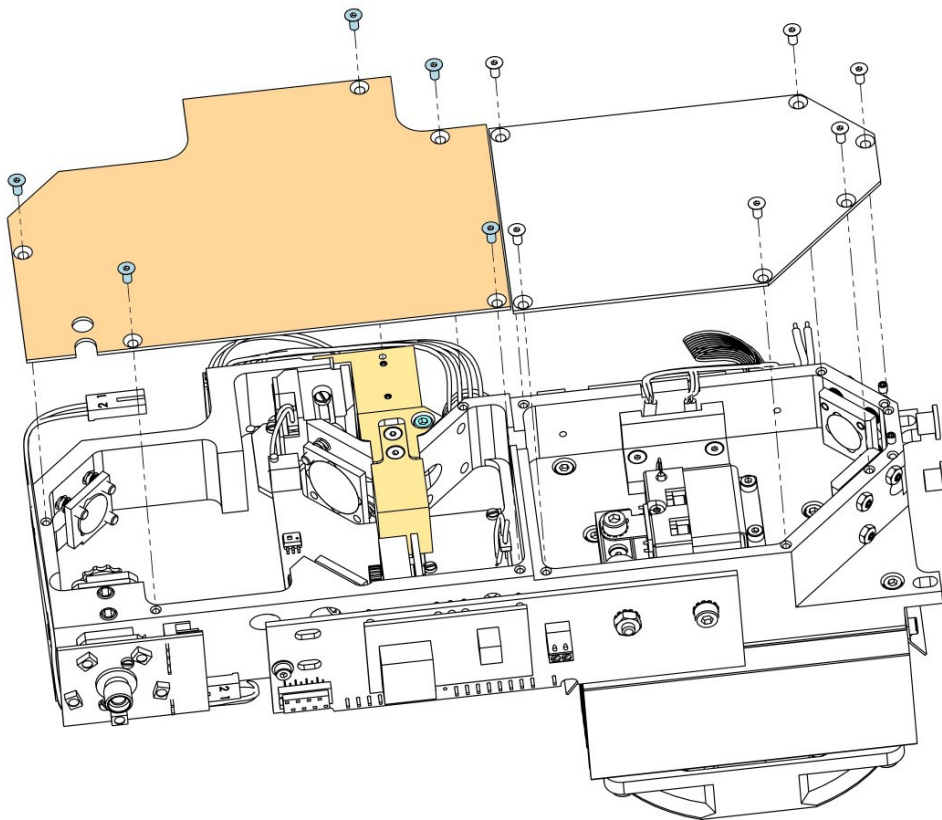
Figure 25: Remove the shutter to reach PL11078

Aiming beam adjustment (near feld)
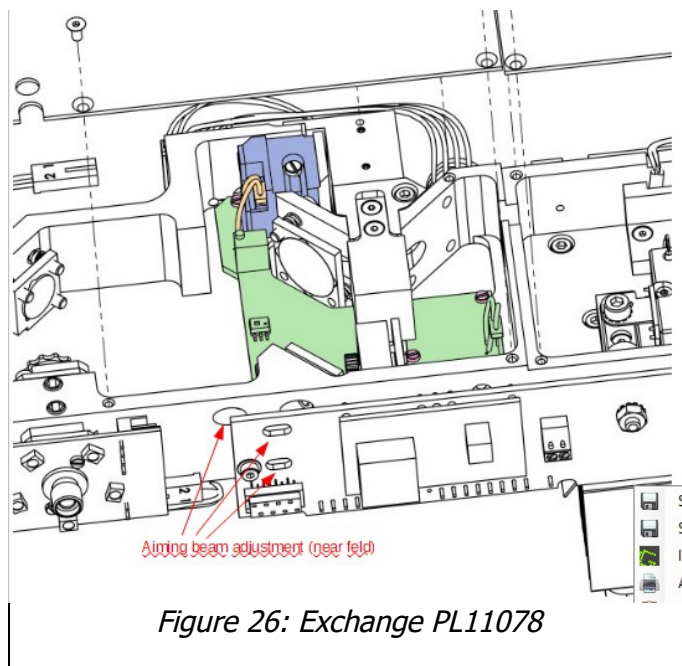
Figure 26: Exchange PL11078

Fan

In some cases the housing fan is broken and has to be exchanged. Before you exchange the fan, please check the signals and its physical intactness. To reach the fan you have to remove the laser head assembly (BG04048). Open the device and separate front and rear panel, then remove the three screws to loosen the laser head (compare Figure 27). Note: in some cases there is a spacer between the laser head and the bracket. You have also to unplug or release several cables to remove the laser head riskless. Please **memorize the correct position** of the cables or you can even make photos of them before releasing.

Figure 27: Remove BG04048
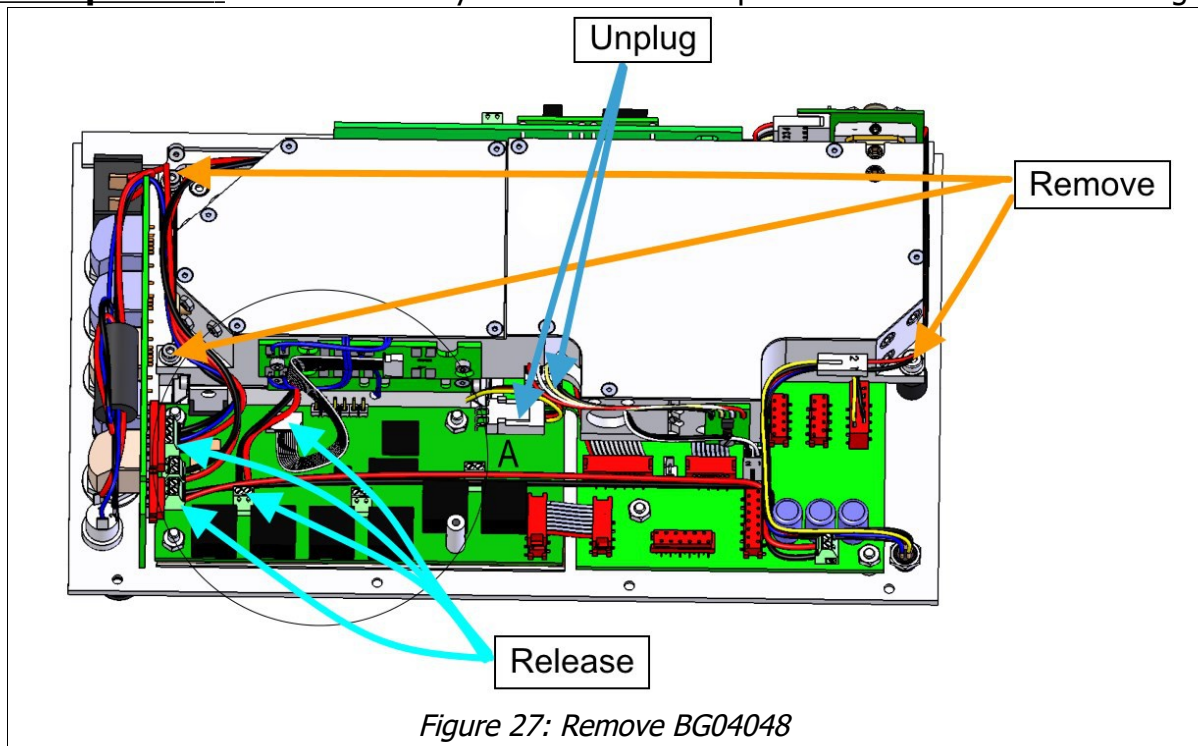
At the rear side of the laser head assembly the fan is mounted. The fan cable is the three wire cable (black, red, yellow) with the plug situated in Figure 27 above the "A".

When the two covering plates of the laser head are mounted (not removed before) you can tilt the assembly and place it rear side up on a clean surface to reach the fan. Then remove the four screws at the edges and exchange the fan. The reassembly is done in reverse order. Please take attention, that, at rebuilding the laser head, there is no influence of pressure to the laser or that there is no twisting by fixation of the laser head.

Figure 28: Fan screws
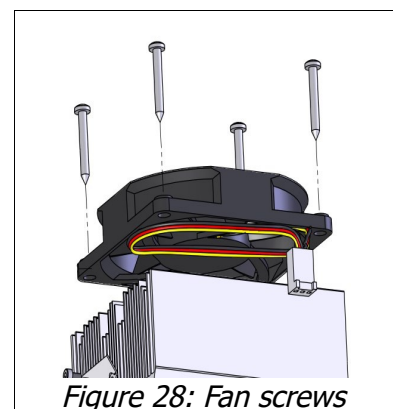
Fiber

Fiber detection (not active with Classic 514nm)

When the READY-mode can't be activated without an obvious reason it could be that the fiber detection is out of function. At first check the fiber detection in Service program: 4 *LH functions*; A, B, C and D.

In normal case the positions A and D are "0" and B and C "1" when the fiber is plugged. To check the opto coupler of the fiber detection you can remove the fiber and check their reaction by e.g. inserting a pen in the fiber port. But be careful not to destroy something or to insert dirt. The opto coupler only change their state when the light is reduced in the right amount, means correct distance. A possible error cause of the non functioning of the opto couplers can also be dirt inside the fiber port.

If this is not the case you have to open the device (see *Disassembling of Classic 514 - Opening of the housing* on page 37) and check the cable to the fiber detection. If this is not the error cause exchange the board PL11168.

Laser diode

If the laser diode is broken you can change it. Please do this only in agreement with A.R.C. Laser Service department! Be sure you have the necessary equipment and a clean and safe environment.

At first you have to open the device as described in chapter *Disassembling of Classic 514 - Opening of the housing* on page 37. Then remove the covering plate (6 screws) illustrated in Figure 29, and than the white plastic. Now you can see the laser diode. The laser diode is situated on peltier element mounted on the heat sink and thermal coupled via thermal conducting foil (see Figure 31).
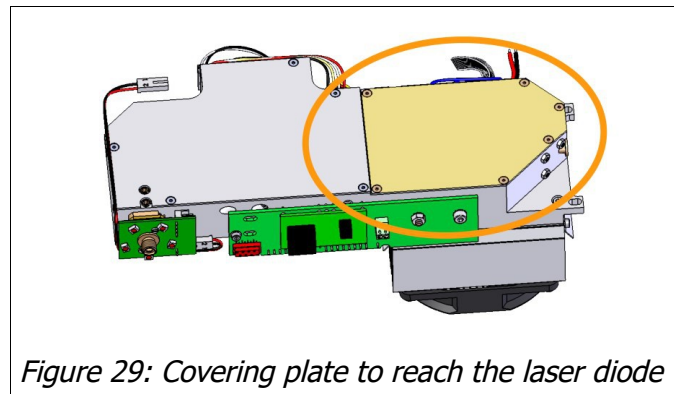
Figure 29: Covering plate to reach the laser diode

The laser diode is mounted in that way, that the diode body is on positive voltage and the little flag on ground.

Remove the four orange screws (see Figure 30: Laser diode) which fix the laser diode and also the plus (red arrow) and minus (black arrow) screw and replace it. Please check before the thermal conducting foils and the peltier element. On mounting the new laser diode take care to fix it evenly.
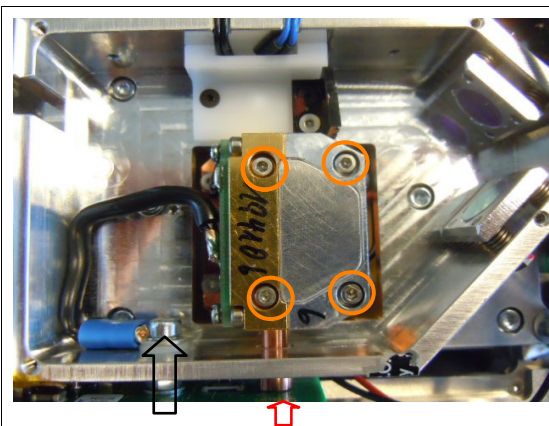
Figure 30: Laser diode

#	A.R.C. No.	Description
1	ME04836	Thermal foil "copper plate diode heat sink"
2	ME04827	Copper plate diode heat sink
3	EM04024	Thermal foil "Peltier heat sink"
4	EM04004	Peltier 20x20x3.1
5	UG04027	NTC in ME04336
6	ME04809	Isolation
7	NT01310	DIN 912M 2 x 10
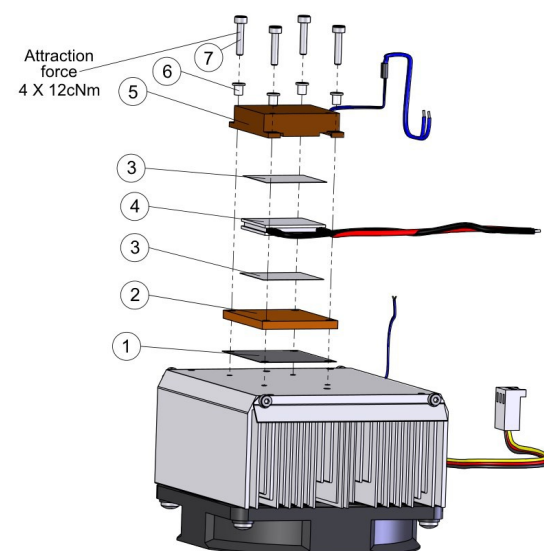
Figure 31: Thermal coupling of the laser diode

Classic_514_SManual_V1.0_en

Preparatory work for the optical adjustment of the laser diode

Open the housing, and connect service adapter with your service PC. Open HyperTerminal and start the laser.

Press <Shift> + <s> to enter Service program. In service menu switch to "1: Safety functions". (Figure 32: Safety function)

- Reset the safety CPU by pressing "i: Safety CPU start",
- than press <j>, <+> to activate the driver voltage
- press <ESC> to go back to main menu

Figure 32: Safety function

- press <4> to enter LH function

Figure 33: LH functions

- press <h>, <+> to open the shutter
- press <ESC> to go back to main menu

Figure 33: LH functions

- press <5> to enter Laser power

Figure 34: Laser power

- press <l> to enter Application factor
- press <b> and set with < - > the value for b to zero
- press <ESC> to go back to Laser power

Figure 34: Laser power

Classic_514_SManual_V1.0_en

- press <i> to enter Peltier controller Figure 35: Peltier control
- press <b> to reset the peltier controller
- press <ESC> to go back to Laser power


```
* Peltier control *

Function keys:
(z = Help, ESC = Exit sub menu)

a = Info CPU version
b = Reset peltier control
c = Peltier 1 info (Setpoint value/actual value/function)
d = Peltier 2 info (Setpoint value/actual value/function)
e = Peltier 3 info (Setpoint value/actual value/function)
f = Peltier control off
1 = Peltier 1 setpoint value +0.X
2 = Peltier 1 setpoint value -0.X
3 = Peltier 2 setpoint value +0.X
4 = Peltier 2 setpoint value -0.X
5 = Peltier 3 setpoint value +0.X
6 = Peltier 3 setpoint value -0.X
8 = Laser enable on
9 = Laser enable off
```

Figure 35: Peltier control


```
* Laser range adjustment *

Function Keys:
(z = Help, ESC = Exit sub menu)

a = Laser (On/Off)
B = Diode voltage   C = Diode current

d = Select -  position     / e= Steps / f= Watt / g=Temp.1
      0     Laser threshold /   xxxxH  /    ----W /   xx.xC
      1      Min-display    /   xxxxH  /    x.xxW /   xx.xC
      2         2/4         /   xxxxH  /    x.xxW /   xx.xC
      3         3/4         /   xxxxH  /    x.xxW /   xx.xC
      4      Max-display    /   xxxxH  /    x.xxW /   xx.xC

i = Peltier control         J = Temperature error (1 = Error)
K = Temperature state (1 = OK)  N = Measuring D2 (xxxxxV)
p = Calculate laser range -->>  Attention laser radiation on for 2.5 minutes!!!

                            (Please open the safety shutter before)

 _a_  _B_    _C__    _d_   _e__   _f__   _g__  J K _N___
*OFF 0.000V 0.009A   00   0E3AH   ----W  32.0° 0 1 0.000V      _
```

Figure 36: Laser range adjustment

Prepare the laser for the optical alignment after exchange of the laser diode. <mark>Attention! Laser radiation! Use the appropriate safety googles!</mark>

In service menu press <a>, <+> to enable the laser radiation. For the laser range adjustment you have five levels (compare to point "d = Select – position"). "0 Laser threshold" is, as its name says, the threshold power and the first step to align. Check if at d "0" is

shown. Press <e> and <+>. Increase the value until the diode starts emitting laser radiation – check with the power meter. For threshold 1mW is enough. If the power is to high press <e> and < - >. Than switch the power off with <a> and < - > to prepare the laser for optical alignment.

Optical alignment after replacing the laser diode

- First place the laser in this position (see Figure 37: Service position, Figure 38: Service position, Figure 24 Opening of the housing - Service position)remove also the fiber and the small port around the fiber
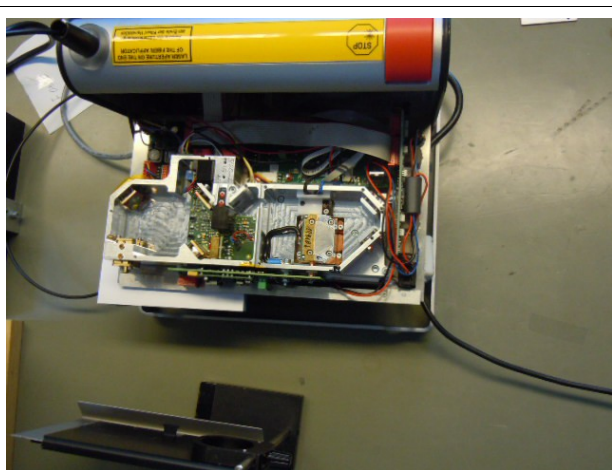
Figure 37: Service position
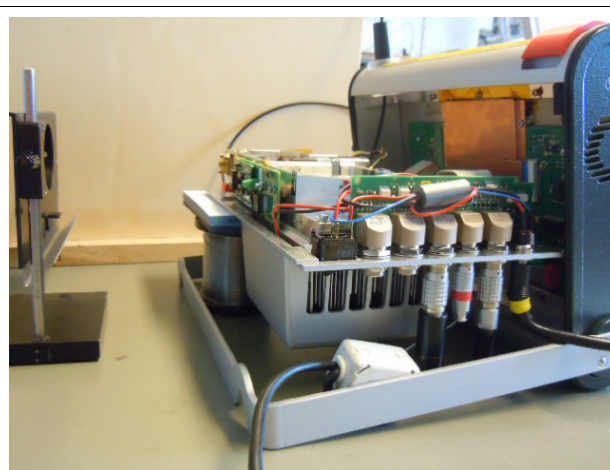
Figure 38: Service position

- for the optical alignment you need a near field and a far field tool (Figure 39:)

far field tool

near field tool

Figure 39:

Classic_514_SManual_V1.0_en
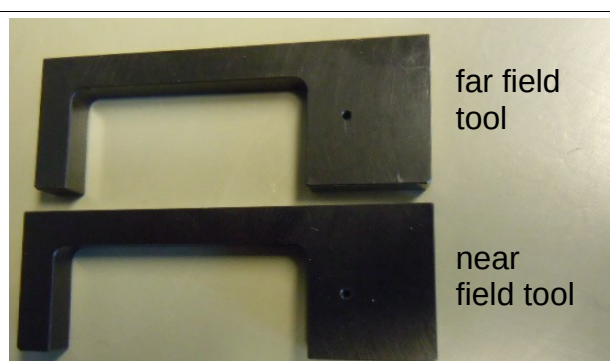
- place the near field tool after the second bending mirror according Figure 40: Near field
- set the laser on (**us threshold power**) with <a>, <+>

- adjust the near field mirror so that the laser beam is in the center of the near field pin hole, this means of the 2 laser beam, is one at the right and the other one at the left side of the pin hole

Figure 40: Near field

- put the near field tool out, so that the beam can pass
- place the far field tool before fiber coupling (Figure 41: Far field)
- adjust the far field mirror (Figure 40: Near field) so that the laser beam is in the center of the far field pin hole (Figure 41: Far field), this means, of the 2 laser beam, is one at the right and the other one at the left side of the pin hole

Figure 41: Far field

- **repeat the steps before, till the beam is in near- and far-field in the center of the pin hole**
- open the fixation screw for the lens (Figure 42:) and take the lens backwards out
- place a black paper with a cross in front of the laser, at a distance of 11cm. The cross must be in the center of the beam. **Then do not change the position of the laser and the pa-**

Figure 42:

Classic_514_SManual_V1.0_en

per

Optical alignment of aiming beam

- go back in the menu Figure 43: LH functions an switch the aiming beam on with <e>, <+>

- go again back in the laser range adjustment menu and set the laser on. Like before set the power to laser threshold.

Figure 43: LH functions

- take the shutter out (see Figure 60: Screw to remove the safety shutter)

- adjust with the 3 screws (see Figure 44: Aiming beam adjustment) the mirror for the near-field, so that the aiming beam is in the middle of the pin hole for the near-field. Now ad-

Figure 44: Aiming beam adjustment

just with the 3 screws the mirror for the far-field, so that the aiming beam is in the middle of the cross. Repeat these steps until the aiming beam is in the near- and far-field in the correct position.

Power adjustment without fiber

- put the power meter in front of the SMA coupler
- set on your power meter the wave length 514nm
- set in the laser range adjustment menu (see Figure 36 page 45) the power according the table Figure 1
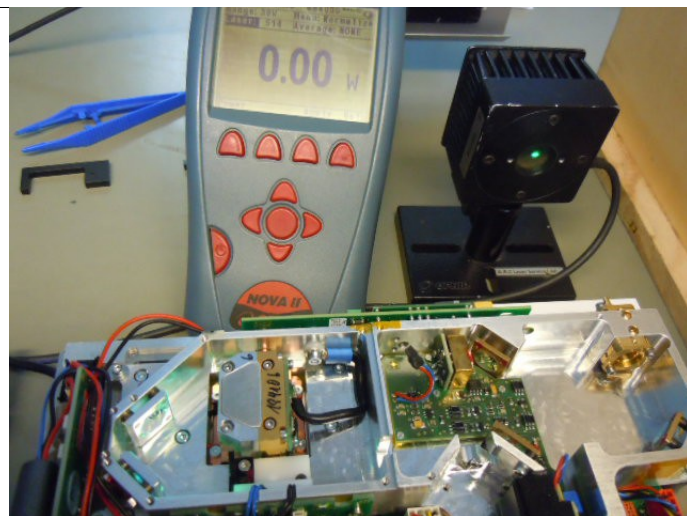
Figure 45: Power adjustment without fiber

c=current	d=steps	f=internal power	Power ext. Meter = internal power + fiber losses	g= temperature	J	K
0-3,8A$_{max}$	0	threshold	1mW	32°	0	1
0-3,8A$_{max}$	1	0,05W	0,06W	32°	0	1
0-3,8A$_{max}$	2	0,2W	0,25W	32°	0	1
0-3,8A$_{max}$	3	0,8W	1W	32°	0	1
0-3,8A$_{max}$	4	1,5W	1,87W	32°	0	1

Figure 46: Power adjustment table

- example for line 1(d=0)
- set d=0 with <d>, <+> or <->
- set the temperature of the diode to 32° with <g>,<+> or <->
- set a on with <a>, <+>
- set the output power according your external power meter to 1mW with <e>,<+> or <->
- **Note: the maximal allowed current for the laser diode is 3,8A**
- repeat these steps for the other power values (d1 - d4)
- Note: the fiber losses are around 20%-25%, which means with an output of 1,5W on the display, there is an output power of 1,87W **before** the fiber coupling

Classic_514_SManual_V1.0_en

Adjustment of focus lens for fiber coupling

- place again the black paper in front of the laser
- set in laser range adjustment d=0 with <d>, <+> or <->
- set the laser on with <a>, <+>
- move the black paper so that the laser beam is exactly in the center of the cross
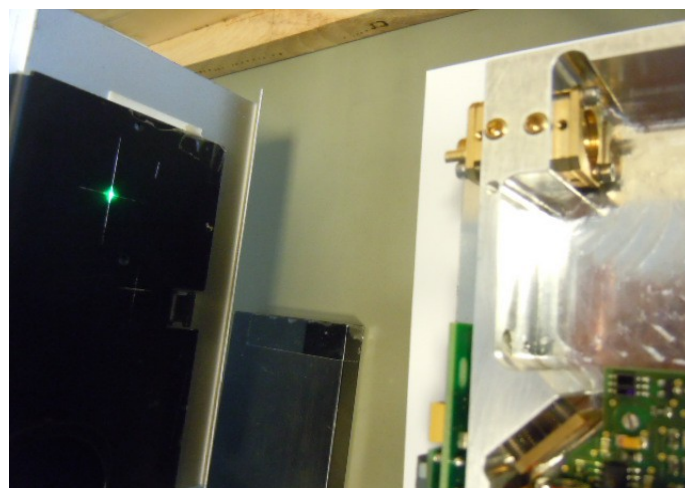
Figure 47:

- than put the focus lens in, adjust the Z-position to approximately 1mm (Figure 48:) and fix it with the fixation screw
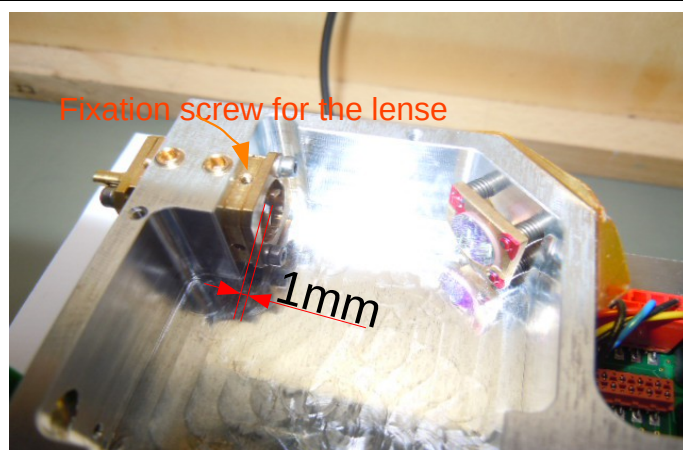
Figure 48:

- open the two XY fixation screw for lens (Figure 71: optocoupler position)
- adjust, with help of the X- and Y- alignment screw for lens the beam so, that he is in the middle of the cross (Figure 71: optocoupler position)
- tighten the XY fixation screw for lens
- switch the laser off with <a>,<->

Figure 49:

Classic_514_SManual_V1.0_en
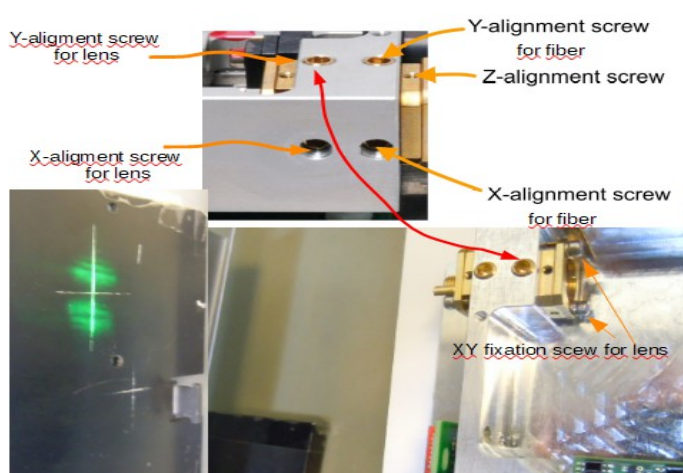
Fiber adjustment

- loosen the fixation screws for the fiber (see Figure 50:)
- connect the fiber to the laser
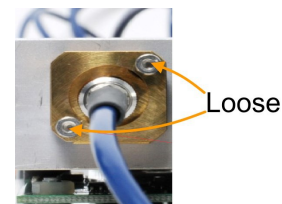
Figure 50:

- place the other fiber end close to a white paper (see Figure 51:)
- set the power in laser range adjustment menu to 0,05W with d=1. For that press<d>, and than with <+> to d=1
- switch the laser on with <a>,<+>
- adjust the fiber position with the X- and Y-adjustment screw **for fiber** (see Figure 71: optocoupler position). Step by step till you see a good laser spot with maximum brightness like Figure 52:

- Note: if the output power increase, increase also the distance to the paper to about 40cm (see Figure 52:)

Figure 51:

Figure 52:

Classic_514_SManual_V1.0_en
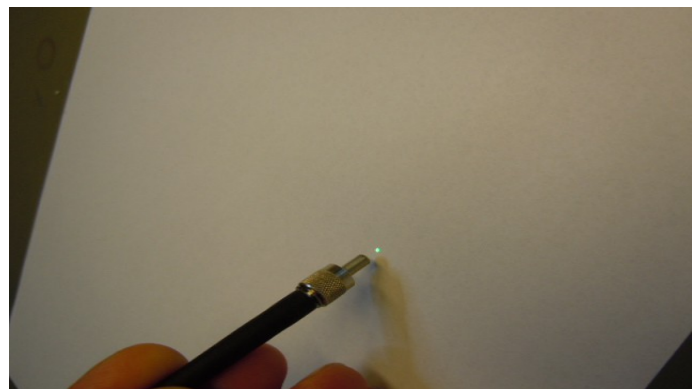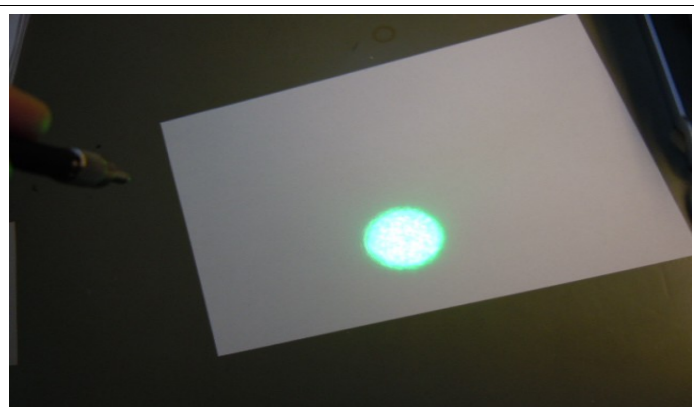
Figure 53:

- now the power meter is sensitive enough and you can place the fiber end in front of the measuring head (Figure 53:)
- make a fine adjustment with the X-Y-adjustment screw
- now open the Z-alignment screw (see Figure 71: optocoupler position)
- push the fiber back and forth in very small steps until you have found the maximum power on the power meter.
- now adjust the fiber again in x-y- direction
- repeat these steps until the fiber losses are not bigger than 20% to 25%
- if the fiber and the power (d0 to d4) are correctly adjusted, than the power is at end of the fiber like Figure 54:
- you can check the values d0-d4 with <d>, <+> or <->
- after you change <d> you must set the power on again with <a>, <+>

d=steps	Output of fiber
0	threshold
1	0,05W
2	0,2W
3	0,8W
4	1,5W

Figure 54:

- if the fiber is correctly adjusted, you can fix the X,Y and Z adjustment screw (see Figure 71: optocoupler position and Figure 50:)
- Note : it can happen, if you fix the screws that the fiber misaligned again, than make a fine calibration again
- after successful optical and electronic adjustment of the diode, make an auto calibration of the internal measurement diode. For that set in laser range adjustment

<p>, <+>. The electronic makes a auto calibration. **Attention laser radiation**.

- go back to the main menu with <ESC>

Optical fine adjustment of aiming beam

- go back in the menu Figure 43: LH functions and switch the aiming beam on witch <e>, <+>

- check the aiming beam at the end of the fiber (Figure 55: Aiming beam spot), if it is not round or like a donut mode, then adjust it with the bending mirror for far field (see Figure 44: Aiming beam adjustment)
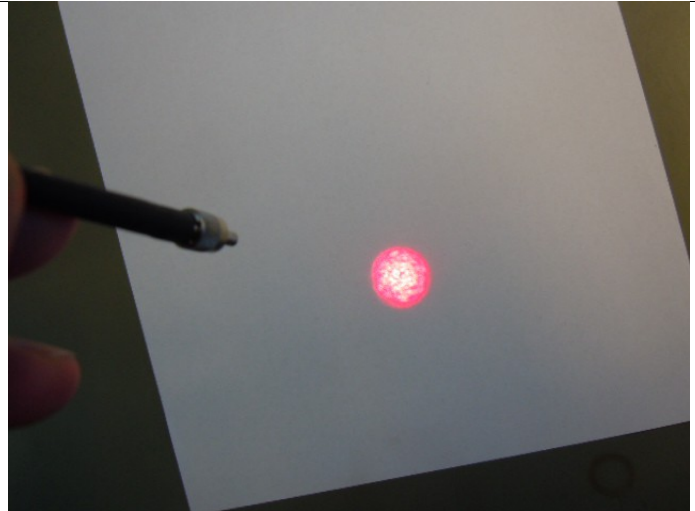
electrical adjustment of aiming beam

- adjust the minimum brightness in Laser head menu, so that the aiming beam brightness is as low as possible. Do this with <f>,<+><->

- adjust the maximum brightness to 1mW with <g>,<+><->

- reinstall the shutter (see Figure 60: Screw to remove the safety shutter)
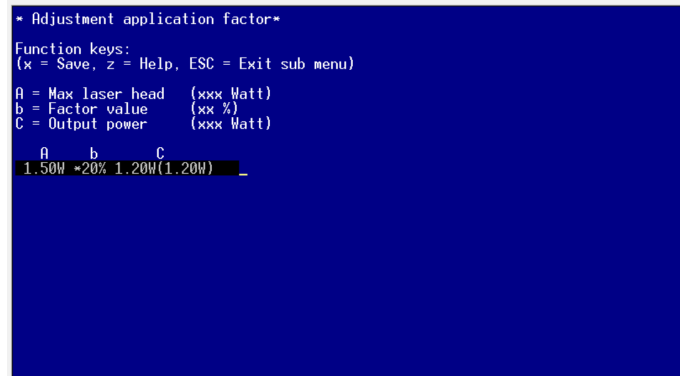
Application factor

- press <5> to enter Laser power

- press <l> to enter Application factor (see Figure 56: Laser power)

- press <b> and set with <+> the value for b to 20%, this are the losses of the slit lamp Note: in that case the Display max value will be reduce of 20%, the
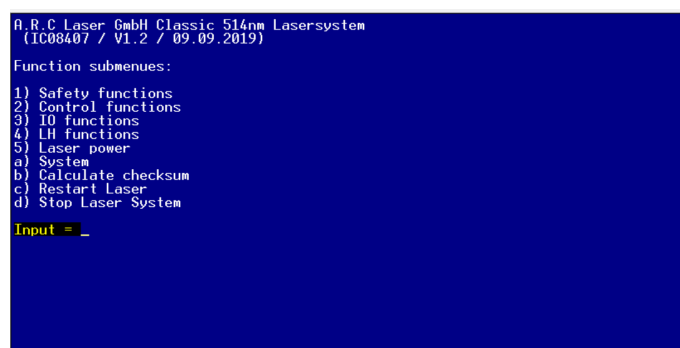
Figure 55: Aiming beam spot

Figure 56: Laser power

Figure 57: Main menu

Classic_514_SManual_V1.0_en

output is still 1.5W

- save the parameter with <x>
- go back to the main menu with<ESC>. (Figure 57: Main menu)

Checksum

- whenever you change values in the service program, you have to build a new check sum, for that set <b>, <Y>
- you will see the picture at Figure 58: Calculate Laser range
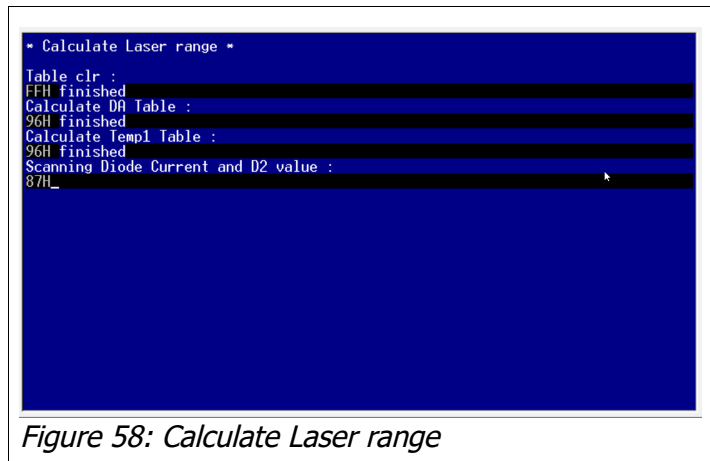
Figure 58: Calculate Laser range

End test

- after all the steps before, you are finish with the replacement of the diode. Restart the laser and make a full check up in normal mode. When everything is in tolerance, you can put the cover on the Laser head an close the system.(see Closing of the housing page 39)

Rotary knob

If the laser shows often the error code F22 the rotary knob is concerned. Before exchanging the rotary knob check its function via pressing and verifying the function in service program in menu "2: Control function" under position "H = Encoder key". If you won't see any change you should exchange the rotary knob.

- Open the housing and remove the rear panel as described in chapter Disassembling of Classic 514 - Opening of the housing on page 37.
- Then you have to remove the rotary knob: at first you have to remove the stuck in round covering (at best without scratching it)
- In Figure 59 you see all the screws and parts to remove at the front side to remove

Classic_514_SManual_V1.0_en

- Remove the locknut and the washer then you can remove the rotary encoder (UG01124) - you only have to unplug the micro match cable.

- Built in the new encoder and mount the locknut and the washer

- When assembling the micro match cable and connecting the rear panel with the front panel of the laser device you can test the function of the new built in rotary knob before mounting it completely

Figure 59: Removing/attaching rotary knob

- If everything works correct built it up completely

Shutter

In some cases it is necessary to exchange the shutter. The shutter concerning error codes are F04 and F05.

- Open the housing and remove the rear panel as described in chapter Disassembling of Classic 514 - Opening of the housing on page 37.

- Loose the screw on the top side of the shutter

- Remove the connector cable to PL11084.

- Now you can remove the shutter (BG04052).

- Built in the new shutter and align its engine currents (compare chapter Safety shutter on page 62)

Figure 60: Screw to remove the safety shutter

Classic_514_SManual_V1.0_en
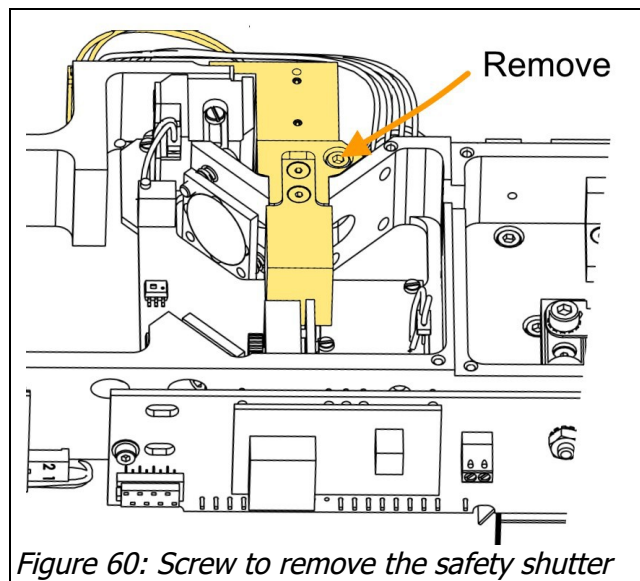
Temperature and humidity sensor

In Classic 514 the PL21169 is built-in as temperature and humidity sensor.

If the sensor is defect please exchange the complete PL21169.

To check the measured values for temperature and air humidity you can at first observe the system-check at point 02) "Temperature" and "Air Humidity".

In service program you can also read out these values in menu *1) Safety functions* → **D** + **E**.
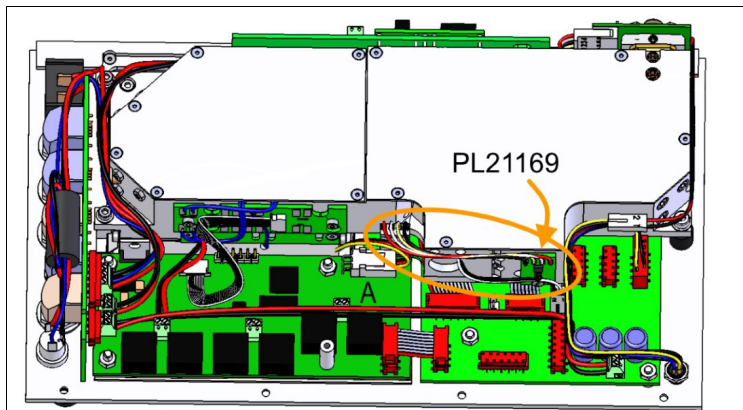
Figure 61: PL21169 humidity and temperature sensor

Please check also at *a) System* the stored type of humidity sensor (7). Here it should be stored "SHT21 PL11169" - if not, please change.

4.3 Realign

Aiming beam

- for Optical fine adjustment of aiming beam please refer page 53
- for Optical alignment of aiming beam   pleas refer page 48
- for electrical adjustment of aiming beam please refer page 53

Eye protection filter

Is the Classic 514 adapted to a slit lamp, normally an eye protection filter is used. If it is an electronically controlled protection filter, it is connected with the Classic 514 and has to be aligned of its working currents. Otherwise a stationary protection filter or a manual set filter is used and the Classic 514 device has to be equipped with a simulator plug, other wise the laser device will run in error F16.

Classic_514_SManual_V1.0_en

Note: Please ensure, that the used eye protection filter is suitable for the wavelength of **514 nm**! The common wavelength is the KTP wavelength 532 nm.

To align the eye protection filter switch in service program to <3>: IO functions (Figure 62: Submenu "IO functions")

```
* IO functions *

Function keys:
(x = Save, z = Help, ESC = Exit sub menu)

Abbreviation: EPF = Eye protection filter shutter

A = External key1  (0 = OFF)   B = External key2    (0 = OFF)
C = External key3  (0 = OFF)   D = External key4    (0 = OFF)
E = 1 Foot switch  (0 = OFF)   F = 2 Foot switch    (0 = OFF)
g = Warning light  (On/OFF)    h = Smoke evacuator  (On/OFF)
I = RC signal      (0 = OFF)   j = RC +12V          (On/OFF)
K = EPF signal     (0 = OFF)
l = EPF open/close (O/C)        m = EPF hold/function(H/F)
n = EPF-(F)-steps  (0-1600)    o = EPF-(H)-steps    (0-1600)
p = EPF test

A B C D E F g h I j K l m  _n__  _o__
0 0 0 0 0 0*0 0 0 1 0 0 H 0800 0400         _
```

Figure 62: Submenu "IO functions"

At **l** you can see the actual state of the eye protection filter "O" for open, "C" for closed. In the case the eye protection filter produces any failure you have the possibility to measure the adjusted currents. Therefore adjust via **m** if the function (**F**) or holding current (**H**) should be applied.

To align the function current change **n** and for the holding current change **o**. To check your alignment switch to the eye protection filter test menu via pressing <p>.

Note: Common settings for electronic eye protection filters are n = 1000, o = 250.
For simulator plugs: n = 800, o = 400.

Save your alignment via <x>.

Figure 63: Submenu "Filter test"
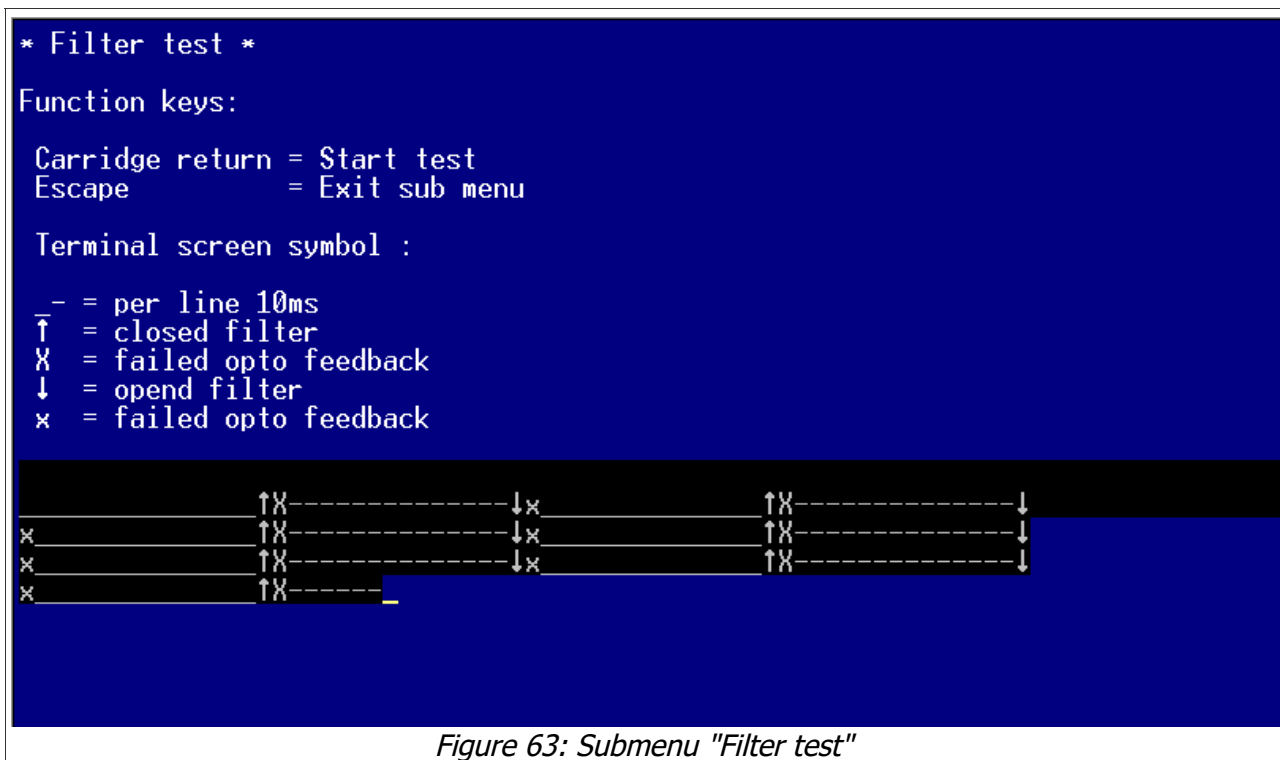
- Start the eye protection filter test via <Return>
- Align:
  - electronic eye protection filter should show max **6 "x"** and **6 "X"**
  - simulator plugs should show **1 "x"** and **1 "X"** (as shown in Figure 63)
- Via <Esc> you return to the previous menu

- After the successful alignment of the eye protection filter and the validation in the test menu you have to create a new checksum.
- Switch therefore in the main menu and use <b>, confirm and the process will start (see also Checksum page 54)
- Finally check your alignment via restarting the laser system and await the self test during system-check.

Fiber coupling

When you have to change the fiber in consequence of e.g. a broken fiber, than it can happen that you must realign the fiber coupling. First we recommended to take the fiber out , measure the power without fiber and than connect the new fiber. Than you can measure the power out of the new fiber and than you can calculate the fiber losses. The losses are normally 20%-25%, if the losses are in tolerance than you are ready, if not than you must realign the fiber port, for that following the next steps.

- Open the housing and take out the rear panel (see: Disassembling of Classic 514 - Opening of the housing on page 37)
- put the laser in service position according Figure 38: Service position
- remove the LED board, for that you must take out the two screws Figure 64:
- than go on with Fiber adjustment page 51), after that check also the aiming beam.
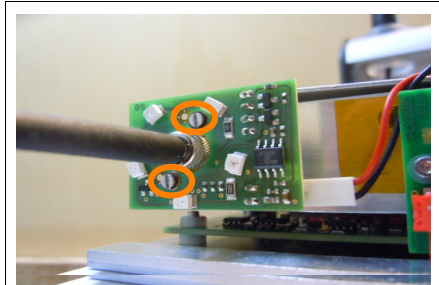

Figure 64:

Laser range adjustment

Please Note: Prerequisite for the laser range adjustment is, that the fiber is properly adjusted and in a good condition

- put the fiber in front of the measurement head of the Power meter
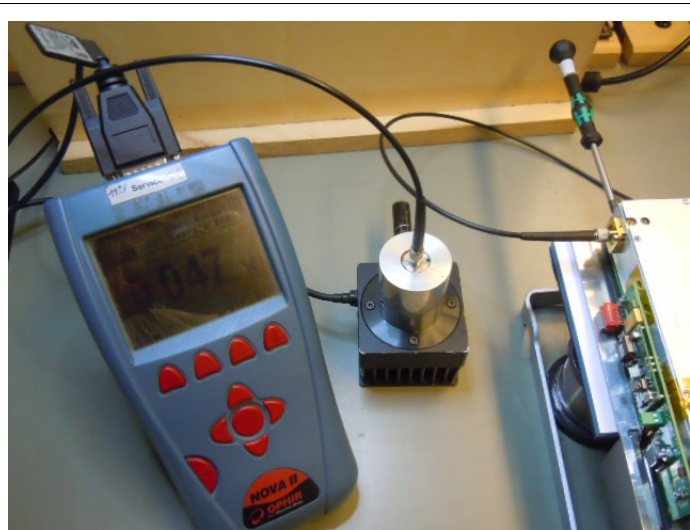- set on your power meter the wave length 514nm

Figure 65:

Classic_514_SManual_V1.0_en

- make some preparation work according Preparatory work for the optical adjustment of the laser diode page 44
- set in the laser range adjustment menu (see Figure 66: Laser range adjustment) the power according the table Figure 67: Power adjustment table

```
* Laser range adjustment *

Function Keys:
(z = Help, ESC = Exit sub menu)

a = Laser (On/Off)
B = Diode voltage  C = Diode current

d = Select - position   / e= Steps / f= Watt / g=Temp.1
    0   Laser threshold /  xxxxH  /  ----W /  xx.xC
    1   Min-display     /  xxxxH  /  x.xxW /  xx.xC
    2      2/4          /  xxxxH  /  x.xxW /  xx.xC
    3      3/4          /  xxxxH  /  x.xxW /  xx.xC
    4   Max-display     /  xxxxH  /  x.xxW /  xx.xC

i = Peltier control          J = Temperature error (1 = Error)
K = Temperature state (1 = OK) N = Measuring D2 (xxxxxV)
p = Calculate laser range -->> Attention laser radiation on for 2.5 minutes!!!

                               (Please open the safety shutter before)

 _a_  _B___ _C___  _d_  _e_   _f_   _g_  J K _N___
*OFF 0.000V 0.009A  00  0E3AH ----W 32.0° 0 1 0.000V       _
```

Figure 66: Laser range adjustment

c=current	d=steps	f=internal power	Power at the end of the fiber	g= temperature	J	K
0-3,8A$_{max}$	0	threshold	1mW	32°	0	1
0-3,8A$_{max}$	1	0,05W	0,06W	32°	0	1
0-3,8A$_{max}$	2	0,2W	0,25W	32°	0	1
0-3,8A$_{max}$	3	0,8W	1W	32°	0	1
0-3,8A$_{max}$	4	1,5W	1,87W	32°	0	1

Figure 67: Power adjustment table

- example for line 1(d=0)
- set d=0 with <d>, <+> or <->
- set the temperature of the diode to 32° with <g>,<+> or <->
- set a on with <a>, <+>
- set the output power according your external power meter to 1mW with <e>,<+> or <->

Classic_514_SManual_V1.0_en

- **Note: the maximal allowed current for the laser diode is 3,8A. The current you can see at <C>**
- repeat these steps for the other power values (d1 – d4)
- after successful electronic adjustment of the diode, make an auto calibration of the internal measurement diode. For that set in laser range adjustment <p>, <+>. The electronic makes an auto calibration. **Attention laser radiation**.
- go back to the laser power menu with <ESC>
- press <l> to enter Application factor (see Figure 68: Laser power)
- press <b> and set with <+> the value for b to 20%, this are the losses of the slit lamp Note: in that case the Display max value will be reduced of 20%, the output is still 1.5W
- save the parameter with <x>

- go back to the main menu with<ESC>. (Figure 69: Main menu

Figure 68: Laser power

Figure 69: Main menu

Checksum
- whenever you change values in the service program, you have to build a new check sum, for that set <b>, <Y>
- you will see the picture at Figure 70: Calculate Laser range

Figure 70: Calculate Laser range

Classic_514_SManual_V1.0_en

Safety shutter

Classic 514 has a safety shutter inside in form of a magnetic rotary shutter.

The rotation of the shutter motor is monitored by 2 optocouplers. Depending on the position of the shutter, one optocoupler is always closed and one is open (see Figure 71: optocoupler position). In the LH functions menu (Figure 73: Submenu "LH functions" page 63) you can use <A> and <B> to see the status of the two optocouplers. With <h>,<+><-> you can change between open and close of the motor, than also the signal at the both optocoupler must change. If the motor position changes but the optocoupler position does not, than an optocoupler could have a defect.

A	B	optocoupler status
0	1	Cls = shutter closed
1	0	Opn = shutter opened
1	1	check function of optocoupler
0	0	check function of optocoupler

Figure 71: optocoupler position

You can also check the optocouplers individually. To do this, simply remove the engine (see Shutter page 55). Then you can use a reflective part (e.g. Allen key), which you hold over the optocoupler (see Figure 72:), to make the optocoupler switch. On <A> and <B> you can see the status (result) of the optocoupler. If an optocoupler does not work, it must be replaced. The type is: SFH 9206
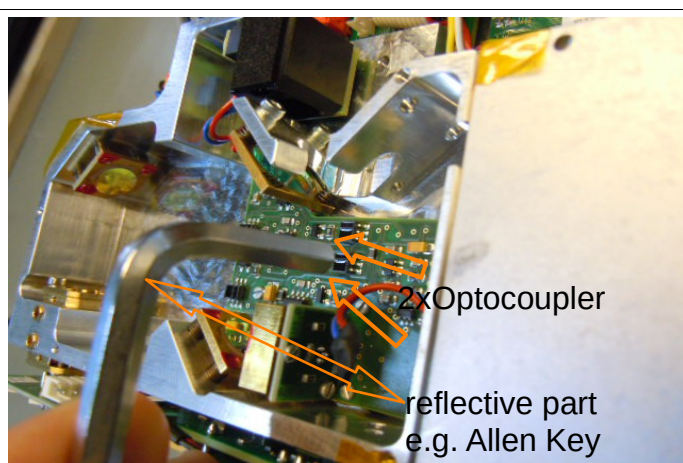

2xOptocoupler

reflective part e.g. Allen Key

Figure 72:

Engine current alignment

To align the safety shutter, switch in service program to <4>: LH functions

```
* LH functions *

Function Keys:
(x = Save, z = Help, ESC = Exit sub menu)

Abbreviation: SSH = Safety shutter

A = Opto-close position (0 = OK)  B = Opto-open position (0 = OK)
C = Fiber SW1            (1 = OK)  D = Fiber SW2          (0 = OK)
e = Aiming beam         (On/OFF)  f = Min brightness     (0-1600)
g = Max brightness      (0-1600)  h = SSH open/close     (O/C)
i = SSH hold/function   (H/F)     j = SSH-(F)-steps      (0-1600)
k = SSH-(H)-steps       (0-1600)  l = SSH test

A B C D e _f__ _g__ h i _j__ _k__
0 1 1 0*0 0381 0560 C H 0900 0400          _
```

Figure 73: Submenu "LH functions"

At **h** you can see the actual state of the safety shutter "O" for open, "C" for closed. In the case the safety shutter produces any failure you have the possibility to measure the adjusted currents. Therefore adjust via **i** if the function (**F**) or holding current (**H**) should be applied.

- To align the function current change **j** and for the holding current change **k**. To check your alignment switch to the shutter test menu via pressing <l>.

Note: Common settings for engine safety shutters are j = 1600, k = 500.

- Save your alignment via <x>

```
* Shutter test *

Function keys:

 Carridge return = Start test
 Escape          = Exit sub menu

 Terminal screen symbol :

 _ = per line 10ms
 ↑ = closed filter
 X = failed opto feedback
 ↓ = opend filter
 x = failed opto feedback

xx_____↑XX------------↓xx_____↑XX------------↓
xx_____↑XX------------↓xx_____↑XX------------↓
xx_____↑XX------------↓xx_____↑XX------------↓
xx_____↑XX------------↓xx_____↑XX------------↓
xx_____↑XX------------↓xx_____↑XX_
```

Figure 74: Submenu "Shutter test"

- Switch to test menu via <l>
- Start the safety shutter test via <Return>
- Ideal: **2 "x"** and **2 "X" or less**
- Via <Esc> you return to the previous menu

- After the successful alignment of the safety shutter and the validation in the test menu you have to create a new checksum.
- Switch therefore in the main menu and use <b>, confirm and the process will start
- Finally check your alignment via restarting the laser system and await the self test during system-check.

4.4   *Solving other problems*

Foot switch

Start the device in service mode and enter main menu. Switch to <3>: IO functions. Here **E** and **F** show you the state of the two built in switches of the foot switch. Both have to change their state by pressing the foot switch – if only one switch operates probably the foot switch is defect.

You can also measure the foot switch itself by measuring at its plug. There the left pair (Pin 7+5) and the right pair (Pin 2+4) of the pins should make a short-circuit when pressing the foot switch. If this is not the case replace the foot switch.

Figure 75: Pin assignment foot switch plug
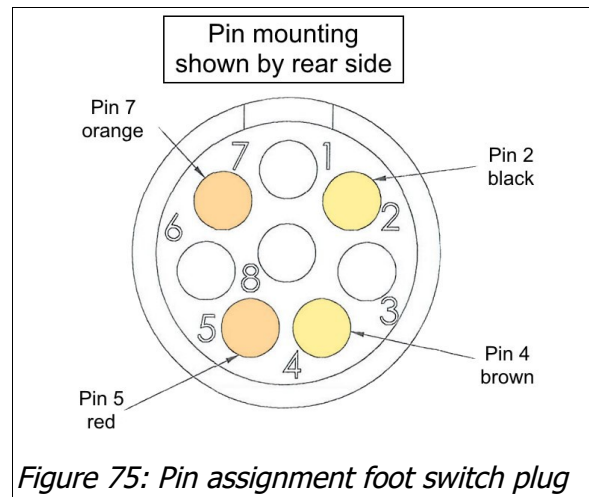
Manual switch

Instead of the foot switch the Classic 514 can also be triggered by the manual switch (joystick) of the slit lamp. To plug the slit lamp joystick the same connector plug is used as with the foot switch. There is a connector cable to combine slit lamp manual trigger with the Classic 514 → KB06031

If a manual switch error occurs check the cables and otherwise proceed same as with foot switch errors.

5 Error list

Error number		Description and solving description
F00		Error of the Safety-CPU
	a	Watchdog timeout registered after restart
	b	Safety-CPU error detected during laser emission control • Check the eye protection filter
	c	Error during check of Safety-CPU: Switch off of diode voltage → < 3.0 V
	d	Error during check of Safety-CPU: Switch on of diode voltage → > 8.5 V
	e	Error during check of Safety-CPU: Switch on of diode voltage → < 11.5 V
	f	After restarting the device you have to wait at least 2 seconds, otherwise this error occurs
F01		Low power error

		Low power of the main device (> - 20%)
		• Check if laser light is emitted
		• If not:
		  ○ Check voltage at the output of the laser driver
		• If yes:
		  ○ Check diode and ambient temperature
		  ○ Check if diode is damaged
		  ○ calibrate the power (see Laser range adjustment , page59)

F02		High power error
		High power of the main device (> + 20%) • Check the output power via an external power meter • Check diode and ambient temperature • calibrate the power (see Laser range adjustment , page59)
F03		Basic power too high (> threshold)

Classic_514_SManual_V1.0_en

	a	Basic power too high during STANDBY-mode
	b	Basic power too high during READY-mode and foot switch pressed
F04		optocoupler safety shutter time exceeded
	a	Error during System-Check • Check safety shutter signal in Service program (see Safety shutter page62) • Check electronic alignment of the shutter currents (see Safety shutter page62) • Check cables • Check shutter engine polarity and function in general (see Safety shutter page62) • Check opto coupler on board PL for proper operation (see Safety shutter page62)
	b	Error during READY sequence • Same as F04a
F05		optocoupler safety shutter – Open in STANDBY-mode • Same as F04a
F06		Short circuit of foot switch - first switch • Check the foot switch • Check the foot switch signals in service menu → (see Foot switch page 65)
F07		Short circuit of foot switch - second switch • Same as F06
F08		Short circuit of foot switch - both switches at one time
	a	Error during System-Check • Same as F06
	b	Error after switch to READY-mode: Foot switch pressed longer than 30 s • Same as F06
F11		No power adjustment possible – error during internal check of the power and the light control • Same as F01
	a	Error occurred at adjustment point P1 (± 10% deviation of the current value) Same as F01
	b	Error occurred at adjustment point P2 (± 10% deviation of the current

		value) • Same as F01
	c	Error occurred at adjustment point P3 (± 10% deviation of the current value) • Same as F01
F15		optocoupler eye protection filter time exceeded – Check during READY sequence
	a	Error: Eye protection filter (EPF) is closed instead of open • Check the of the optocoupler inside the EPF (see Eye protection filter page 56) • Check the EPF signal alignment in Service program (see Eye protection filter page 56) • Check electronic alignment of the filter currents (see Eye protection filter page 56) • Check cables • Check EPF engine polarity and function in general (see Eye protection filter page 56)
	b	Error: EPF is open instead of closed • Same as F15a
	c	Error: EPF is open instead of closed during emission sequence • Same as F15a
F16		optocoupler eye protection filter time exceeded – Check during System-Check
	a	Error: Eye protection filter (EPF) is closed instead of open • Same as F15a
	b	Error: EPF is open instead of closed • Same as F15a
F21		Error Ready-Button • Check the signal in Service program (2 Control functions) • Check the board PL11077 • Check the button itself
F22		Error button digipoti • Check the signal in Service program (see Rotary knob page54) • Check the board PL11077 • Check the button itself
F23		Error voltage check during System-Check: 12 V

Classic_514_SManual_V1.0_en

	a	**< 11.5 V** • Restart system and observe System-Check → Position 02 • Check the voltage in Service program (1 Safety functions) • Check the board PL11084 • Check the measuring resistors
	b	**> 12.5 V** • Same as F23a
F24		**Error voltage check during System-Check: 5 V / 3.3. V**
	a	**5 V not in range: 4.8-5.2 V** • Check input voltage (power supply) • Restart system and observe System-Check → Position 02 • Check the voltage in Service program (1 Safety functions) • Check the board PL11084 • Check the measuring resistors
	b	**3.3 V not in range: 3.1-3.5 V** • Same as F23a
F32	a - h	**Check-up of the laser driver failed** • Check ambient temperature (too warm or to cold) • Check position of the laser head → plug connections • If the laser head has been changed and no laser range adjustment has been done → perform a laser range adjustment • If nothing helps: PL11081 has to be exchanged → send the device back to A.R.C. Laser service headquarters
F33		**Peltier Timeout**
	a	**No feedback signal 4 min after System-Check** • Check the function in Service program (5 Laser power) • Check board PL11098
	b	**No feedback signal 2 min after READY-sequence** • Same as F33a
F38		**Error DA-converter** **DA-voltage out of range 3 V ± 200 mV** • Check the voltage in Service program • Check the electronic alignment • Check board PL11084

Classic_514_SManual_V1.0_en

F47		Error checksum test
	a	**Comparison of the complete checksum failed during System-Check** • Check the data in service menu → data have been changed without calculating a new checksum • Calculate a new checksum (see Checksum page 54)
	b	**Comparison of the power checksum failed during emission routine** • Check the data in service menu → power adjustment values have been changed without calculating a new checksum → check the power adjustment • Calculate a new checksum (see Checksum page 54)
F50	a-g	**I²C-Bus defective** • Restart the device • Check SDA and SCL line • Send the device back to A.R.C. Laser service headquarters
F51		**Button on front panel defective** • Check the different signals in Service program (2 Control functions) • Check the cable connection

6 Appendix

6.1 Cable overview

Figure 76: USB-Debug adapter EM01579

Figure 77: USB cable

Figure 78: RS 232 service cable KB01005

Figure 79: RS232 USB adapter cable EL01368

Classic_514_SManual_V1.0_en

KB08038

Figure 80: Service cable intern KB08038

KB04038

Figure 81: Programming adapter Classic KB04038

KB04022

Figure 82: Service adapter cable KB04022

ME04353 Pinhole near field
ME04354 Pinhole fare field

Figure 83: Pinhole for near and fare field adjustment